MANIPULATION OF THE SPINE, THORAX AND PELVIS

An Osteopathic Perspective

Peter Gibbons • Philip Tehan

Foreword by Philip Greenman

CHURCHILL LIVINGSTONE

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Manipulation of the Spine, Thorax and Pelvis

For Churchill Livingstone

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Manipulation of the Spine, Thorax and Pelvis

An Osteopathic Perspective

with accompanying CD-ROM

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The CD-ROM accompanying this text includes video sequences of all the techniques described in Part B and the first four techniques described in Part C. These are indicated in the text by the following symbol  . To look at the video for a given technique, click on the relevant icon in the contents list on the CD-ROM.

The CD-ROM is designed to be used in conjunction with the text and not as a stand-alone teaching aid.

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Foreword

Manipulation is one of the oldest continuing forms of patient treatment in use primarily for musculoskeletal pain syndromes. It predated Hippocrates, the father of medicine. The techniques of manipulation are used by a number of practitioners of different professions within the scope of practice of their profession. It is incumbent upon every manipulating health care provider to be as knowledgeable about the field as possible.

High velocity low amplitude (HVLA) thrust technique is one of the oldest forms of manipulation and one of the more commonly used. It can, however, be used inappropriately, and there are potential complications of its use that all practitioners should be aware of.

The authors of this text have chosen to limit the scope to HVLA thrust techniques, and have geared it towards both new students and experienced practitioners. They have limited the techniques to the more commonly used in the areas of the spine and pelvis, and have included sixteen for the cervical spine, eight for the thoracic spine and ribs, six for the lumbar spine and five for the sacroiliac region.

The authors have provided the most current information about vertebral motion and spinal coupling – a much needed update. Their descriptions of the principles of spinal positioning and locking are clear and accurate. They provide a sound rationale for the use of HVLA technique and clearly describe the potential problems of its use and how to prevent the common complications. The material is well referenced, and the reader can find more information about the issues presented by reading the referenced material.

The techniques are clearly described in a format that remains consistent throughout and provides a step-by-step approach that the neophyte can easily follow, and the experienced practitioner can refine techniques used daily. Experience is necessary to identify which techniques are indicated for each patient's presentation.

This book fills a need in the manipulation literature for a single text on one of the many types of manipulation available in the practitioners' armamentarium. It is clear, concise, accurate, easily readable and highly recommended.

Philip E. Greenman

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Preface

Thrust techniques are widely used in the treatment of musculoskeletal dysfunction by osteopaths, physiotherapists, chiropractors and medical practitioners with increasing evidence of their effectiveness. For a commonly used treatment approach it is surprising that there are such limited resources to support learning and skill refinement in High Velocity Low Amplitude (HVLA) thrust techniques. Most of the learning of HVLA thrust techniques has been dependent upon personal instruction and demonstration.

There are only a handful of osteopathic technique books and manuals, and few of these relate solely to thrust techniques. The material presented in this text has been developed in response to the learning needs of undergraduate and postgraduate students over a 25-year period. The novice has to acquire the basic skills, and experienced practitioners should reflect upon their performance and constantly refine each thrust technique. It has been our experience that the structured step-by-step format used in the text and the visual reinforcement offered by the accompanying CD-ROM have been successful in assisting both initial development and subsequent refinement of the psychomotor skills necessary for the effective delivery of HVLA thrust techniques.

Thrust techniques are considered to be potentially more dangerous when compared to other osteopathic techniques. Patient safety is a major consideration when selecting a treatment approach. Our goal has been to prepare a text that will provide the necessary information relating to all aspects of the delivery of HVLA thrust techniques in one comprehensive volume, so that practitioners can use these techniques safely and in the appropriate circumstances.

Melbourne 2000

Peter Gibbons
Philip Tehan

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We are grateful to those colleagues who knowingly or unknowingly assisted in the development of the book. We also acknowledge that the constant questioning by students has significantly contributed to the development of the material in the text.

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Our greatest debt of gratitude goes to those family members and special friends whose tireless support made the writing of the book possible.

PART

A

HVLA thrust techniques – an osteopathic perspective

CONTENTS

1 Introduction
2 Osteopathic philosophy and technique
3 Kinematics and coupled motion of the spine
4 Spinal positioning and locking
5 Safety and HVLA techniques
6 Rationale for the use of HVLA techniques
7 Validation of clinical practice by research

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1 Introduction

Manipulative techniques for the spine, thorax and pelvis are commonly utilized for the treatment of pain and dysfunction. Proficiency in their use requires training, practice and development of palpatory and psychomotor skills. The purpose of this book is to provide a resource that will aid development of the knowledge and skills necessary to perform high-velocity low-amplitude (HVLA) thrust techniques in practice. It is written not just for the novice manipulator but also for any practitioner who uses thrust techniques. While the book presents an osteopathic perspective, it does not promote or endorse any particular treatment model or approach.

The term 'manipulation' is often used to describe a range of manual therapy techniques. This text focuses specifically upon HVLA procedures where the practitioner applies a rapid thrust or impulse. The aim of HVLA techniques is to achieve joint cavitation that is accompanied by a 'popping' or 'cracking' sound. This audible release distinguishes HVLA techniques from other osteopathic manipulative techniques. HVLA techniques are also known by a number of different names, e.g. adjustment, high-velocity thrust, mobilization with impulse and grade V mobilization.

The book is divided into four parts. Part A comprises seven chapters that provide an osteopathic perspective on the use of HVLA techniques and reviews indications, kinematics, safety and research.

An overview of the osteopathic philosophy that underpins osteopathic manipulative technique and treatment is presented in Chapter 2. Chapter 3 reviews spinal kinematics and coupled motion of the spine. Practitioners require knowledge of biomechanics and coupled motion characteristics in order to apply the principles of spinal locking used in HVLA techniques. The osteopathic profession has developed a classification of spinal motion. Chapter 4 describes type I and type II movements and the relevance of coupled motion to spinal positioning and joint locking.

Complications of, and contraindications to, HVLA techniques are outlined in Chapter 5. Protocols for testing vertebrobasilar insufficiency and upper cervical instability are described and their application reviewed in light of the published literature.

While there is increasing evidence for the effectiveness of manipulation in the treatment of spinal pain and dysfunction, there is little published research comparing the effectiveness of the different osteopathic manipulative techniques. Chapter 6 provides a rationale for the use of HVLA techniques, reviews the literature relating to cavitation and provides a schema that will assist practitioners to determine when a HVLA technique might be indicated.

Research is necessary to validate the use of osteopathic techniques in clinical practice, including HVLA techniques. Chapter 7 identifies strategies that can be used by practitioners

to classify patients and document patient outcomes in clinical practice.

Parts B and C outline in detail specific HVLA techniques for the spine, rib cage and pelvis. These two parts combine photographs and descriptive text.

HVLA techniques can be described in terms of bone movement or joint gliding. In this text, all 35 techniques are outlined utilizing the principle of joint gliding. This approach has been shown to be effective in the teaching of HVLA techniques to undergraduate osteopathic students.

The text has been designed to provide a logical step-by-step format that has consistency throughout the book. Each technique is described from the moment the patient is positioned on the couch, through a series of steps up to and including segmental localization and delivery of the thrust. Each individual technique is logically organized under a number of specific headings:

- Contact point(s)
- Applicator(s)
- Patient positioning
- Operator stance
- Positioning for thrust
- Adjustments to achieve appropriate pre-thrust tension
- Immediately pre-thrust
- Delivering the thrust.

Individuals use a variety of methods to acquire complex psychomotor skills, with structured and repeated practice a key element in the development and maintenance of proficiency. The learning of HVLA techniques can be enhanced by experiencing these both as an operator and as a model.

The art of manipulation is very individual, requiring HVLA techniques to be adapted to the needs of both practitioner and patient. While some modification to the described techniques will occur with developing proficiency, the underlying principles remain the same. These principles can be summarized as follows:

1. Exclude contraindications.
2. Obtain informed consent.
3. Ensure patient comfort.
4. Ensure operator comfort and optimum posture.
5. Use spinal locking.
6. Identify appropriate pre-thrust tissue tension.
7. Apply HVLA thrust.

If these principles are applied, HVLA techniques provide a safe and effective treatment option.

A common experience in the evolution of proficiency in thrust techniques is a sense of frustration and impatience when skill development is slow or variable. Experienced practitioners can similarly experience difficulties achieving cavitation in certain circumstances. Part D provides a troubleshooting and self-evaluation guide to identify those problems that may limit the effective application of HVLA techniques.

Integral to the practice of osteopathic medicine is an understanding of the interrelationship of mind, body and environment. Osteopathic treatment encompasses more than joint manipulation alone and this manual represents only part of the art and science of osteopathic medicine.

2 Osteopathic philosophy and technique

Osteopathy, or Osteopathic Medicine, is a philosophy, a science and an art. Its philosophy embraces the concept of the unity of body structure and function in health and disease. Its science includes the chemical, physical and biological sciences related to the maintenance of health and the prevention, cure, and alleviation of disease. Its art is the application of the philosophy and the science in the practice of osteopathic medicine and surgery in all its branches and specialties.

Health is based on the natural capacity of the human organism to resist and combat noxious influences in the environment and to compensate for their effects; to meet, with adequate reserve, the usual stresses of daily life and the occasional severe stresses imposed by extremes of environment and activity.

Disease begins when this natural capacity is reduced, or when it is exceeded or overcome by noxious influences.

Osteopathic medicine recognizes that many factors impair this capacity and the natural tendency towards recovery, and that among the most important of these factors are the local disturbances or lesions of the musculoskeletal system. Osteopathic medicine is therefore concerned with liberating and developing all the resources that constitute the capacity for resistance and recovery, thus recognizing the validity of the ancient observation that the physician deals with a patient as well as a disease.[1]

The philosophy underpinning the osteopathic approach to patient care can be enunciated as the following precepts:

- The body is an integrated unit.
- The body is a self-regulating organism whose homeostatic mechanisms provide an inherent capacity for healing and repair.
- Structure and function are interdependent.
- There are somatic components to disease.
- Dysfunction of the neuromusculoskeletal system can affect a patient's overall health status and the ability to recover from injury and disease.
- Free and unhindered fluid interchange and drainage are necessary for the maintenance of health, e.g. blood, interstitial fluid, lymph, synovial fluid and cerebrospinal fluid.

DIAGNOSIS OF SOMATIC DYSFUNCTION

The accepted definition for somatic dysfunction in the *Glossary of Osteopathic Terminology*[2] is as follows:

> Somatic dysfunction is an impaired or altered function of related components of the somatic (body framework) system: skeletal, arthrodial and myofascial structures, and related vascular, lymphatic, and neural elements.

Osteopaths diagnose somatic dysfunction by searching for abnormal function within the somatic system. Palpation is fundamental to structural and functional diagnosis.[3]

Research has explored both inter- and intra-examiner reliability of various diagnostic palpatory procedures. Inter-examiner reliability consists of one assessment of all subjects

by each of two or more examiners, blinded to each other's observations, and allows assessment of examiner agreement. Intra-examiner reliability is determined by repeated measurements of single individuals to evaluate examiner self-consistency.

Osteopaths have shown reasonable levels of inter-examiner agreement for passive gross motion testing on selected subjects with consistent findings of regional motion asymmetry.[4,5] One osteopathic study demonstrated low agreement of findings for patients with acute spinal complaints when practitioners used their own diagnostic procedures.[6] Level of agreement can be improved by negotiating and selecting specific tests for detecting patient improvement.[7] Standardization of testing procedures can improve both inter- and intra-examiner reliability.

In asymptomatic somatic dysfunction, high levels of inter- and intra-observer agreement for palpatory findings have yet to be demonstrated. Many studies show that inter- and intra-examiner reliability for palpatory motion testing without pain provocation are poor.[8–15] However, palpation as a diagnostic tool can demonstrate high levels of sensitivity and specificity in detecting symptomatic intervertebral segments in the cervical spine.[16,17]

Diagnosis of somatic dysfunction is made on the basis of a number of positive findings. Specific criteria in identifying areas of dysfunction have been developed.

Somatic dysfunction is identified by the A–R–T–T of diagnosis (Box A.2.1)

Box A.2.1 Diagnosis of somatic dysfunction

- A — relates to asymmetry
- R — relates to range of motion
- T — relates to tissue texture changes
- T — relates to tissue tenderness

A — relates to asymmetry

DiGiovanna and Schiowitz[18] link the criterion of asymmetry to a positional focus, stating that the 'position of the vertebra or other bone is asymmetrical'.[18] Greenman[19] broadens the concept of asymmetry by including functional in addition to structural asymmetry.

R — relates to range of motion

Alteration in range of motion can apply to a single joint, several joints or a region of the musculoskeletal system. The abnormality may be either restricted or increased mobility and includes assessment of quality of movement and 'end feel'.

T — relates to tissue texture changes

The identification of tissue texture change is important in the diagnosis of somatic dysfunction. Palpable changes may be noted in superficial, intermediate and deep tissues. It is important for clinicians to be able to differentiate normal from abnormal.

T — relates to tissue tenderness

Undue tissue tenderness may be evident. Pain provocation and reproduction of familiar symptoms are often used to localize somatic dysfunction.

Information gained from a thorough history, clinical examination and segmental analysis will direct the osteopath towards any possible somatic dysfunction and/or pathology. This depth of diagnostic deliberation is essential if one is to select which case may or may not be amenable to treatment and which treatment approach might be the most effective while offering the patient a reasoned prognosis.

SOMATIC DYSFUNCTION AND OSTEOPATHIC MANIPULATIVE TECHNIQUES

A patient's overall management requires the identification of broad therapeutic objectives. The Quebec Task Force[20] developed a list of objectives in the treatment of spinal disorders. Box A.2.2 is a modified list of these objectives, which takes account of an osteopathic perspective.

Patients should be made aware of the potential debilitation of excessive bed rest, the dangers of overmedication, and the inadvisability of surgery without strong preoperative indications.

Once a practitioner has established therapeutic objectives, consideration must be given to the specific treatment of somatic dysfunction. There are many osteopathic approaches that can be used (see Box A.2.3). Ideally, osteopaths should embrace a range of different techniques and not favour any one specific approach.

Box A.2.2 Therapeutic objectives in the treatment of spinal disorders

- To promote rest for the affected anatomic structures
- To diminish muscle spasm
- To diminish inflammation
- To improve tissue fluid drainage
- To reduce symptomatic pain
- To increase muscle strength
- To increase range of motion
- To increase endurance
- To increase functional and physical work capacity
- To modify work and home environment
- To alter mechanical structures by surgical intervention
- To alter neurological structures by denervation
- To modify social environment
- To provide treatment adapted to the psychological aspects of the problem

Box A.2.3 Osteopathic manipulative techniques

- Articulatory
- Chapman's reflexes
- Craniosacral
- Facilitated positional release
- Fascial ligamentous release
- Functional
- High-velocity low-amplitude (HVLA) thrust
- Lymphatic
- Muscle energy
- Myofascial release
- Soft tissue
- Strain and counterstrain
- Trigger point
- Visceral

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3 Kinematics and coupled motion of the spine

Clinicians use palpatory assessment of individual intervertebral segments prior to the application of a thrust technique. The osteopathic profession has used Fryette's model of the physiological movements of the spine to assist in the diagnosis of somatic dysfunction and the application of treatment techniques. Fryette[1] outlined his research into the physiological movements of the vertebral column in 1918. He presented a model that indicated that coupled motion occurred in the spine and displayed different coupling characteristics dependent upon spinal segmental level and posture. The 'muscle energy' approach is one system of segmental spinal lesion diagnosis and treatment predicated upon Fryette's laws.[2] Practitioners utilizing the muscle energy technique (MET) use these laws of coupled motion, as a predictive model, both to formulate a mechanical diagnosis and to select the precisely controlled position required in the application of both muscle energy and thrust techniques. Current literature challenges the validity of Fryette's laws.

BIOMECHANICS

Convention dictates that intervertebral motion is described in relation to motion of the superior vertebra upon the inferior vertebra. Motion is further defined in relation to the anterior surface of the vertebral body; an example of this is the direction of vertebral rotation that is described in relation to the direction in which the anterior surface of the vertebra moves rather than the posterior elements.

In the clinical setting, vertebral motion is described using standard anatomical cardinal planes and axes of the body. Spinal motion can be described as rotation around, and translation along, an axis as the vertebral body moves along one of the cardinal planes. By convention, the vertical axis is labelled the y-axis, the horizontal axis is labelled the x-axis, and the anteroposterior axis is the z-axis (Fig. A.3.1).

In biomechanical terms, flexion is anterior (sagittal) rotation of the superior vertebra around the x-axis while there is accompanying forward (sagittal) translation of the vertebral body along the z-axis. In extension, the opposite occurs and the superior vertebra rotates posteriorly around the x-axis and translates posteriorly along the z-axis. In sidebending there is bone rotation around the anteroposterior z-axis, but sidebending is rarely a pure movement and is generally accompanied by vertebral rotation. The combination, and association, of one movement with others is termed coupled motion. The concept of coupled motion is not recent. As early as 1905, Lovett[3] published his observations of coupled motion of the spine.

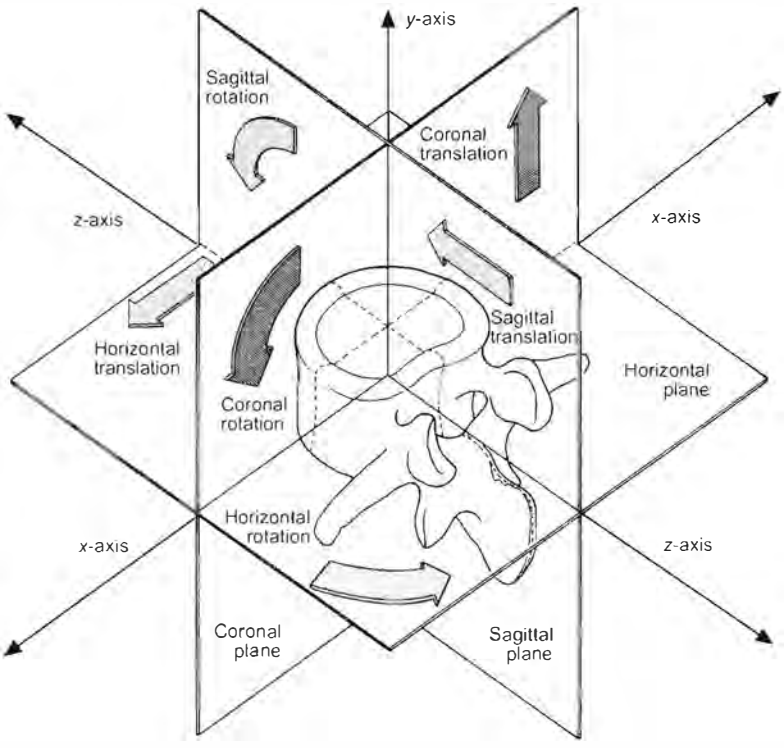

Fig. A.3.1 Axes of motion. (Reproduced with permission from Bogduk.[5])

COUPLED MOTION

Coupled motion is described by White and Panjabi[4] as a 'phenomenon of consistent association of one motion (translation or rotation) about an axis with another motion about a second axis'. Bogduk[5] describes coupled movements as 'movements that occur in an unintended or unexpected direction during the execution of a desired motion'. Stokes et al[6] simply state coupling to be when 'a primary (or intentional) movement results in a joint also moving in other directions'. Where rotation occurs in a consistent manner as an accompaniment to sidebending, it has been termed conjunct rotation.[7,8] Therefore, in rotation, the vertebra should rotate around the vertical *y*-axis, but translation will be complex dependent upon the extent and direction of coupling movements. Coupling will cause shifting axes of motion.

Greenman[9] maintains that rotation of the spinal column is always coupled with sidebending, with the exception of the atlantoaxial joint. The coupled rotation can be in the same direction as sidebending (e.g. sidebending right, rotation right) or in opposite directions (e.g. sidebending right, rotation left). The osteopathic profession developed the convention of naming the coupled movements as type 1 and type 2 movements (see Figs A.3.2 and A.3.3).

These concepts of vertebral motion are attributed to Fryette. Fryette acknowledges the contribution made to his understanding of spinal movement by Lovett, who had undertaken research on cadavers in order to understand the structure and aetiology of scoliotic curves.

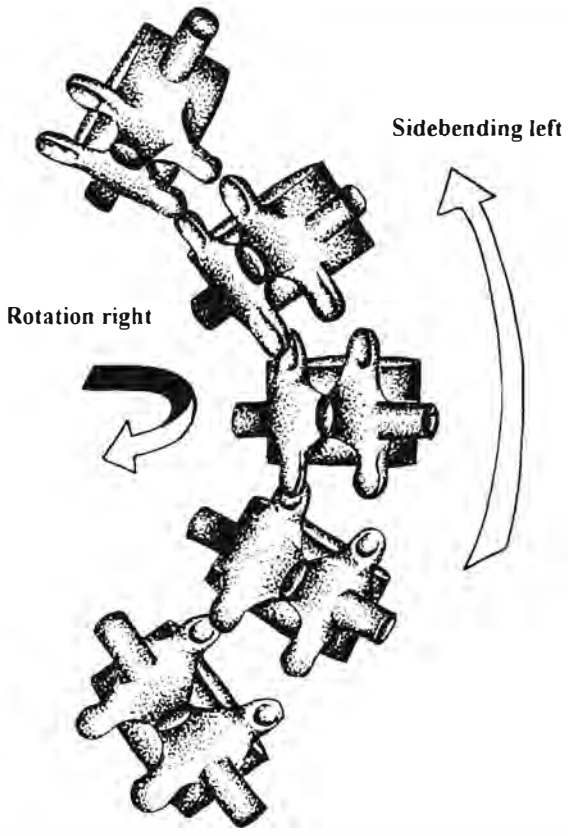

Fig. A.3.2 Type 1 movement — sidebending and rotation occur to opposite sides. (Reproduced with permission from Gibbons and Tehan.[25])

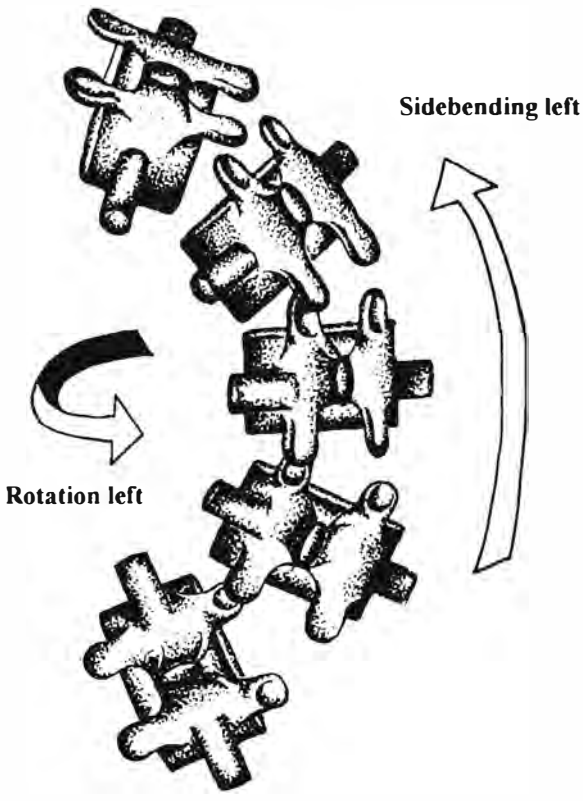

Fig. A.3.3 Type 2 movement — sidebending and rotation occur to the same side. (Reproduced with permission from Gibbons and Tehan.[25])

Fryette acknowledged that Lovett's findings for the thoracic and lumbar spine were correct for the position in which Lovett had placed the spine for his cadaveric experiments but maintained that they would not be true if the lumbar and thoracic spine were placed in different positions of flexion or extension. Fryette performed his own experiments upon a 'spine mounted in soft rubber' and introduced the concept of neutral (facets not engaged) and non-neutral (facets engaged and controlling vertebral motion) positioning. Fryette defined neutral to mean 'the position of any area of the spine in which the facets are idling, in the position between the beginning of flexion and the beginning of extension'. In the cervical spine below C2, the facets are considered to always be in a non-neutral position and are therefore assumed to control vertebral motion. The thoracic and lumbar regions have the possibility of neutral and non-neutral positioning. Mitchell[2] summarizes Fryette's laws as follows:

- *Law 1.* Neutral sidebending produces rotation to the other side, or in other words, the sidebending group rotates itself toward the convexity of the sidebend, with maximum rotation at the apex.

- *Law 2.* Non-neutral (vertebra hyperflexed or hyperextended) rotation and sidebending go to the same side, individual joints acting at one time.
- *Law 3.* Introducing motion to a vertebral joint in one plane automatically reduces its mobility in the other two planes.

Research into coupled movement has been undertaken on cadavers and live subjects. Cadaver research has allowed precise measurements to be taken of coupling behaviour but has the disadvantage of being unable to reflect the activity of muscles or the accurate effects of load on different postures. Plane radiography has been superseded by the more accurate biplanar radiographic studies that allow research to be undertaken under more normal physiological conditions. Most research has been performed on the lumbar spine.

Brown[10,11] indicates, after an extensive literature review, the conflicting results of studies into coupled motion. Many authors have demonstrated a coupling relationship between sideflexion and rotation,[8,12–19] but there is inconsistent reporting of the direction of coupling. Other authors maintain that sidebending and rotation are purely uniplanar motion occurring independently of each other.[20,21]

Stoddard[12] demonstrated radiologically that sidebending in the cervical spine is always accompanied by rotation to the same side regardless of cervical posture. Stoddard's observations in relation to the cervical spine are consistent with Lovett's findings and Fryette's laws. These findings are further supported by research undertaken using biplanar X-ray analysis.[17] In 20 normal male volunteers, when the head was rotated, lateral bending occurred by coupling in the same direction at each segment below the C3 vertebra. Interestingly, coupling was not restricted to lateral bending. At the same time, flexion took place by coupling at each segment below the C5–6 vertebrae and extension above the C4–5 level.

While there is agreement as to the direction of axial rotation and lateral flexion coupling in the cervical spine, i.e. sidebending and rotation occurring to the same side, the patterns for coupling in the lumbar spine are less clear. Stoddard's findings in the lumbar spine were that 'sidebending is accompanied by rotation to the opposite side if the commencing position is an erect one of extension. If, however, the starting position is full flexion, sidebending is then accompanied by rotation to the same side'.[12] Other authors do not support these findings and report inconsistent coupling.[8,14,16,18]

Plamondon et al,[16] using a stereoradiographic method to study lumbar intervertebral motion in vivo, demonstrated that axial rotation and lateral bending were coupled motions but reported there was 'no strict pattern that the vertebrae follow in executing a movement'.

Pearcy and Tibrewal,[14] in a three-dimensional radiographic study of normal volunteers, with no history of back pain requiring time off work or medical treatment, found that the relationship between axial rotation and lateral bending is not consistent at different levels of the lumbar spine. Some individuals occasionally demonstrate 'movements in the opposite direction to the voluntary movement at individual intervertebral levels, most commonly at L4–5 and L5–S1. In lateral bending there was a general tendency for L5–S1 to bend in the opposite direction to the voluntary movement'. This unexpected finding is consistent with a study by Weitz.[22]

Panjabi et al, [18] using fresh human cadaveric lumbar spines from L1–sacrum, assessed coupled motion under load in different spinal postures using stereophotogrammetry. They concluded that coupling is an inherent property of the lumbar spine as advocated by Lovett, but that in vitro coupling patterns are more complex than generally believed. They demonstrated that the presence of muscles is

not a requirement for coupled motion but acknowledged that they may significantly alter coupling behaviour. The specific effect of physiological loading and muscle activity upon coupled motion is presently unknown. In a neutral posture, left axial torque produced right lateral bending at the upper lumbar levels and left lateral bending at the lower two levels with L3–4 being a transition level. They concluded that the 'rotary coupling patterns in the lumbar spine are a function of the intervertebral level and posture'. At the upper lumbar levels, axial torque produced lateral bending to the opposite side, whereas at the lower lumbar levels, axial torque produced lateral bending to the same side. It was also noted that 'the spine does not exhibit mechanical reciprocity'; for example, at L4–5, applied left axial torque produced coupled left lateral bending, but applied left lateral bending produced coupled right axial rotation.

Panjabi et al's[18] finding that 'at L2–3, coupled lateral bending increased from about 0.5° in the fully extended posture to 1.5° in neutral and to about 2° in flexed postures' conflicts with Fryette's third law which indicates that introduction of motion to a vertebral joint in one plane automatically reduces its mobility in the other two planes. In lumbar flexion, the coupled lateral bending increased by 0.5° from the neutral to the flexed position.

A number of studies have indicated that coupled movement occurs independently of muscular activity.[8,13,23] In 1977, Pope et al[13] utilized a biplanar radiographic technique to evaluate spinal movements in intact cadaveric and living human subjects. They confirmed that 'vertebral motion occurs as a coupling motion, and that axial rotation uniformly is associated with lateral bend'. Frymoyer et al[23] measured spinal mobility using orthogonal radiography on 20 male cadavers and nine male living subjects. They found that complex coupling does occur in the lumbar spine and demonstrated remarkably similar spinal behaviour between the two groups. These studies indicate that coupling occurs independently of muscular activity.

Vicenzino and Twomey[8] used four human male postmortem lumbar spines from L1 to the sacrum, with ligaments intact and muscles removed, to assess conjunct rotation of the spine when sidebending was introduced in both a flexed and extended position. They found that in the flexed position, lateral flexion of the lumbar spine was associated with conjunct rotation to the same side. This is consistent with Fryette's laws. However in the extended position, lateral flexion was associated with conjunct rotation to the opposite side, which supports Stoddard's[12] radiographic observations of coupled motion in the extended position. These findings are not consistent with Fryette's laws, which predict sidebending and rotation to the same side as the facets are not 'idling' when in the extended position. Vicenzino and Twomey's[8] study reveals that the L5–S1 segment is unique in that conjunct rotation was always in the same direction as sideflexion independent of flexion or extension positioning. This finding for the L5–S1 segment was supported by Pearcy and Tibrewal[14] who found that during axial rotation at L5–S1, lateral bending always occurred in the same direction as the axial rotation.

Vicenzino and Twomey[8] draw the conclusion that as both in vitro and in vivo studies have demonstrated conjunct rotation, the noncontractile components of the lumbar spine may have primary responsibility for the direction of conjunct rotation and that neuromuscular activity may only modify the coupling. The impact of muscular activity on coupled motion in both the normal and the dysfunctional intervertebral joint requires further study.

The presence of apophysial joint tropism might influence spinal motion and confound predictive models of vertebral coupling. The incidence of facet tropism has been reported as

20% at all lumbar levels but may increase to 30% at the L5–S1 segment.[5] The incidence of facet tropism is also higher in patient populations attending manual medicine practitioners. It has been estimated that as many as 90% of patients presenting with low back pain and sciatica have articular tropism with pain occurring on the side of the more obliquely oriented facet.[5] Cyron and Hutton[24] subjected 23 cadaveric lumbar intervertebral joints to a combination of compressive and shear forces. When asymmetric facets were present, the vertebrae that have such facets rotated towards the side of the more oblique facet. They concluded that articular tropism could lead to lumbar instability manifesting itself as joint rotation towards the side of the more oblique facet. This was not a study of coupled motion and no clear comments can therefore be made about the influence of facet tropism on patterns of coupling, but it does suggest that tropism can influence spinal mechanics.

Disc degeneration and spinal pathology presenting with pain and nerve root signs might also influence spinal coupling. In 1985, Pearcy et al[15] undertook a three-dimensional radiographic analysis of lumbar spinal movements. They studied patients with back pain alone and patients with back pain plus nerve tension signs demonstrated by restricted straight leg raise. Coupled movements were increased only in those patients without nerve tension signs, indicating the possibility of asymmetrical muscle action. It was concluded that 'the disturbance from the normal pattern of coupled movements in the group with back pain alone suggests that the ligaments or muscles were involved unilaterally, and thus acted asymmetrically when the patient moved'. The fact that coupled movements were increased in the back pain group suggests that muscular activity, while not being essential for coupling, can influence the magnitude of coupled movement. The action of the contractile elements in normal, dysfunctional and pain states requires more study before any definite statements can be made relating to their effect upon coupled motion.

It is evident that many factors, such as facet tropism, vertebral level, intervertebral disc height, back pain and spinal position, might influence the degree and direction of coupling.

While it appears that Fryette's laws are open to question, there are still only two possibilities for the coupling of sidebending and rotation, i.e. to the same or the opposite side. With this in mind, it appears reasonable to classify spinal movement as type 1 and type 2 in relation to coupled sidebending and rotation. What is not clearly established is the influence of flexion and extension in relation to type 1 and type 2 movements.

CONCLUSION

Conclusions that can be drawn from the literature are limited for a number of reasons. Cadaver studies exclude the effects of muscular activity and normal physiological loading; the studies were also often single segment analysis and generally of small sample size. Plane radiographic studies have inherent measuring difficulties associated with extrapolating three-dimensional movements from two-dimensional films. The use of biplanar radiographic assessment improved the accuracy of measurement and allowed studies to be performed with muscular activity and in more normal physiological conditions; again, however, the groups studied were small. Notwithstanding these observations, there are a number of conclusions that can be drawn:

- Coupled motion occurs in all regions of the spine.
- Coupled motion occurs independently of muscular activity, but muscular activity might influence coupled movement.
- Coupling of sidebending and rotation in the lumbar spine is variable in degree and direction.

- There are many variables that can influence the degree and direction of coupled movement, including pain, vertebral level, posture and facet tropism.
- There does not appear to be any simple and consistent relationship between conjunct rotation and intervertebral motion segment level in the lumbar spine.

There is evidence to support Lovett's initial observations and Fryette's laws in relation to sidebending and rotation coupling in the cervical spine, i.e. sidebending and rotation occur to the same side.[12,17] However, the evidence in relation to lumbar spine coupling is inconsistent.[8,14,16,18]

While Fryette's laws may be useful for predicting coupling behaviour in the cervical spine, caution should be exercised for the thoracic and lumbar spine, where modification of the model may be necessary.

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4 Spinal positioning and locking

Spinal locking is necessary for long-lever, high-velocity low-amplitude (HVLA) techniques to localize forces and achieve cavitation at a specific vertebral segment.[1–7] Short-lever HVLA techniques do not require locking of adjacent spinal segments.

Locking can be achieved by either facet apposition or the utilization of ligamentous myofascial tension, or a combination of both.[1–5,7] The principle used in these approaches is to position the spine in such a way that leverage is localized to one joint without undue strain being placed upon adjacent segments.

The osteopathic profession developed a nomenclature to classify spinal motion based upon the coupling of sidebending and rotation movements. This coupling behaviour will vary depending upon spinal positioning:

- *Type 1 movement* — sidebending and rotation occur in opposite directions (see Fig. A.4.1)
- *Type 2 movement* — sidebending and rotation occur in the same direction (see Fig. A.4.2).

The principle of facet apposition locking is to apply leverages to the spine that cause the facet joints of uninvolved segments to be apposed and consequently locked. To achieve locking by facet apposition, the spine is placed in a position opposite to that of normal coupling behaviour. The vertebral segment at which you wish to produce cavitation should never be locked.

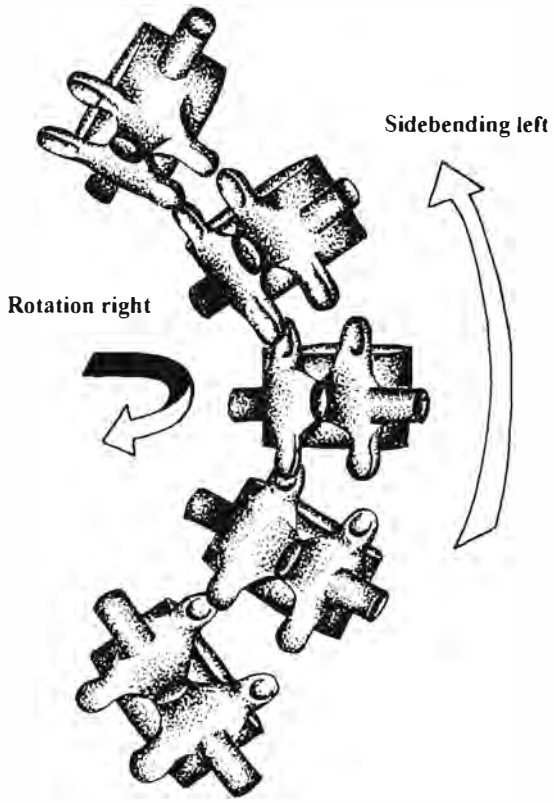

Fig. A.4.1 Type 1 movement — sidebending and rotation occur to opposite sides. (Reproduced with permission from Gibbons and Tehan.[20])

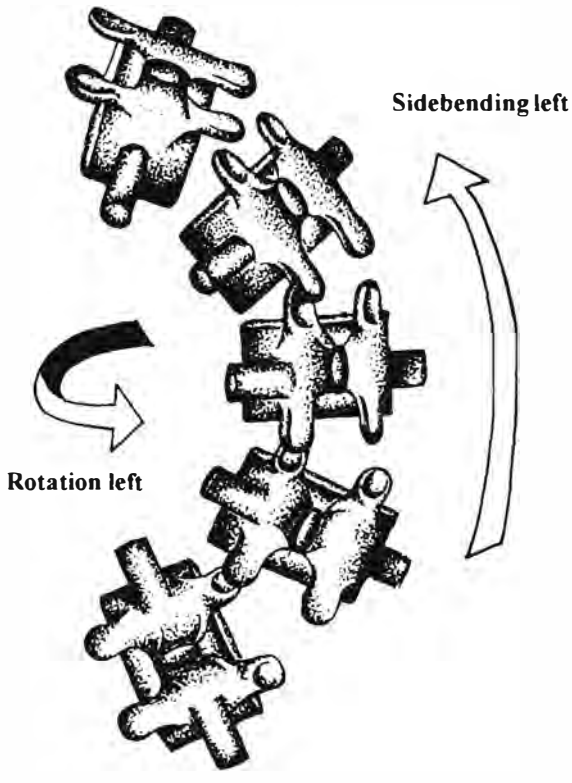

Fig. A.4.2 Type 2 movement — sidebending and rotation occur to the same side. (Reproduced with permission from Gibbons and Tehan.[20])

CERVICAL SPINE (see Table A.4.1)

Greenman[7] describes the normal coupled motion of sidebending and rotation at the occipitoatlantal (C0–C1) segment as being type 1. The principle of facet apposition locking does not apply to HVLA thrust techniques directed to the C0–C1 segment. However, facet apposition locking of the C0–C1 segment can be utilized for HVLA thrust techniques directed to other cervical levels.

The type of coupled movement available at the C1–2 segment is complex. This segment has a predominant role in total cervical rotation.[8–11] Up to 77% of total cervical rotation occurs at the atlantoaxial joint, with a mean rotation range of 40.5° to either side.[8,10] The great range of rotation at the atlantoaxial joint can be attributed to facet plane, the loose nature of the ligamentous fibrous capsule and the absence of ligamentum flavum above C2.[11] Only a small amount of rotation occurs at the joints above and below the atlantoaxial joint.[12–14]

Below C2, normal coupling behaviour in the cervical spine is type 2, i.e. sidebending and rotation occur to the same side.[7,15,16] To generate facet apposition locking, the operator must introduce a type 1 movement, which is sidebending of the cervical spine in one direction and rotation in the opposite direction, e.g. sidebending right with rotation left. This positioning locks the segments above the joint to be cavitated and enables a thrust to be applied to one vertebral segment. The amount or degree of sidebending and rotation can be varied to obtain facet locking. The intent should be to have a primary and secondary leverage. The principal or primary leverage can be either sidebending or rotation (see Fig. A.4.3).

Table A.4.1

Spinal level	Coupled motion	Facet apposition locking
C0–C1 (occipitoatlantal)	Type 1	Type 2
C1–2 (atlantoaxial)	Complex — primary rotation	Not applicable
C2–T4	Type 2	Type 1

Fig. A.4.3 Cervical HVLA positioning for up-slope gliding thrust. Primary leverage of rotation to the left and secondary leverage of sidebending to the right achieve facet apposition locking down to the desired segment on the right.

The principles of facet apposition locking that apply to the cervical spine are also utilized for HVLA techniques to the cervicothoracic junction (C7–T4). If cervicothoracic region techniques require locking via the cervical spine, this is achieved by introducing type 1 movements to the cervical spine.

THORACIC AND LUMBAR SPINE

Current research relating to coupled movements of sidebending and rotation in the thoracic and lumbar spine is inconsistent. Although research does not validate any single model for spinal positioning and locking in the thoracic and lumbar spine, the model in Table A.4.2 is useful for teaching HVLA techniques.

Evidence supports the view that spinal posture and positioning alter coupling behaviour.[17–19] This has implications for joint locking in the thoracic and lumbar spine. In relation to patient positioning, the locking procedures will be different depending on whether the patient's spine is placed in a flexed or a neutral/extended position.

There is some evidence to support the view that, in the flexed position, the coupling of sidebending and rotation is to the same side,[17–19] whereas in the neutral/extended position, the coupling of sidebending and rotation occurs to opposite sides.[17,18] The model outlined in Table A.4.2 incorporates the available evidence and is useful in the teaching and application of HVLA techniques. Because the evidence for coupling behaviour is inconsistent, it must be understood that this is a model for facet apposition locking which cannot be relied upon in all circumstances.

Neutral/extension positioning

The patient's lumbar and thoracic spine is positioned in a neutral/extended posture (Fig. A.4.4). Using the model outlined, the normal coupling behaviour of sidebending and

Table A.4.2

	Coupled motion	Facet apposition locking
Spinal level		
T4–12	Type 1 or type 2	Type 2 or type 1
L1–5	Type 1 or type 2	Type 2 or type 1
Position of spine T4–L5		
Flexion	Type 2	Type 1 — sidebending and rotation to the opposite side
Neutral/extension	Type 1	Type 2 — sidebending and rotation to the same side

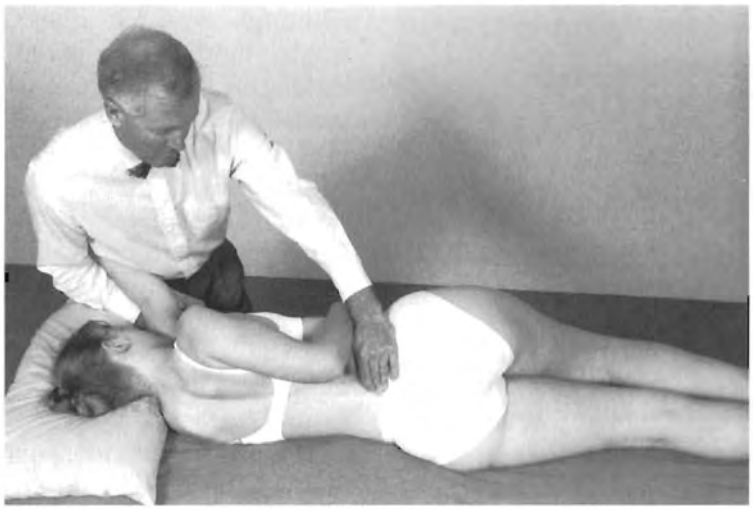

Fig. A.4.4 Neutral/extension positioning.

Fig. A.4.5 Neutral/extension positioning. Type 2 locking — rotation and sidebending to the same side, i.e. sidebending right and rotation right.

rotation in the neutral/extension position is type 1 movement. Facet apposition locking will be achieved by introducing a type 2 movement, i.e. sidebending and rotation to the same side.

The spine in the neutral/extension position is slung between the pelvis and shoulder girdle and creates a long C curve with the trunk sidebending to the patient's right when the patient lies on the left side.

Trunk rotation to the right is introduced by gently pushing the patient's upper shoulder away from the operator. Rotation and sidebending to the same side achieve facet apposition locking in the neutral or extended position, in this instance with sidebending and rotation to the right (Fig. A.4.5).

Flexion positioning

The patient's lumbar and thoracic spine is positioned in a flexed posture (Fig. A.4.6). The normal coupling behaviour of sidebending

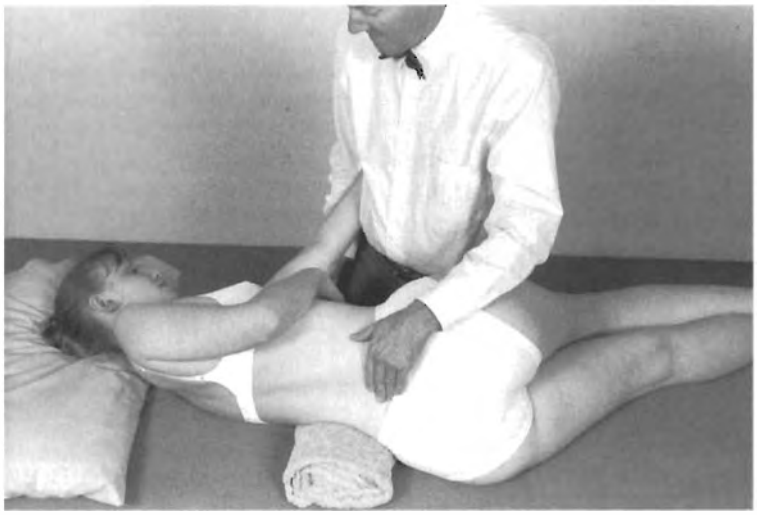

Fig. A.4.6 Flexion positioning.

Fig. A.4.7 Flexion positioning. Type 1 locking — rotation and sidebending to opposite sides, i.e. sidebending left and rotation right.

and rotation in the flexed position is type 2 movement. Facet apposition locking will be achieved by introducing a type 1 movement, i.e. sidebending and rotation to opposite sides.

To achieve facet apposition locking of the spine, in the flexed posture, the trunk must be rotated and sidebent to opposite sides (Fig. A.4.7). The operator introduces trunk sidebending to the left by placing a pillow under the patient's thoracolumbar spine. Trunk rotation to the right is introduced by gently pushing the patient's upper shoulder away from the operator (Fig. A.4.7).

Many factors, such as facet tropism, vertebral level, intervertebral disc height, back pain and spinal position, can affect coupling behaviour and there will be occasions when the model outlined needs to be modified to suit an individual patient. In such circumstances, the operator will need to adjust patient positioning to facilitate effective localization of forces. To achieve this, the operator must develop the palpatory skills necessary to sense appropriate pre-thrust tension and leverage prior to delivering the HVLA thrust.

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5 Safety and HVLA techniques

INTRODUCTION

There are risks and benefits associated with any therapeutic intervention. High-velocity low-amplitude (HVLA) techniques are distinguished from other osteopathic techniques because the practitioner applies a rapid thrust or impulse. Thrust or impulse techniques are considered to be potentially more dangerous than non-impulse mobilization.

COMPLICATIONS

Incidence

Most published literature relating to the incidence of injury resulting from manipulative techniques focuses upon serious sequelae resulting from cervical spine manipulation.

There is wide variation in estimated serious adverse reactions arising from cervical manipulation. Rivett and Milburn[1] estimated the incidence of severe neurovascular compromise to be within the range 1 in 50 000 to 1 in 5 million cervical spine manipulations. Other authors estimate complications for cervical spine manipulation to be 1.46 times per 1 million manipulations[2] and 1 case of cerebrovascular accident in every 1.3 million cervical treatment sessions, increasing to 1 in every 0.9 million for upper cervical manipulation.[3] Dvorak and Orelli[4] report a ratio of 1 serious complication per 400 000 cervical manipulations, while Patijn[5] found an overall ratio of 1 complication per 518 886 manipulations.

Published figures may not accurately reflect the true incidence of serious cervical spine complications.[1,5–7] The frequency with which complications arise in patients receiving cervical spine manipulation can only be an estimate, as the true number of manipulations performed and the number of patients receiving cervical manipulation remain unknown.[8] In relation to vertebral artery dissection, Haldeman et al[9] indicate that a database of multiple millions of cervical manipulations are necessary to obtain accurate statistics.

Classification of complications

Serious non-reversible impairment

- Death
- Cerebrovascular accident
- Spinal cord compression
- Cauda equina syndrome.

Substantive reversible impairment

- Disc herniation
- Disc prolapse
- Nerve root compression
- Fracture.

Transient

- Local pain or discomfort
- Headache
- Tiredness
- Radiating pain or discomfort
- Paraesthesia
- Dizziness
- Nausea
- Hot skin
- Fainting.

Less common transient reactions include early or heavy menstruation, epigastric pain, tremor, palpitation and perspiration.[10]

Transient side-effects resulting from manipulative treatment may be more common than one might expect and may remain unreported by patients unless information is explicitly requested. A study of common side-effects resulting from chiropractic treatment indicated that 55% of patients reported at least one unpleasant reaction during a course of treatment.[11] These side-effects generally disappear within 24 hours.

Causes of complications

Incorrect patient selection

- Lack of diagnosis
- Lack of awareness of possible complications
- Inadequate palpatory assessment
- Lack of patient consent.

Poor technique

- Excessive force
- Excessive amplitude
- Excessive leverage
- Inappropriate combination of leverage
- Incorrect plane of thrust
- Poor patient positioning
- Poor operator positioning
- Lack of patient feedback.

CONTRAINDICATIONS

Whenever a practitioner applies a therapeutic intervention, due consideration must be given to the risk:benefit ratio — the benefit to the patient must outweigh any potential risk associated with the intervention. Traditionally, risks have been classified as absolute and relative. The distinction between absolute and relative contraindications is influenced by factors such as the skill, experience and training of the practitioner, the type of technique selected, the amount of leverage and force used, and the age, general health and physique of the patient.

Absolute

- Bone — any pathology that has led to significant bone weakening:
  - — tumour, e.g. metastatic deposits
  - — infection, e.g. tuberculosis
  - — metabolic, e.g. osteomalacia
  - — congenital, e.g. dysplasias
  - — iatrogenic, e.g. long-term corticosteroid medication
  - — inflammatory, e.g. severe rheumatoid arthritis
  - — traumatic, e.g. fracture.
- Neurological
  - — cervical myelopathy
  - — cord compression
  - — cauda equina compression
  - — nerve root compression with increasing neurological deficit.
- Vascular
  - — diagnosed vertebrobasilar insufficiency
  - — aortic aneurysm
  - — bleeding diatheses, e.g. severe haemophilia.
- Lack of a diagnosis
- Lack of patient consent
- Patient positioning cannot be achieved because of pain or resistance.

Relative

Certain categories of patients have an increased potential for adverse reactions following the application of a HVLA technique. Special consideration should be given prior to the use of HVLA techniques in the following circumstances:

- Adverse reactions to previous manual therapy
- Disc herniation or prolapse
- Inflammatory arthritides
- Pregnancy
- Spondylolysis
- Spondylolisthesis
- Osteoporosis
- Anticoagulant or long-term corticosteroid use
- Advanced degenerative joint disease and spondylosis
- Vertigo
- Psychological dependence upon HVLA technique
- Ligamentous laxity
- Arterial calcification.

The above list is not intended to cover all possible clinical situations. Patients who have pathology may also have coincidental spinal pain and discomfort arising from mechanical dysfunction that may benefit from manipulative treatment.

The use of manipulation techniques under general anaesthesia for low back pain is associated with an increased risk of serious neurological damage.[12] There is no evidence that this approach for the treatment of low back pain is effective.[13]

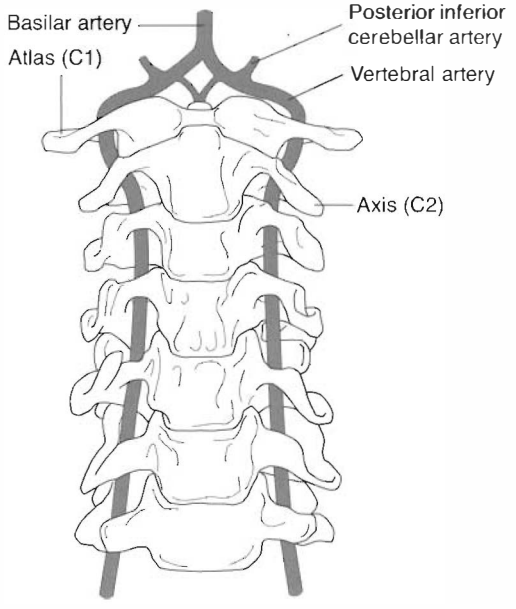

Fig. A.5.1 Relationship of the cervical spine to the vertebral artery.

VERTEBROBASILAR INSUFFICIENCY

The vertebrobasilar system comprises the two vertebral arteries and their union to form the basilar artery (Fig. A.5.1). This system supplies approximately 20% of the intracranial blood supply.[14] Blood flow in the vertebral artery may be affected by intrinsic and extrinsic factors. Intrinsic factors, such as atherosclerosis, narrow the vessel lumen, increase turbulence and reduce blood flow. Extrinsic factors compress or impinge upon the external wall of the vertebral artery.

There are three areas where the vertebral artery is vulnerable to external compression:

- at the level of the vertebral foramen of C6 by the contraction of the longus colli and/or the anterior scalene muscles
- within the foramen transversarium between C6 and C2
- at the level of C1 and C2 (Fig. A.5.2).

The ability to recognize symptoms that may indicate vertebrobasilar insufficiency (VBI) is essential for safe practice. Symptoms of VBI occur because of ischaemia in the structures

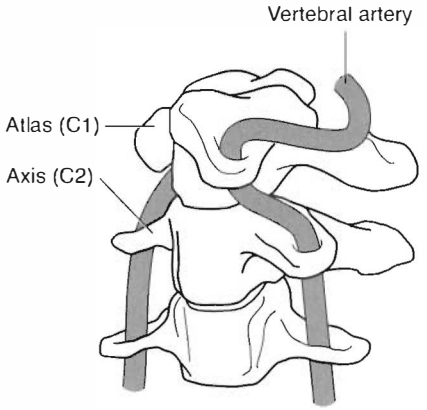

Fig. A.5.2 Upper cervical rotation stretches the vertebral artery between the atlas and the axis.

supplied by the vertebrobasilar system. There are a number of signs and symptoms that may be suggestive of VBI.

Signs of VBI

- Nystagmus
- Gait disturbances
- Horner's syndrome.

Symptoms of VBI

- Dizziness/vertigo
- Diplopia
- Tinnitus
- Nausea
- Drop attacks
- Dysarthria
- Dysphagia
- Occipital headaches
- Facial paraesthesia
- Tingling in the upper limbs
- Pallor and sweating
- Blurred vision
- Light-headedness
- Fainting/blackouts.

Box A.5.1 Causes of dizziness

Systemic causes of dizziness
- Medication
- Hypotension
- Diabetes
- Hypothyroidism

Central causes of dizziness
- Demyelinating diseases
- Tumours of brain or spinal cord
- Seizures
- Vertebrobasilar insufficiency
- Post-traumatic (concussion) vertigo

Peripheral causes of dizziness
- Benign positional vertigo
- Ménière's disease
- Cervical spine dysfunction
- Labyrinthitis
- Vestibulotoxic medication

Dizziness is a common presenting complaint with multiple aetiologies that must be distinguished from dizziness arising from VBI (Box A.5.1). It has been suggested that questioning about nausea during VBI testing is as important as enquiring about dizziness.[15] Diagnosed VBI is an absolute contraindication to HVLA techniques to the cervical spine.

VBI testing protocol

Testing for VBI prior to manipulation of the cervical spine is common because of legal implications and the risk of a cerebrovascular accident following HVLA. There are many physical tests described for determining the presence or absence of VBI.[16–21]

A comprehensive testing procedure might include both active and passive movements (Box A.5.2). All positions should be end of range and maintained for 10 seconds unless symptoms or signs are provoked sooner. On returning the patient's neck to the neutral position, a period of 10 seconds should be allowed before proceeding with the next neck movement. During this time the patient should be asked whether any symptoms were

Box A.5.2 Vertebrobasilar insufficiency testing protocol

Patient sitting/active movement/cervical spine
- Rotation right (Fig. A.5.3)
- Rotation left (Fig. A.5.4)
- Extension (Fig. A.5.5)
- Extension and rotation right (Fig. A.5.6)
- Extension and rotation left (Fig. A.5.7)

Patient supine/passive movement/cervical spine
- Rotation right (Fig. A.5.8)
- Rotation left (Fig. A.5.9)
- Extension (Fig. A.5.10)
- Extension and rotation right (Fig. A.5.11)
- Extension and rotation left (Fig. A.5.12)

provoked. Reproduction of symptoms and/or signs of VBI constitutes a positive test.

The rationale for using active movement as part of the protocol is that the vertebral artery may be vulnerable to external compression at the level of the vertebral foramen of C6 by the contraction of the longus colli and/or the anterior scalene muscles.

Fig. A.5.4 Active rotation left.

Fig. A.5.3 Active rotation right.

Fig. A.5.5 Active extension.

Fig. A.5.6 Active extension and rotation right.

Fig. A.5.7 Active extension and rotation left.

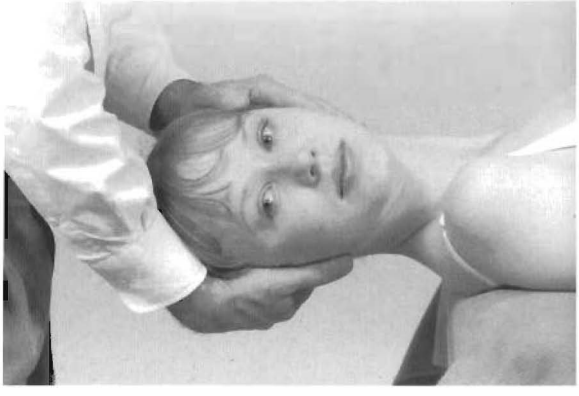

Fig. A.5.8 Passive rotation right.

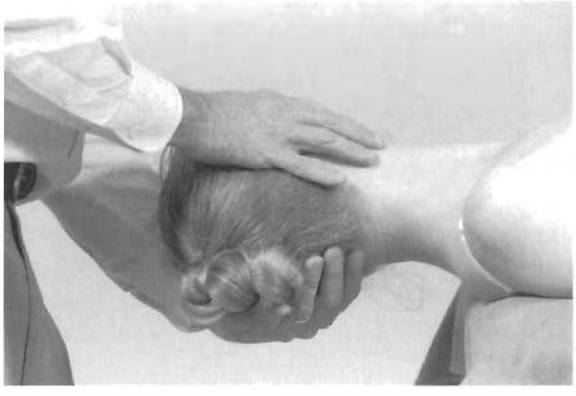

Fig. A.5.9 Passive rotation left.

Tests for VBI are based upon the premise that cervical spine positioning may reduce the lumen and blood flow in the vertebral arteries.[22,23] Studies on cadaveric specimens have demonstrated reduced flow through contralateral vertebral arteries in combined extension and rotation.[24,25] In vivo studies also support the view that cervical spine positioning may reduce vertebral artery blood flow.[26–28] A study of normal volunteers concluded that

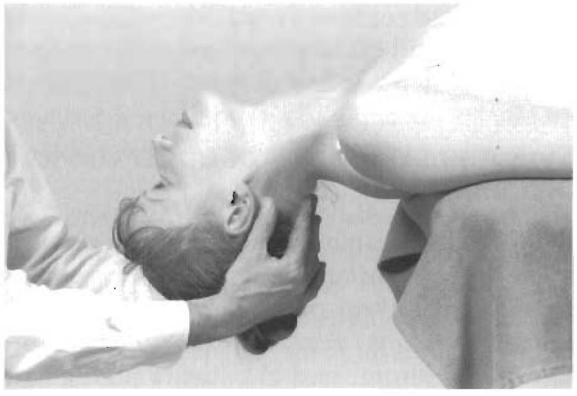

Fig. A.5.10 Passive extension.

Fig. A.5.11 Passive extension and rotation right.

Fig. A.5.12 Passive extension and rotation left.

blood velocity altered significantly at 45° cervical spine rotation, and again at full-range cervical spine rotation.[28]

Evidence linking vertebral artery narrowing or occlusion with cervical spine extension and rotation positioning has contributed to the development and use of many pre-manipulative tests for VBI. It is postulated that a reduction in blood flow as a result of cervical spine positioning will produce detectable symptoms or signs in a patient with VBI. Positive tests are assumed to be predictors of patients at risk of cerebrovascular complications of manipulation. However, tests for VBI may have low sensitivity and specificity for predicting cerebral ischaemia prior to neck manipulation,[29] and the value of these tests in determining VBI has been questioned.[21,30–32]

There is debate as to whether VBI testing can reliably detect patients with VBI or identify those patients at risk of a cerebrovascular accident following cervical spine manipulation. It has been suggested that the tests themselves hold certain risks and could have a morbid effect on the vertebral artery.[33] There is a need for continuing research to investigate the sensitivity and specificity of VBI testing in identifying those patients at risk of complications from manipulation, and to relate this research to the ethical and legal aspects of practice.

UPPER CERVICAL INSTABILITY

The bony anatomy of the atlantoaxial joint favours mobility rather than stability,[34] with the atlantoaxial joint being more vulnerable to subluxation than other segments of the cervical spine.[35] The transverse and alar ligaments have an integral role in maintaining stability in the upper cervical spine. Instability of the upper cervical spine may compromise related vascular and neurological structures and, in these circumstances, would be a contraindication to the use of HVLA techniques.

Instability must be differentiated from hypermobility.[36,37] Instability is a pathological situation that exists with clinical symptoms or complaints.[37] Causes of upper cervical instability may be a result of incompetence of the odontoid process or of the transverse atlantal ligament. These causes can be classified as congenital, inflammatory, neoplastic and traumatic.

Congenital

Incompetence of the odontoid process
- Separate odontoid — 'os odontoideum'
- Free apical segment — 'ossiculum terminale'
- Agenesis of odontoid base
- Agenesis of apical segment
- Agenesis of odontoid process.

Incompetence of the transverse atlantal ligament
- Idiopathic
- Down's syndrome.

Inflammatory

Incompetence of the odontoid process
- Osteomyelitis.

Incompetence of the transverse atlantal ligament
- Bacterial infection
- Viral infection
- Granulomatous change
- Rheumatoid arthritis
- Ankylosing spondylitis.

Neoplastic

Incompetence of the odontoid process
- Primary tumour of bone
- Metastatic tumour of bone.

Traumatic

Incompetence of the odontoid process
- Acute bony injury
- Chronic bony change.

Incompetence of the transverse atlantal ligament
- Acute ligamentous damage associated with fracture and trauma
- Chronic ligamentous change.

Symptoms and signs of upper cervical instability

Symptomatic instability of the upper cervical spine is rare. Atlantoaxial instability occurs most frequently in patients with rheumatoid arthritis and is also well documented in Down's syndrome and in patients subsequent to retropharyngeal inflammatory processes.

The ability to recognize symptoms and signs that may indicate upper cervical instability is essential for safe practice. There are four cardinal symptoms and signs that may indicate presence of upper cervical instability:[38]

- Overt loss of balance in relation to head movements
- Facial lip paraesthesia, reproduced by active or passive neck movements
- Bilateral or quadrilateral limb paraesthesia, either constant or reproduced by neck movements
- Nystagmus produced by active or passive neck movements.

In addition to the cardinal features of instability, there are other symptoms which may also indicate the presence of instability, including:[37]

- Neck pain
- Limitation of neck movements
- Torticollis
- Neurological symptoms
  - — headache
  - — dizziness
  - — buzzing in the ears
  - — dysphagia
- Neurological signs
  - — hyperreflexia
  - — gait disturbances
  - — spasticity
  - — pareses.

The above symptoms and signs might also indicate the presence of VBI or spinal cord compression unrelated to upper cervical instability. Thus, it is necessary to establish whether the symptoms or signs are related to instability of the upper cervical spine or to other causes.

Currently, the most reliable method for detecting increased movement in the upper cervical spine is by the use of imaging techniques. The atlantodental interval is the distance between the most anterior point of the dens of the axis and the back of the anterior arch of the atlas. This is measured on lateral radiographs of the cervical spine in flexion, neutral and extension positions. An atlantodental interval greater than 2.5–3 mm in adults and greater than 4.5–5 mm in children indicates atlantoaxial instability.[39] Computerized tomography may have some advantages over plane radiographs[40] with magnetic resonance imaging also offering benefits because of the ability to provide direct sagittal projection.[37]

A number of physical tests have been described for the examination of instability of the upper cervical region.[38,41,42] A comprehensive testing procedure should include movements and positions that stress both the transverse atlantal and alar ligaments.

Transverse atlantal ligament stress test

The Sharp–Purser test was designed to demonstrate anterior instability at the atlantoaxial segment in patients with rheumatoid arthritis and ankylosing spondylitis.[42,43] A modified Sharp–Purser test analyses the onset of symptoms and signs following head and neck flexion, and the reduction of signs and symptoms accompanying posterior translation of the occiput and atlas on the axis.

Patient position. Sitting with the head and neck relaxed in a semi-flexed position.

Operator position. Standing to the right of the patient with your right arm cradling the patient's forehead. The spinous process and vertebral arch of the axis are stabilized with the thumb and index finger of your left hand (Fig. A.5.13).

Stress applied. The occiput and atlas are translated posteriorly by applying pressure on the forehead with your right arm (Fig. A.5.14).

Positive test. A positive test occurs when:

- there is onset of symptoms and signs with head and neck flexion

Fig. A.5.13 ✲ Stabilization

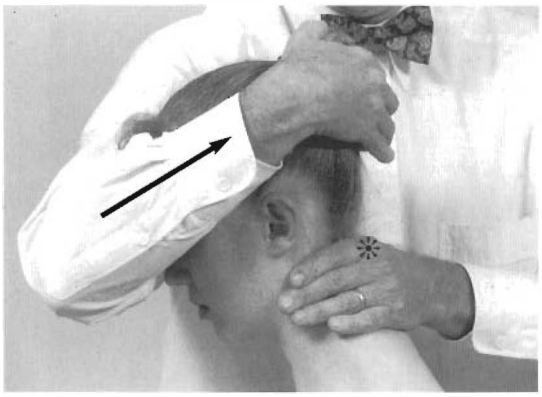

Fig. A.5.14 ✲ Stabilization
→ Plane of force (operator)

- there is a reduction of symptoms and signs with posterior translation of the occiput and atlas on the axis
- there is palpable hypermobility of anterior/posterior translation.

Alar ligament stress tests

There are many tests that purport to stress the alar ligaments and identify alar ligament instability. A comprehensive testing regimen might include the following three tests:

Patient sitting with the neck in a neutral position. Ensure that there is no sidebending of the head and neck. Stabilize the spinous process and vertebral arch of the axis with the thumb and index finger. Passively rotate the occiput and atlas to the right (Fig. A.5.15). There should be no more than 20–30° rotation. Repeat the procedure to the left.

A *positive test* is characterized by the onset of symptoms or signs and/or a range of passive rotation greater than 30° at the upper cervical segments.

Patient sitting with the neck in a neutral position. Ensure the head is straight and there is no rotation of the neck. Stabilize the spinous process and vertebral arch of the axis with the thumb and index finger while placing the other hand on the patient's vertex (Fig. A.5.16). Attempt to passively sidebend the head to the left and then to the right (Fig. A.5.17). There should be minimal movement in either direction. This test must be repeated with the neck in flexion (Fig. A.5.18) and extension (Fig. A.5.19).

Fig. A.5.16 ✳ Stabilization

Fig. A.5.15 ✳ Stabilization
➡ Direction of body movement

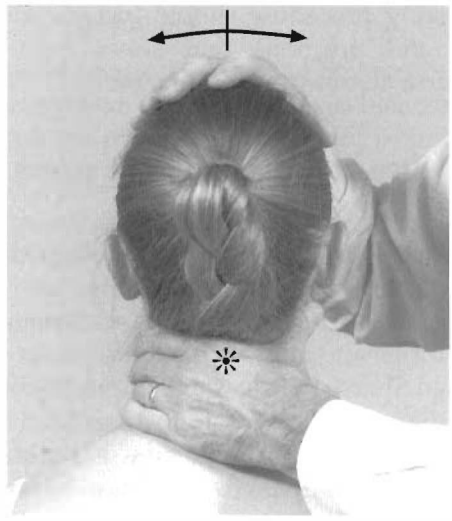

Fig. A.5.17 ✳ Stabilization
⟷ Direction of body movement

Fig. A.5.18 ✲ Stabilization

Fig. A.5.19 ✲ Stabilization

A *positive test* is characterized by the onset of symptoms or signs and/or an increased range of passive sidebending in all positions of neutral, flexion and extension.

Patient supine with the head and neck beyond the end of the couch and in a neutral position. Ensure the head is straight and there is no rotation of the neck. Stabilize the spinous process and vertebral arch of the axis with the thumb and index finger while placing the other hand on the patient's vertex (Fig. A.5.20). Both hands support the weight of the patient's head. Attempt to passively sidebend the head to the left and then to the right. There should be minimal movement in either direction. This test must be repeated with the neck in flexion (Fig. A.5.21) and extension (Fig. A.5.22).

A *positive test* is characterized by the onset of symptoms or signs and/or an increased range of passive sidebending in all positions of neutral, flexion and extension.

Fig. A.5.20

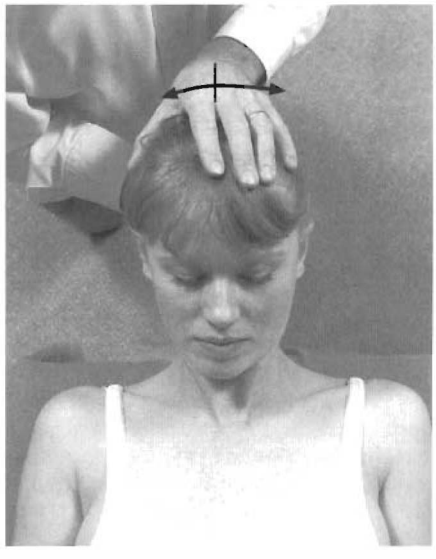

Fig. A.5.21 ⟷ Direction of body movement

Fig. A.5.22

Transverse atlantal and alar ligament stress tests have been developed on the premise that patients at risk from manipulation to the upper cervical spine may be identified using physical examination techniques. There is a need for continuing research to investigate the reliability and validity of upper cervical instability tests in identifying those patients at risk.

CONCLUSION

It is often stated that manipulation of the spine is a therapeutic technique associated with a high level of risk. The potential benefits[44,45] for the patient must be weighed against the risks associated with manipulation of the cervical spine. While there is a potential for serious sequelae, the risk is extremely low.

The evidence review accompanying the national clinical guidelines on acute and recurrent low back pain indicates that the risks of manipulation for low back pain are very low provided patients are assessed and selected for treatment by trained practitioners.[46,47]

An extensive review of the literature between 1925 to 1993 indicates that the key to safety is dependent upon appropriate training, a thorough patient history and physical assessment prior to the application of any manipulative procedure.[48]

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6 Rationale for the use of HVLA techniques

High-velocity low-amplitude (HVLA) techniques are widely used in patient care with increasing evidence of their effectiveness. However, the use of HVLA techniques must be considered within the context of a comprehensive patient management plan, which may include the application of other osteopathic manipulative techniques and adjunctive therapies.

Various authors have described specific indications for the use of HVLA techniques (see Box A.6.1).

Box A.6.1 Specific indications for HVLA techniques as listed by various authors

- Hypomobility[1,2]
- Motion restriction[3–5]
- Joint fixation[6,7]
- Acute joint locking[2,8,9]
- Motion loss with somatic dysfunction[10,11]
- Somatic dysfunction[12–14]
- Restore bony alignment[4,15]
- Meniscoid entrapment[1,3,4,7,16]
- Adhesions[17]
- Displaced disc fragment[18]
- Pain modulation[1,5,9,19,20]
- Reflex relaxation of muscles[1,5,21–23]
- Reprogramming of the central nervous system[12]
- Release of endorphins[24]

OSTEOPATHIC TREATMENT MODELS

Scientific validation for the use of manual and manipulative approaches, including HVLA techniques, is limited. Consequently, practitioners must rely upon theoretical and clinical models to justify the use of HVLA techniques in clinical practice.

Osteopaths use five treatment and clinical reasoning models:[14]

- Biomechanical
- Neurological
  - — autonomic nervous system
  - — pain
  - — neuroendocrine
- Respiratory/circulatory
- Bioenergy
- Psychobehavioral.

Biomechanical (postural/structural)

This model is based upon the concept that mechanical and structural dysfunction can result from single incidences of trauma or from microtrauma occurring over time and as a result of postural imbalance or occupational and environmental stresses. Cumulative microtrauma can lead to a breakdown of the body's normal compensatory mechanisms with resultant development of dysfunction and pain.

The biomechanical model requires the practitioner to restore maximum function to the neuromusculoskeletal system with enhancement of the body's ability to compensate for external mechanical stresses and any primary

or secondary postural imbalance. Therapy is directed towards restoring as near normal motion and/or function to joints, ligaments, muscles and fascia. The aim is to regain optimal function within the musculoskeletal system.

Neurological

This model is based upon the concept that neural mechanisms may be influenced by the use of manual medicine approaches. The neurological models provide a framework for treatment that is based upon postulated mechanisms of interaction between the somatic and neurological systems. These mechanisms are complex and beyond the scope of this manual. It is suggested that manual intervention may influence:

- the two divisions of the autonomic nervous system
- the integration of function between the central and peripheral nervous systems for modulation of pain
- the neuroendocrine-immune connection, resulting in both local and systemic effects.

Respiratory/circulatory

This model is based upon the concept that normal fluid exchange is essential for the continued health of tissues at both the 'micro' and 'macro' level. Manual treatment is directed towards improving blood and lymph flow and aiding intracellular fluid exchange by enhancing musculoskeletal function. Treatment is directed towards restoring the capacity of the musculoskeletal system to assist venous and lymphatic return.

Bioenergy

This model is based upon the body's inherent energy fields that can be utilized for diagnosis and treatment. Internal and external environmental factors may influence the vitality and quality of energy flow within the human body. The aim of treatment is to restore balance and harmony to these fields of energy.

Psychobehavioral

This model recognizes that many internal and external factors influence a patient's response to pain and dysfunction. Social, economic and cultural factors all impact upon the way in which a patient deals with pain, dysfunction and disability. An understanding of the factors that can influence a patient's coping mechanisms is pivotal to this model, as is a knowledge of the psychosocial interventions that may assist the patient to deal with pain and disability.

These five models provide a conceptual framework upon which decisions relating to patient management can be made. It must be understood that these are simply conceptual models with varying amounts of evidence to support their use.

These osteopathic models provide a framework for choosing a treatment approach and selecting osteopathic manipulative techniques. However, the treatment models do not clearly establish a rationale for the use of HVLA techniques as distinct from other osteopathic manipulative techniques.

CAVITATION ASSOCIATED WITH HVLA TECHNIQUES

The aim of HVLA techniques is to achieve joint cavitation that is accompanied by a 'popping' or 'cracking' sound. This audible release distinguishes HVLA procedures from other osteopathic manipulative techniques.

Research involving the metacarpophalangeal joint indicates that the audible release is generated by a cavitation mechanism resulting from a drop in the internal joint pressure.[25-28] Following cavitation, there is an

increase in the size of the joint space and gas is found within that space.[25–29] The gas bubble has been described as 80% carbon dioxide[26] or having the density of nitrogen.[14] The gas bubble remains within the joint for between 15 and 30 min,[14,25–27,29] which is consistent with the time taken for the gas to be reabsorbed into the synovial fluid.[26] An increased range of joint motion immediately following cavitation has been demonstrated.[29]

It is possible that cavitation occurring at spinal synovial joints has similar characteristics to that exhibited at the metacarpophalangeal joint. A number of studies have reported that thrust techniques are associated with a temporary increase in the range of spinal motion.[30–35] Longer-term effects of HVLA techniques have also been reported[36,37] and it is postulated that these may be due to reflex mechanisms that either directly cause muscle relaxation or inhibit pain.[5] However, the sound of a 'crack' or 'pop' associated with a HVLA technique does not necessarily indicate that reflex or tissue changes have occurred.

Repeated 'cracking' or 'popping' of the joints of the hand, associated with cavitation, has not been shown to be linked with an increased incidence of degenerative change.[38,39]

Within manual medicine there is an ongoing debate about the specific effects of HVLA techniques compared with other manual interventions. The evidence suggesting efficacy of individual manual medicine techniques is limited at best and absent in many cases.

INDICATIONS FOR THE USE OF HVLA TECHNIQUES

A practitioner may select a HVLA technique based upon a number of different criteria:

- The technique is widely used and supported by years of clinical experience.
- The technique is underpinned by biologically plausible theories.
- Research has demonstrated measurable and proven therapeutic outcomes.

A practitioner will be conscious of a basis or rationale for selecting a HVLA technique in patient management. After considering safety issues and excluding contraindications, a HVLA technique may be selected based upon one or more of the following:

- diagnosis of somatic dysfunction
- physiological model of manipulation
- research evidence.

Diagnosis of somatic dysfunction

Somatic dysfunction is identified by the A–R–T–T of diagnosis and is made on the basis of a number of positive findings relating to asymmetry, range of motion, tissue texture changes and tissue tenderness (Box A.6.2). A number of treatment models use elements of A–R–T–T as the basis for the selection of HVLA techniques.[12,14,21,40–42]

Box A.6.2 Diagnosis of somatic dysfunction

- A — relates to asymmetry
- R — relates to range of motion
- T — relates to tissue texture changes
- T — relates to tissue tenderness

Physiological model of manipulation

Lederman[43] has proposed a physiological model for the effects of manipulation (Fig. A.6.1). This model can be adapted to provide three categories of indications for the use of HVLA techniques:

- biomechanical
- neurological
- psychological and psychophysiological (whole person).

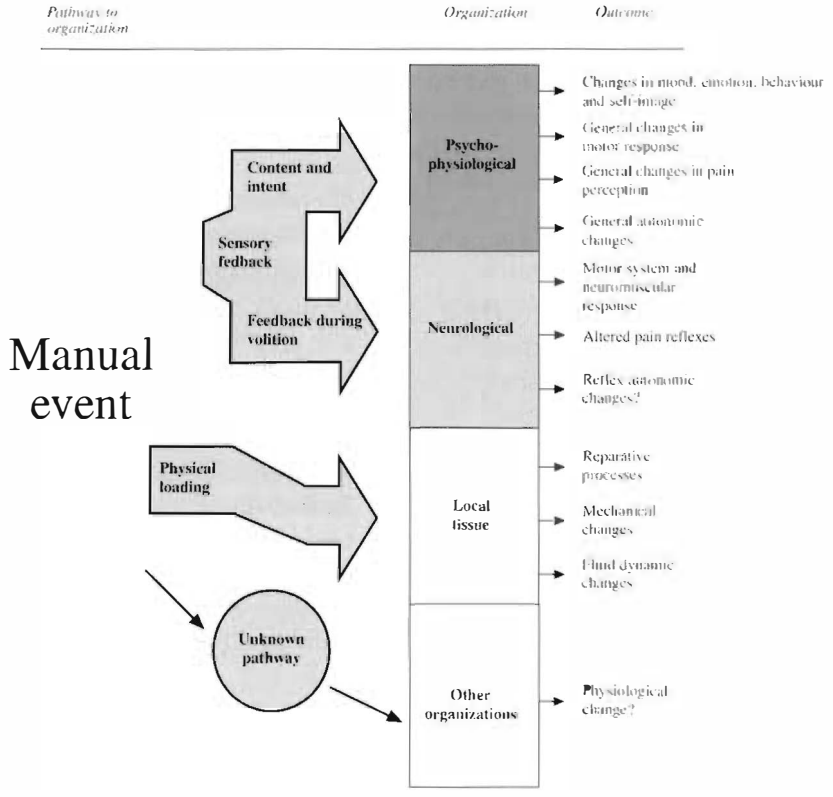

Fig. A.6.1 The physiological model of manipulation. (Reproduced with permission from Lederman.[43])

Biomechanical indications

- To improve the plasticity and elasticity of shortened and thickened soft tissues
- To improve fluid dynamics, e.g. blood, lymph and synovial fluid.

Neurological indications

- To diminish increased muscle tone
- To modulate pain (manual analgesia).

Psychological and psychophysiological indications (whole person)

- To improve general muscle relaxation
- To improve visceral function
- To diminish pain perception.

Research evidence

There have been a number of randomized controlled trials of manipulation for low back and neck pain. The balance of evidence indicates that manipulation for acute low back pain can provide short-term improvement in pain and activity levels.[44] Research also indicates that cervical spine manipulation probably provides short-term benefits for some patients with neck pain and headaches.[45] Unfortunately, this research has not identified specific indications

for the use of HVLA techniques, because the published literature often does not clearly distinguish between thrust and non-thrust techniques when reporting outcomes from manipulation. Further research is required to identify the specific indications for a range of osteopathic manipulative procedures, including HVLA techniques.

CONCLUSION

Osteopaths have used HVLA techniques for the treatment of somatic dysfunction for many years. Practitioners rely upon theoretical and clinical models to justify their use in clinical practice. While there is increasing evidence for the effectiveness of manipulation, more research is necessary to validate existing treatment models and identify indications for the use of HVLA techniques.

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7 Validation of clinical practice by research

Responsibility for the scientific credence that can be afforded osteopathic medicine rests largely within its own discipline. The osteopathic profession is obligated to question the value of teaching unsubstantiated doctrines, except within their historical perspective. Students and the profession should be encouraged to engage in active research. Research is needed both to establish the clinical efficacy of osteopathic therapeutic intervention and to elaborate the biological basis and physiological mechanisms that underlie the osteopathic principles of practice. Patient satisfaction is also an important measure of the quality of care.[1] If there is to be a commitment to research, where should the osteopathic profession focus its research funds and activities?

WHY UNDERTAKE RESEARCH?

Given the financial constraints placed upon health expenditure and the increasing pressure upon third party payers to rationalize and limit costs, one can expect that health professionals will be required to demonstrate efficacy of treatment. It will no longer be acceptable to claim that therapy is beneficial solely because individual patients report improvement after treatment. The challenge is to demonstrate that symptom improvement is a direct outcome of specific intervention rather than natural recovery and that this intervention is more effective, and cost-effective, than marketplace competitors. Bogduk[2] argues that research is not an indulgence of academics but constitutes the basis of best practice and quality assurance.

Various osteopathic authors have acknowledged the need for research and the importance of continuing to search for new knowledge.[3–5] The need for research should be indisputable, but where should the osteopathic profession's resources be concentrated? Bogduk and Mercer[6] express a view that it is more valuable to demonstrate the efficacy of a therapy before one explores its mechanism. They suggest there may be limited value in utilizing scarce resources researching the underlying mechanisms of a therapy that may eventually be shown to be ineffective.

It would also be reasonable for a profession to hold the view that there is a place for both therapeutic trials and continuing research to explore the biological basis and physiological mechanisms that underpin osteopathic treatment. However, it should be recognized that even if we had a clear understanding of the biological and physiological mechanisms underlying all osteopathic therapeutic interventions, this in itself would not prove that their use would produce a positive clinical outcome. Only properly conducted clinical trials can legitimize a therapy by demonstrating positive outcomes from therapeutic intervention.

WHERE SHOULD RESEARCH BE FOCUSED?

Research effort should be directed towards designing and implementing effective therapeutic trials that could demonstrate the efficacy or otherwise of therapeutic interventions.[6] Validation of osteopathic practice by outcome studies could be a way forward. Management of patients utilizing outcome measures has the benefit of establishing baselines, documenting progress and assisting in quality assurance.[7]

Osteopathic practice is diverse. Individual practitioners, depending upon their style of practice and interests, treat a wide variety of different complaints. Osteopaths see and treat a significant number of patients presenting with spinal pain.[8,9] Outcome studies on patients presenting with spinal pain and disability are an obvious area for osteopathic research. Despite this fact, there is a paucity of osteopathic outcome studies.

Various authors[4,10,11] highlight the point that there are significant difficulties associated with clinical research in the osteopathic area. Stoddard[11] emphasizes that clinical research in osteopathy is hampered by the complexity and diversity of the presenting problems and the difficulties associated with patient allocation to syndrome groups that vary constantly over time. However, similar problems associated with clinical research exist for other disciplines practising manual therapies. Despite the difficulties, other disciplines are participating in an increasing number of research projects.

PATIENT CLASSIFICATION

A possible spectrum of research designs would include conventional and unconventional group designs, ethnomethodological designs and single case studies.[12] Each research method has advantages and limitations, with varying applicability, differing ranges of validity and ethical constraints, and will generate differing sets of data. Which approach would be most useful for outcome studies in osteopathic medicine? The nature of the research question should guide the selection of research design.

One of the major problems associated with clinical trials related to spinal pain lies in the area of diagnosis.[13] The aetiology of most low back pain is unknown,[14] with the pathological or structural diagnosis uncertain in 80–90% of patients presenting with disabling back pain.[15–17] Assessment procedures used may not be able to diagnose the pathology involved or may be incorrectly interpreted.[18] Problems associated with poor inter-observer reliability for clinical findings further confound the picture.

Palpatory findings are integral to the establishment of an osteopathic diagnosis. For palpatory diagnosis to be useful for classification purposes, good inter-examiner reliability needs to be demonstrated. It is well documented that there is poor inter-observer reliability for palpatory findings without pain provocation.[19,20] For these reasons, current osteopathic diagnostic labels cannot be used effectively in clinical trials of spinal pain and disability, and an alternative means of classification needs to be identified.

The Quebec Task Force[13] recognized the lack of uniformity in diagnostic terminology used for spinal disorders and proposed a classification that does not depend upon pathological entities but reflects the clinical presentations encountered in practice. A modified form of this classification can be utilized for conducting research. This classification system can be used by all clinicians, regardless of discipline, to categorize patients with spinal pain in the clinical setting and links patient symptomatology with duration of symptoms and working status (Table A.7.1). The Quebec Task Force classification consists of 11 categories with classification based upon historical markers and clinical and paraclinical examinations. Some

Table A.7.1. Classification of activity-related spinal disorders (Quebec Task Force[13])

Classification	Symptoms	Duration of symptoms from onset	Working status at time of evaluation
1	Pain without radiation	a (< 7 days)	W (working)
2	Pain + radiation to extremity, proximally	b (7 days–7 weeks)	I (idle)
3	Pain + radiation to extremity, distally	c (> 7 weeks)	
4	Pain + radiation to upper/lower limb + neurological signs		
5	Presumptive compression of a spinal nerve root on a simple roentgenogram (i.e. spinal instability or fracture)		
6	Compression of a spinal root confirmed by: —specific imaging techniques (i.e. CAT, myelography or MRI) —other diagnostic techniques (e.g. electromyography, venography)		
7	Spinal stenosis		
8	Post-surgical status, 1–6 months after intervention		
9	Post-surgical status, > 6 months after intervention 9.1 Asymptomatic 9.2 Symptomatic		
10	Chronic pain syndrome		W (working)
11	Other diagnoses		I (idle)

categories are further subdivided by stage, i.e. acute, subacute and chronic, and whether the patient is able to work.

A number of authors have suggested different methods of classification[31,32]. DeRosa and Porterfield[32] modified the Quebec Task Force classification for spinal pain, making it more appropriate for physical therapy diagnosis (Table A.7.2).

Categorizing patients using the Quebec Task Force or a similar system of classification enables outcome studies to be performed on groups of patients with spinal pain without the need for a specific osteopathic or mechanical diagnosis. This does not obviate the need for the practitioner to undertake a full and thorough assessment of each patient but does allow classification of patients into groups for the purpose of research. This form of classification removes the obstacles to research associated with a lack of standardization and validation of diagnostic terminology in spinal disorders.

Table A.7.2 Modified physical therapy diagnosis classification (DeRosa and Porterfield[32])

Category	Definition
1	Back pain without radiation
2	Back pain with referral to extremity, proximally
3	Back pain with referral to extremity, distally
4	Extremity pain greater than back pain
5	Back pain with radiation and neurological signs
6	Post-surgical status (< 6 months or > 6 months)
7	Chronic pain syndrome

More recently, the Quebec Task Force[33] published a similar classification for whiplash-associated disorders. This classification of whiplash 'provides categories that are jointly exhaustive and mutually exclusive, clinically meaningful, stand the test of common sense,

and are "user friendly" to investigators, clinicians, and patients'. A classification system exists that would also allow outcome studies on 'whiplash' patients to be undertaken.

MEASURING OUTCOMES

Consideration needs to be given as to what instruments might be used to measure patient outcomes arising from osteopathic intervention. The process of selecting appropriate measuring instruments can be broken down into three stages:

- The researcher must identify what he or she wishes to measure, e.g. spinal pain and disability.
- What is to be measured must be defined in quantifiable terms, e.g. the intensity of pain suffered by the patient and the impact the pain and disability have upon the patient's activities of daily living.
- Selection of appropriate data collection and recording instruments that will give reliable and valid results.

While patient records are easily accessible to the practitioner, there are problems associated with this form of data collection for the purpose of outcomes assessment. Recording in patient records lacks standardization and is often incomplete, and what is recorded may not reflect what has actually occurred.[34] Practitioners also record physical examination findings, but the large variability in normal values and poor inter-examiner agreement limit the use of such tests in research.

A variety of easily used tools have been developed that allow practitioners to assess specific outcomes resulting from therapeutic interventions. Leibenson and Yeomans[7] have identified eight categories of available outcome approaches (Table A.7.3).

As the range of questionnaires and pain rating scales is diverse, researchers must be confident that they have selected the most appropriate measurement tools for their clinical trials. A different approach and rating instrument would be selected for assessment of chronic spinal pain, with the possibility of a strong affective component, as compared with acute spinal pain. Clinicians undertaking research must be cognizant of both the advantages and disadvantages of individual outcome assessment instruments. Once the most appropriate measurement tool has been selected, it should be used throughout the period of the study. Different scales and questionnaires are not interchangeable.

In relation to spinal pain and disability, there is evidence that appropriately designed questionnaires have at least equal scientific validity to practitioner measurements.[35,36] Specific questionnaires can measure a patient's presenting level of pain and disability and be used to reflect changes in that pain and disability after treatment and over time. The Oswestry Low Back Pain Disability Questionnaire[37–39] and the Roland–Morris Low Back Pain Disability Questionnaire[40] have been shown in randomized controlled trials to have validity and reliability in measuring results for patients with back pain. Vernon and Mior[41] demonstrated a high degree of test–retest reliability and internal consistency for the Neck Disability Index. This index was modified from the Oswestry Low Back Pain Disability Questionnaire.

Of the large number of scales available to measure functional disability and impairment in back pain patients, the most widely accepted are the Roland, Oswestry, Million and Waddell scales.[42] These scales have been demonstrated to reliably detect changes in the level of disability and impairment over time and are reproducible and acceptable to patients.

The subjective sensation of pain can be self-rated by patients using a number of different measures. The most commonly used include the visual analogue scale, numerical rating scale and the verbal rating scale. With the

Table A.7.3 Outcome approaches. (Adapted from Leibenson and Yeomans[7])

Category based on assessment goals	Outcomes assessment instrument
1. Pain level	1. Numerical pain scale (NPS) 2. Visual analogue scale (VAS) 3. McGill/Melzack Pain Questionnaire
2. Region/condition-specific disability questionnaires —LBP —Neck —Headache	4. Oswestry Low Back Pain Disability Questionnaire 5. Roland–Morris Low Back Pain Disability Questionnaire 6. Dallas Pain Questionnaire 7. Low Back Pain 'TyPE' 8. Neck Disability Index (NDI) 9. Headache Disability Index (HDI)
3. General health	10. Dartmouth COOP charts 11. Health Status Questionnaire 2.0 12. Short Form (SF)-36
4. Psychometrics	13. Health Status Questionnaire (HSQ) 20 14. SF-16 15. Waddell's Non-organic LBP signs 16. Modified Zung Questionnaire 17. Modified Somatic Perception Questionnaire 18. Beck's Depression Scale 19. Fear Avoidance Beliefs Questionnaire 20. SCL-90-R
5. Patient satisfaction	21. Patient Satisfaction Questionnaire 22. Visit specific Questionnaire 23. Chiropractic Satisfaction Questionnaire
6. Job dissatisfaction	24. APGAR
7. General disability	25. Vermont Disability Questionnaire 26. Vermont Disability Questionnaire — brief form 27. Functional Assessment Screening Questionnaire 28. Fear Avoidance Beliefs Questionnaire
8. Job demands	29. Job Demands Questionnaire

visual analogue scale (Fig. A.7.1), the patient records the level of pain by making a single perpendicular line along the 100 mm scale. This can be repeated at second and subsequent visits. The researcher measures the pain level for all visits by measuring from the left end of the 100 mm line. As the line is 100 mm long, all measurements can be expressed as a percentage. However, even with this simple scale, experience has demonstrated that patients need oral reinforcement and supervision in addition to written instructions in case they use a circle or a cross to indicate level of pain rather than a perpendicular line. Such responses would render the rating imprecise and invalid. Modifications to refine use of the visual analogue scale to include pain level at present, average pain grade and worst pain grade have been suggested.[43] If applied in a clinical setting, it is recommended that the scale be used every 2 weeks.[44]

The numerical rating scale is similar to the visual analogue scale but offers the patient more defined pain categories to mark. The

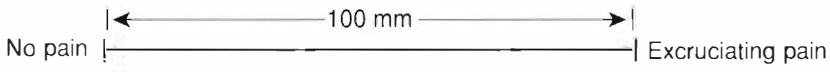

Fig. A.7.1 Visual analogue scale.

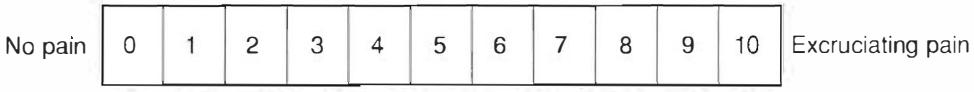

Fig. A.7.2 Numerical rating scale.

Not noticeable	
Just noticeable	
Very weak	
Weak	
Mild	
Moderate	
Strong	
Very strong	
Intense	
Very intense	
Severe	
Excruciating	

Fig. A.7.3 Twelve-point verbal rating scale.

patient is asked to rate the severity of pain by marking one box on the scale in Figure A.7.2.

With the verbal rating scale, the patient must select an adjective, from a standardized list, that best describes the pain. There are many verbal rating scales with the level of pain severity being represented in the questionnaire varying from as few as 4 to 14 (Fig. A.7.3).

There is evidence that tissue tenderness is also measurable. The American College of Rheumatology recommends a five-grade classification of tenderness (Box A.7.1).[45]

Box A.7.1 Standardized palpation of tenderness (Wolfe et al 1990[45])

Using 4 kg of pressure (enough to blanch the tip of the thumbnail if you pressed on a table):

Grade 0 No tenderness
Grade I Tenderness with no physical response
Grade II Tenderness with grimace and/or flinch
Grade III Tenderness with withdrawal (+ jump sign)
Grade IV Withdrawal to non-noxious stimuli

CONCLUSION

There is a strong desire amongst the osteopathic profession to see effective clinical research undertaken. Establishing the effectiveness of osteopathic treatment was rated highly in a study of responses from a group of osteopathic professionals.[46] Structured questionnaires and pain rating scales have been shown to be valid and reliable research instruments to evaluate the efficacy of any given therapy in altering pain and disability. Standardized patient classification systems are available for patients with spinal pain which remove problems associated with use of diagnostic labels. The use of standardized classification systems would enable comparison of efficacy of treatment between professions and of therapeutic approaches within a profession.

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PART

B

HVLA thrust techniques – spine and thorax

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1.10 Cervical spine C2–7: down-slope gliding; chin hold; patient supine
1.11 Cervical spine C2–7: down-slope gliding; cradle hold; patient supine
1.12 Cervical spine C2–7: down-slope gliding; patient sitting; operator standing to the side
1.13 Cervicothoracic spine C7–T3: rotation gliding; patient prone; operator at side of couch
1.14 Cervicothoracic spine C7–T3: rotation gliding; patient prone; operator at head of couch
1.15 Cervicothoracic spine C7–T3: sidebending gliding; patient sitting
1.16 Cervicothoracic spine C7–T3: sidebending gliding; patient side-lying

Section 2 Thoracic spine and rib cage

2.1 Thoracic spine T4–9: extension gliding; patient sitting
2.2 Thoracic spine T4–9: flexion gliding; patient supine
2.3 Thoracic spine T4–9: rotation gliding; patient supine
2.4 Thoracic spine T4–9: rotation gliding; patient prone; short lever technique
2.5 Ribs R1–3: patient prone
2.6 Ribs R4–10: patient supine

2.7 Ribs R4–10: patient prone
2.8 Ribs R4–10: patient sitting

Section 3 Lumbar and thoracolumbar spine
3.1 Thoracolumbar spine T10–L2: neutral positioning; patient side-lying
3.2 Thoracolumbar spine T10–L2: flexion positioning; patient side-lying
3.3 Lumbar spine L1–5: neutral positioning; patient side-lying
3.4 Lumbar spine L1–5: flexion positioning; patient side-lying
3.5 Lumbar spine L1–5: neutral positioning; patient sitting
3.6 Lumbosacral joint L5–S1: patient side-lying

Introduction
Part B includes 30 manipulative techniques applied to the spine from the atlanto-occipital to the lumbosacral joint. All techniques are described using a variable height manipulation couch.

This part of the book relates to specific high-velocity, low-amplitude (HVLA) techniques applied to spinal joints. HVLA techniques are also known by a number of different names, e.g. adjustment, high-velocity thrust, mobilization with impulse, grade V mobilization. Despite the different nomenclature, the common feature in techniques of this type is that they are designed to achieve a joint cavitation (pop or cracking sound) within synovial joints of the spine and periphery. The cause of the popping or cracking sound is open to some speculation.

Information gained from a thorough history, clinical examination and segmental analysis will direct the practitioner towards any possible somatic dysfunction and/or pathology. The use of HVLA techniques is dependent on a diagnosis of somatic dysfunction.

Somatic dysfunction is identified by the A-R-T-T of diagnosis:

- A – relates to asymmetry
- R – relates to range of motion
- T – relates to tissue texture changes
- T – relates to tissue tenderness.

The manual is designed in a format that presents a standardized approach to each region of the spine. If the instructions are followed conscientiously, the novice manipulator will be well placed to achieve a positive outcome from the procedure. The nature of manipulative practice is such that there are many different ways to achieve joint cavitation at any given spinal segment. Many clinicians achieve extremely high levels of expertise and competence in the use of HVLA techniques. This is the result of many years of individual clinical experience and practice.

This manual is designed to be a safe and effective starting point upon which practitioners can build basic and then more refined technical skills. No text can teach the subtle nuances of HVLA techniques. For example, the sense of appropriate

pre-thrust tension is difficult to describe and acquire. Extensive practice under the supervision of skilled and experienced clinicians is strongly recommended.

This text lays out the primary and secondary joint leverages required to facilitate effective localization of forces to a specific segment of the spine prior to application of the thrust. If the instructions are followed, the resultant thrust is likely to achieve joint gliding and cavitation with the use of minimal force. The joint to be thrust should not be locked by facet apposition, but remain free so that the practitioner can direct a gliding thrust along the joint plane. Appropriate pre-thrust tension is then developed by positioning the joint towards the limit of its available range and not at its anatomical barrier.

Techniques are described using facet apposition locking. In broad terms, facet apposition locking uses combinations of sidebending and rotation. An understanding of the biomechanics associated with coupled movements of the spine in different postures allows the operator to decide on optimal leverages. While rotation and sidebending are the principal leverages used, the more experienced manipulator may include elements of flexion, extension, translation, compression or traction to enhance localization of forces and patient comfort.

Patient relaxation is an essential prerequisite for effective HVLA techniques. This may be facilitated by the use of respiration and other distraction methods.

After making a diagnosis of somatic dysfunction and prior to proceeding with a thrust, it is recommended that the following checklist be used for each of the techniques described in this section:

- Have I excluded all contraindications?
- Have I explained to the patient what I am going to do?
- Do I have informed consent?
- Is the patient well positioned and comfortable?
- Am I in a comfortable and balanced position?
- Do I need to modify any pre-thrust physical or biomechanical factors?
- Have I achieved appropriate pre-thrust tissue tension?
- Am I relaxed and confident to proceed?
- Is the patient relaxed and willing for me to proceed?

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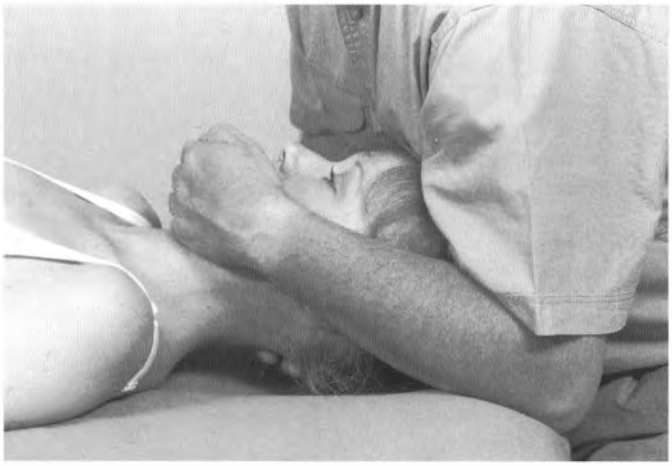
1 Section 1
Cervical and cervicothoracic spine

CERVICAL SPINE HOLDS AND GRIPS

The hold or wrist position selected for any particular technique is that which enables the operator to effectively localize forces to a specific segment of the spine and deliver a high-velocity low-amplitude (HVLA) force in a controlled manner. Patient comfort must be a major consideration in selecting the most appropriate hold.

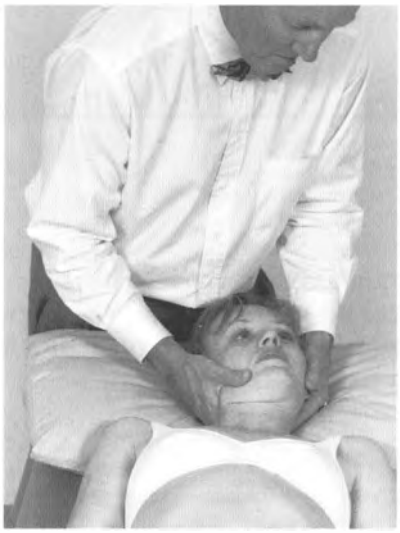
Chin hold



- Operator's left forearm must be over, or slightly in front of, the patient's left ear.
- Operator's fingers lightly clasp the patient's chin.
- Operator's chest should be in contact with the vertex of the patient's head.
- Operator's right hand applies applicator to contact point.

Cradle hold

- Patient's left ear resting in the palm of operator's left hand.
- Operator's left hand spread out for maximum contact.
- Operator's right hand applies applicator to contact point and gives support to the patient's occiput.
- The weight of the patient's head and neck is balanced between the operator's left and right hands.



Wrist position

Operators can select from either the pistol grip or wrist extension grip.

Pistol grip Note: radius in line with first metacarpal.

Wrist extension grip Note: wrist extension.

1.1

Atlanto-occipital joint C0–C1

Contact point on occiput

Chin hold Patient supine
Anterior and superior thrust in a curved plane

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a thrust in the plane of the C0–C1 apophysial joint to produce cavitation on the right (Fig. B1.1.1)

Fig. B1.1.1

1	**Contact point**	Right posterior occiput. Medial and posterior to the mastoid process.
2	**Applicator**	Lateral border, proximal or middle phalanx of the operator's right index finger.
3	**Patient positioning**	Supine with the neck in a neutral relaxed position. If necessary, remove pillow or adjust pillow height. The neck should not be in any significant amount of flexion or extension.
4	**Operator stance**	Head of couch, feet spread slightly. Adjust couch height so that the operator can stand as erect as possible and avoid crouching over the patient, as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact point

Place fingers of both hands gently under the occiput. Lift the head slightly and gently rotate it to the left, taking the weight of the head in your left hand. Remove your right hand from the occiput and palpate the contact point on the occiput with the tip of your index or middle finger. Ensure that you are medial to, and not on, the mastoid process. Slowly but firmly slide your right index finger, in close approximation to the suboccipital musculature, downward (towards the couch) along the occiput until it approximates the middle or proximal phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point. It is important to obtain a contact point as far along the underside of the occiput as possible, and into the suboccipital musculature. This thrust uses a curved plane of movement to produce a cavitation and this positioning ensures that the applicator will not slip during the thrust.

6 Fixation of contact point

Keep your right index finger firmly pressed on the contact point while you flex the other fingers and thumb of the right hand so as to clasp the back of the occiput and head, thereby locking the applicator in position. You must now keep the applicator on the contact point until the technique is complete. Keeping the hands in position, return the head to the neutral position.

7 Chin hold

Keep your right hand in position and slide the left hand, slowly and carefully, forwards until the fingers lightly clasp the chin. Ensure that your left forearm is over or slightly anterior to the ear. Placing the forearm on or behind the ear puts the neck into too much flexion. The head is now controlled by balancing forces between the right palm and left forearm. Maintain the applicator in position.

8 Vertex contact

Move your body forward slightly so that your chest is in contact with the vertex of the patient's head. The head is now securely cradled between the left forearm, the flexed left elbow, the right palm and your chest. Vertex contact is often useful in a heavy, stiff or difficult case but can, on occasions, be omitted.

9 Positioning for thrust

Step to the right and stand across the right corner of the couch, keeping the hands firmly in position and taking care not to lose pressure on the contact point. Gently introduce a little rotation of the head to the left. Straighten your right wrist so that the radius and first metacarpal are in line. While maintaining firm applicator pressure, allow the right index finger to roll slightly on the contact point as you move your right elbow towards the patient's right shoulder. This facilitates optimal alignment for the thrust, which is in a curved plane because of the shape of the apophysial joint. It is important that your applicator is well beneath the occiput so that you do not slip when

applying the thrust along a curved facet plane. Keep your right elbow close to the couch in order to keep the contact point on the occiput (Fig. B1.1.2).

Fig. B1.1.2

Add extension and slight sidebending to the right to provide a feeling of tension at the contact point. Extensive practice is necessary to develop an appreciation of the required tension. The extension and right sidebending are introduced by pivoting slightly via the legs and trunk so your trunk and upper body rotate to the left. Do not attempt to introduce sidebending by moving the hands or arms as this will lead to loss of contact and inaccurate technique.

10 Adjustments to achieve appropriate pre-thrust tension

Ensure the patient remains relaxed. Maintaining all holds, make any necessary minor changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the contact point. The patient should not be aware of any pain or discomfort. You should introduce these final adjustments by slight movements of the ankles, knees, hips and trunk, not by altering the position of your hands or arms.

11 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

12 Delivering the thrust

This is a difficult technique to master, as the thrust must be applied along a curved plane. Apply a HVLA thrust to the occiput, using both hands, in an anterior and superior direction along a curved plane which follows the shape of the occipto-atlantal articulation (Fig. B1.1.3).

Fig. B1.1.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Atlanto-occipital joint C0–C1

Contact point on occiput
Chin hold Patient supine

- **Contact point.** Right posterior occiput.
- **Applicator.** Lateral border, proximal or middle phalanx.
- **Patient positioning.** Supine with the neck in a neutral relaxed position.
- **Operator stance.** Head of couch, feet spread slightly.
- **Palpation of contact point.** Ensure that you are medial to, and not on, the mastoid process.
- **Fixation of contact point.**
- **Chin hold.** Ensure your left forearm is over or slightly anterior to the ear.
- **Vertex contact.** Optional.
- **Positioning for thrust.** Step to the right and stand across the right corner of the couch. Optimal alignment for the thrust is in a curved plane. Keep your right elbow close to the couch in order to keep the contact point on the occiput (Fig. B1.1.2).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust must be applied, using both hands, along a curved plane that follows the shape of the occipto-atlantal articulation (Fig. B1.1.3).

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1.2 Atlanto-occipital joint C0–C1

Contact point on atlas

Chin hold Patient supine
Anterior and superior thrust in a curved plane

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a thrust in the plane of the C0–C1 apophysial joint to produce cavitation on the right (see below)

1	**Contact point**	Right posterior arch of atlas.
2	**Applicator**	Lateral border, proximal or middle phalanx of operator's right index finger.
3	**Patient positioning**	Supine with the neck in a neutral relaxed position. If necessary, remove pillow or adjust pillow height. The neck should not be in any significant amount of flexion or extension.
4	**Operator stance**	Head of couch, feet spread slightly. Adjust couch height so that the operator can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact point

Place fingers of both hands gently under the occiput. Lift the head slightly and gently rotate it to the left, taking the weight of the head in your left hand. Remove your right hand from occiput and palpate the contact point on the right posterior arch of the atlas with the tip of your index or middle finger. Slowly but firmly slide your right index finger, in close approximation to the suboccipital musculature, downward (towards the couch) along the posterior arch of the atlas until it approximates the middle or proximal phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.

6 Fixation of contact point

Keep your right index finger firmly pressed on the contact point while you flex the other fingers and thumb of the right hand so as to clasp the back of the occiput and head, thereby locking the applicator in position. You must now keep the applicator on the contact point until the technique is complete. Keeping the hands in position, return the head to the neutral position.

7 Chin hold

Keep your right hand in position and slide the left hand, slowly and carefully, forwards until the fingers lightly clasp the chin. Ensure that your left forearm is over or slightly anterior to the ear. Placing the forearm on or behind the ear puts the neck into too much flexion. The head is now controlled by balancing forces between the right palm and left forearm. Maintain the applicator in position.

8 Vertex contact

Move your body forward slightly so that your chest is in contact with the vertex of the patient's head. The head is now securely cradled between the left forearm, the flexed left elbow, the right palm and your chest. Vertex contact is essential in this technique.

9 Positioning for thrust

Step to the right and stand across the right corner of the couch, keeping the hands firmly in position and taking care not to lose pressure on the contact point. Gently introduce a little rotation of the head to the left. Straighten your right wrist so that the radius and first metacarpal are in line. While maintaining firm applicator pressure, allow the right index finger to roll slightly on the contact point as you move your right elbow towards the patient's right shoulder. This facilitates optimal alignment for the thrust, which is in a curved plane because of the shape of the apophysial joint. It is important that your applicator has a firm contact on the atlas so that you do not slip when applying the thrust along a curved facet plane. Keep your right elbow close to the couch in order to keep the contact point on the atlas (Fig. B1.2.1).

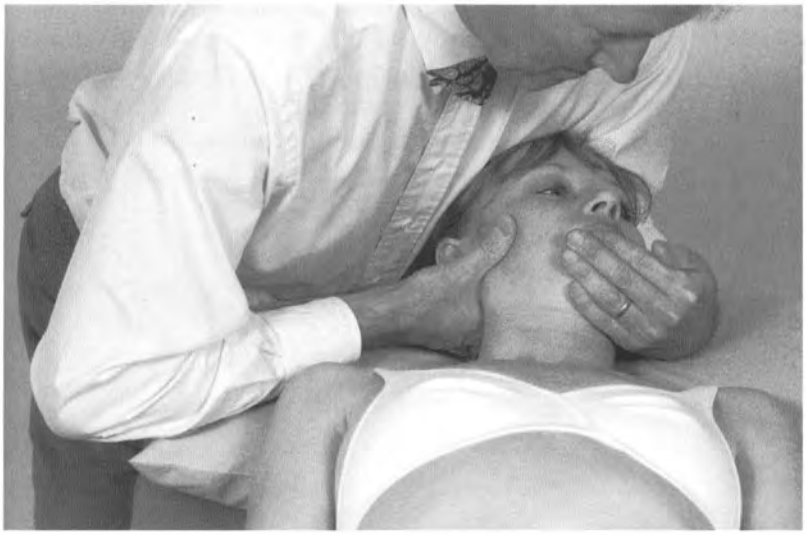

Fig. B1.2.1

Add extension and slight sidebending to the right to provide a feeling of tension at the contact point. Extensive practice is necessary to develop an appreciation of the required tension. The extension and right sidebending are introduced by pivoting slightly via the legs and trunk so your trunk and upper body rotate to the left. Do not attempt to introduce sidebending by moving the hands or arms as this will lead to loss of contact and inaccurate technique.

10 Adjustments to achieve appropriate pre-thrust tension

Ensure the patient remains relaxed. Maintaining all holds, make any necessary minor changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the contact point. The patient should not be aware of any pain or discomfort. You should introduce these final adjustments by slight movements of the ankles, knees, hips and trunk, not by altering the position of your hands or arms.

11 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

12 Delivering the thrust

This is a difficult technique to master, as the thrust must be applied along a curved plane. Apply a HVLA thrust to the posterior arch of the atlas in an anterior and superior direction along a curved plane which follows the shape of the occipto-atlantal articulation. Apply no simultaneous rapid increase of cervical rotation, extension or sidebending with the left hand (Fig. B1.2.2).

Fig. B1.2.2

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Atlanto-occipital joint C0–C1

Contact point on atlas
Chin hold Patient supine

- **Contact point.** Right posterior arch of atlas.
- **Applicator.** Lateral border, proximal or middle phalanx.
- **Patient positioning.** Supine with the neck in a neutral relaxed position.
- **Operator stance.** Head of couch, feet spread slightly.
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Chin hold.** Ensure your left forearm is over or slightly anterior to the ear.
- **Vertex contact.** Essential in this technique.
- **Positioning for thrust.** Step to the right and stand across the right corner of the couch. Optimal alignment for the thrust is in a curved plane. Keep your right elbow close to the couch in order to keep the contact point on the atlas (Fig. B1.2.1).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust must be applied along a curved plane, which follows the shape of the occipto-atlantal articulation (Fig. B1.2.2).

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1.3 Atlantoaxial joint C1–2

Chin hold

Patient supine Rotation thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a thrust in the plane of the atlantoaxial (C1–2) apophysial joint to produce cavitation on the right (Figs B1.3.1, B1.3.2)

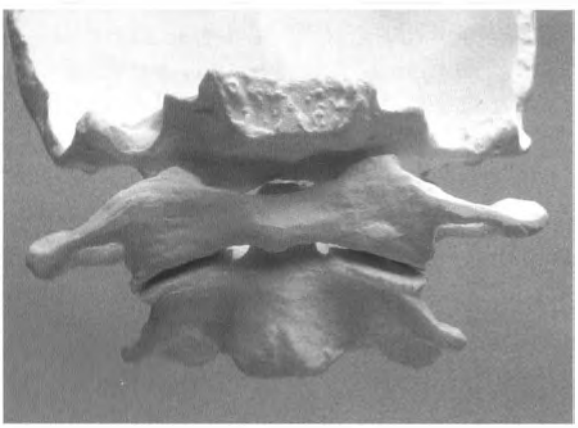

Fig. B1.3.1

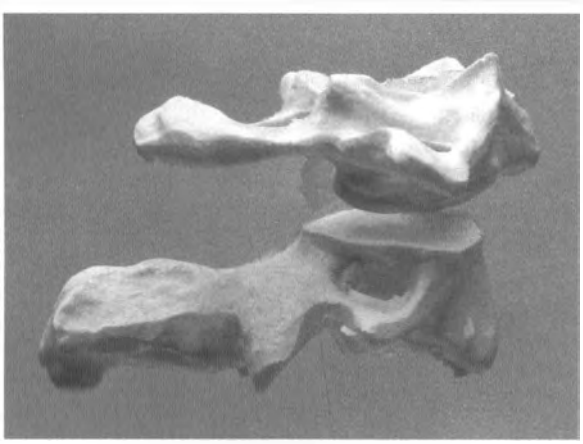

Fig. B1.3.2

1 Contact point — Right posterior arch of atlas.

2 Applicator — Lateral border, proximal or middle phalanx of operator's right index finger.

3 Patient positioning — Supine with the neck in a neutral relaxed position. If necessary, remove pillow or adjust pillow height. The neck should not be in any significant amount of flexion or extension.

4 Operator stance — Head of couch, feet spread slightly. Adjust couch height so that the operator can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact point — Place fingers of both hands gently under the occiput. Lift the head slightly and gently rotate it to the left, taking the weight of the head in your left hand. Remove your right hand from the occiput and palpate the region of the right posterior arch of the atlas with the tip of your index or middle finger. Slowly but firmly slide your right index finger downwards (towards the couch) along the posterior arch of the atlas until it approximates the middle or proximal phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.

6 Fixation of contact point — Keep your right index finger firmly pressed upon the contact point while you flex the other fingers and thumb of the right hand so as to clasp the back of the neck and occiput, thereby locking the applicator in position. You must now keep the applicator on the contact point until the technique is complete. Keeping the hands in position, return the head to the neutral position.

7 Chin hold — Keep your right hand in position and slide the left hand, slowly and carefully, forwards until the fingers lightly clasp the chin. Ensure that your left forearm is over, or slightly anterior to, the ear. Placing the forearm on or behind the ear puts the neck into too much flexion. The head is now controlled by balancing forces between the right palm and left forearm. Maintain the applicator in position.

8 Vertex contact — Move your body forward slightly so that your chest is in contact with the vertex of the patient's head. The head is now securely cradled between the left forearm, the flexed left elbow, the right palm and your chest. Vertex contact is often useful in a heavy, stiff or difficult case but can, on occasions, be omitted.

9 Positioning for thrust

Step to the right and stand across the right corner of the couch, keeping the hands firmly in position and taking care not to lose pressure on the contact point. Gently introduce rotation of the head to the left, to the point at which the posterior arch becomes more obvious under your contact point. Straighten your right wrist so that the radius and first metacarpal are in line. While maintaining firm applicator pressure, allow the right index finger to roll slightly on the contact point as you move your right elbow towards the patient's right shoulder to reach that point when your line of thrust is directed towards the corner of the patient's mouth. The thrust plane is into rotation. Ensure that you maintain a firm contact point on the posterior arch of the atlas and that your applicator is in line with your forearm.

(a) Primary leverage of rotation. Maintaining all holds and contact points, complete full rotation of the head and neck to the left until slight tension is palpated in the tissues at your contact point (Fig. B1.3.3). Maintain firm pressure against the contact point. A common mistake is to use insufficient head and neck rotation.

Fig. B1.3.3

(b) Secondary leverage. This technique uses minimal secondary leverage.

10 Adjustments to achieve appropriate pre-thrust tension

This is almost a pure rotation thrust but the appropriate tension can be achieved by adjusting flexion, extension and sidebending. The patient should not be aware of any pain or discomfort. Introduce any sidebending, flexion or extension by pivoting slightly via the legs and trunk. Do not attempt to introduce these leverages by moving the hands or arms as this will lead to loss of contact and inaccurate technique.

11 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

12 Delivering the thrust

Apply a HVLA thrust to the posterior arch of the atlas directed towards the corner of the patient's mouth. Simultaneously, apply a rapid low-amplitude increase of head rotation to the left by supinating the left forearm (Fig. B1.3.4). This rotation movement of the head is very small but of high velocity. This ensures that the occiput and atlas move as one unit during the thrust. The atlas rotates about the odontoid peg of the axis and cavitation occurs at the right C1–2 articulation. A very rapid contraction of the flexors and adductors of the right shoulder induces the thrust. The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

Fig. B1.3.4

SUMMARY

Atlantoaxial joint C1–2

Chin hold
Patient supine · Rotation thrust

- **Contact point.** Right posterior arch of atlas.
- **Applicator.** Lateral border, proximal or middle phalanx.
- **Patient positioning.** Supine with the neck in a neutral relaxed position.
- **Operator stance.** Head of couch, feet spread slightly.
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Chin hold.** Ensure your left forearm is over or slightly anterior to the ear.
- **Vertex contact.** Optional.
- **Positioning for thrust.** Step to the right and stand across the right corner of the couch. Use primary leverage of rotation with minimal secondary leverage. Your direction of thrust is towards the patient's mouth and into rotation (Fig. B1.3.3).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the corner of the patient's mouth. Simultaneously, apply a rapid low-amplitude increase of head rotation to the left. The occiput and atlas move as one unit during the thrust (Fig. B1.3.4).

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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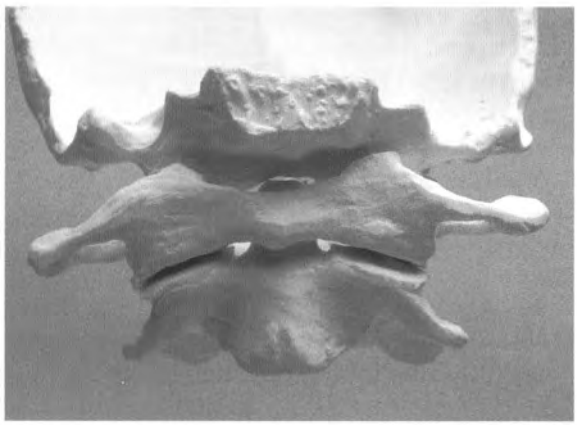
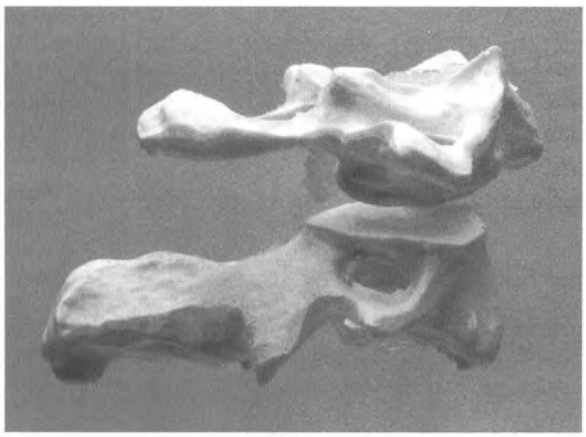
1.4 Atlantoaxial joint C1–2

Cradle hold

Patient supine Rotation thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a thrust in the plane of the atlantoaxial (C1–2) apophysial joint to produce cavitation on the right (see below)





1	**Contact point**	Right posterior arch of atlas.
2	**Applicator**	Lateral border, proximal or middle phalanx of operator's right index finger.
3	**Patient positioning**	Supine with the neck in a neutral relaxed position. If necessary, remove pillow or adjust pillow height. The neck should not be in any significant amount of flexion or extension.
4	**Operator stance**	Head of couch, feet spread slightly. Adjust couch height so that the operator can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.
5	**Palpation of contact point**	Place fingers of both hands gently under the occiput. Lift the head slightly and gently rotate it to the left, taking the weight of the head in your left hand. Remove your right hand from the occiput and palpate the region of the right posterior arch of the atlas with the tip of your index or middle finger. Slowly but firmly slide your right index finger downwards (towards the couch) along the posterior arch of the atlas until it approximates the middle or proximal phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.
6	**Fixation of contact point**	Keep your right index finger firmly pressed upon the contact point while you flex the other fingers and thumb of the right hand so as to clasp the back of the neck and occiput, thereby locking the applicator in position. You must now keep the applicator on the contact point until the technique is complete. Keeping the hands in position, return the head to the neutral position.
7	**Cradle hold**	Keep your left hand under the head and spread the fingers out for maximum contact. Keep the patient's ear resting in the palm of the your left hand. Flex the left wrist, allowing you to cradle the patient's head in your palm, flexed wrist and anterior aspect of forearm. Keep your right index finger firmly on the contact point and press the right palm against the occiput. The weight of the patient's head and neck is now balanced between your left and right hands with the cervical positioning controlled by the converging pressures of your two hands and arms.
8	**Vertex contact**	None in this technique.
9	**Positioning for thrust**	The elbows are held close to or only slightly away from your sides. This is an essential feature of the cradle hold method. Stand easily upright at the head of the couch and do not step to the right as in the chin hold method.

(a) Primary leverage of rotation. Maintaining all holds and contact points, complete the rotation of the head and neck to the left until tension is palpated at the contact point. Supination of the left wrist and forearm and simultaneous pronation of the right wrist and forearm achieve the rotation movement (Fig. B1.4.1). Do not lose firm pressure on the contact point. Do not force rotation; take it up fully but carefully. A common mistake is to use insufficient primary leverage of head and neck rotation.

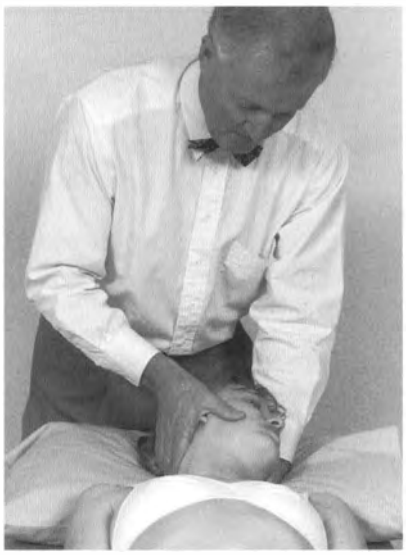


Fig. B1.4.1

(b) Secondary leverage. This technique uses minimal secondary leverage.

10 Adjustments to achieve appropriate pre-thrust tension

This is almost a pure rotation thrust, but the appropriate tension can be achieved by adjusting flexion, extension and sidebending. The patient should not be aware of any pain or discomfort. The operator makes final minor adjustments by introducing any sidebending, flexion or extension with slight movements of the wrists, arms and shoulders.

11 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

12 Delivering the thrust

Apply a HVLA thrust to the posterior arch of the atlas directed towards the corner of the patient's mouth. This thrust is generated by rapid pronation of your right forearm. Simultaneously, apply a rapid low-amplitude increase of head rotation to the left by supinating the left forearm (Fig. B1.4.2). This rotation movement of the head is very small but of high velocity. This ensures that the occiput and atlas move as one unit during the thrust. The atlas rotates about the odontoid peg of the axis and cavitation occurs at the right C1–2 articulation. This is a HVLA 'flick' type thrust. Coordination between the left and right hands and forearms is critical.

Fig. B1.4.2

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Atlantoaxial joint C1–2

Cradle hold
Patient supine · Rotation thrust

- **Contact point.** Right posterior arch of atlas.
- **Applicator.** Lateral border, proximal or middle phalanx.
- **Patient positioning.** Supine with the neck in a neutral relaxed position.
- **Operator stance.** Head of couch, feet spread slightly.
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Cradle hold.** The weight of the patient's head and neck is balanced between your left and right hands with cervical positioning controlled by the converging pressures.
- **Vertex contact.** None.
- **Positioning for thrust.** Stand upright at the head of the couch. The elbows are held close to or only slightly away from your sides. Use primary leverage of rotation with minimal secondary leverage. Your direction of thrust is towards the patient's mouth and into rotation (Fig. B1.4.1).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the corner of the patient's mouth. Simultaneously, apply a rapid low-amplitude increase of head rotation to the left. The occiput and atlas move as one unit during the thrust (Fig. B1.4.2).

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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1.5

Cervical spine C2–7

Up-slope gliding Chin hold
Patient supine

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use an upward and forward gliding thrust, parallel to the apophysial joint plane, to produce cavitation at C4–5 on the right (Figs B1.5.1, B1.5.2)

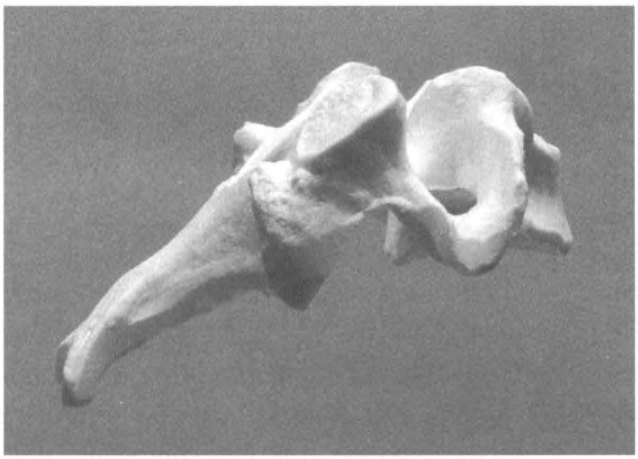

Fig. B1.5.1

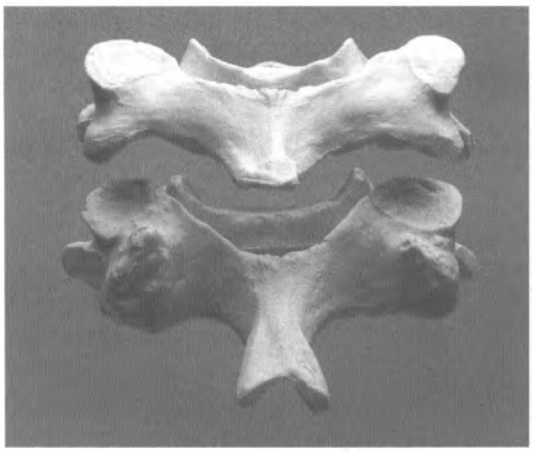

Fig. B1.5.2

1	**Contact point**	Posterolateral aspect of right C4 articular pillar.
2	**Applicator**	Lateral border, proximal or middle phalanx of operator's right index finger.
3	**Patient positioning**	Supine with the neck in a neutral relaxed position. If necessary, remove pillow or adjust pillow height. The neck should not be in any significant amount of flexion or extension.
4	**Operator stance**	Head of couch, feet spread slightly. Adjust couch height so that you can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.
5	**Palpation of contact point**	Place fingers of both hands gently under the occiput. Rotate the head to the left, taking its weight in your left hand. Remove your right hand from the occiput and palpate the right articular pillar of C4 with the tip of your index or middle finger. Slowly but firmly slide your right index finger downwards (towards the couch) along the articular pillar until it approximates the middle or proximal phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.
6	**Fixation of contact point**	Keep your right index finger firmly pressed upon the contact point while you flex the other fingers and thumb of the right hand so as to clasp the back of the neck and thereby lock the applicator in position. You must now keep the applicator on the contact point until the technique is complete. Keeping the hands in position, return the head to the neutral position.
7	**Chin hold**	Keeping your right hand in position, slide the left hand slowly and carefully forwards until the fingers lightly clasp the chin. Ensure that your left forearm is over or slightly anterior to the ear. Placing the forearm on or behind the ear puts the neck into too much flexion. The head is now controlled by balancing forces between the right palm and left forearm. Maintain the applicator in position.
8	**Vertex contact**	Move your body forward slightly so that your chest is in contact with the vertex of the patient's head. The head is now securely cradled between your left forearm, the flexed left elbow, the right palm and your chest. Vertex contact is often useful in a heavy, stiff or difficult case but can, on occasions, be omitted.
9	**Positioning for thrust**	Step to the right and stand across the right corner of the couch, keeping the hands firmly in position and taking care not to lose pressure on the contact point. Straighten the right wrist so that the radius and first metacarpal are in line. Maintaining applicator pressure, allow the right index finger to roll slightly on the contact point to

align your right wrist and forearm with the thrust plane, which is upwards and towards the midline in the direction of the patient's left eye. Keep the right elbow close to the couch in order to maintain the contact point on the posterolateral aspect of the articular pillar.

(a) Primary leverage of rotation. Maintaining all holds and contact points, complete the rotation of the head and neck to the left until tension is palpated at the contact point (Fig. B1.5.3). Do not lose firm pressure at the contact point. A common mistake is to use insufficient primary leverage of head and neck rotation.

Fig. B1.5.3

(b) Secondary leverage. Add a very small degree of sidebending to the right, down to and including C4. The operator pivoting slightly, via the legs and trunk, introduces the right sidebending, so that the trunk and upper body rotate to the left, enabling the hands and arms to remain in position (Fig. B1.5.4). Do not attempt to introduce sidebending by moving the hands or arms as this will lead to loss of contact and inaccurate technique.

Fig. B1.5.4

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

10 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. You make these final adjustments by slight movements of your ankles, knees, hips and trunk, not by altering the position of the hands or arms.

11 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

12. Delivering the thrust

Apply a HVLA thrust to the right articular pillar of C4. The thrust is upwards and towards the midline in the direction of the patient's left eye, parallel to the apophysial joint plane. Simultaneously, apply a slight, rapid increase of rotation of the head and neck to the left but do not increase the sidebending leverage (Fig. B1.5.5). The increase of rotation to the left is accomplished by slight supination of the left wrist and forearm. The thrust is induced by a very rapid contraction of the flexors and adductors of the right shoulder, and, if necessary, trunk and lower limb movement.

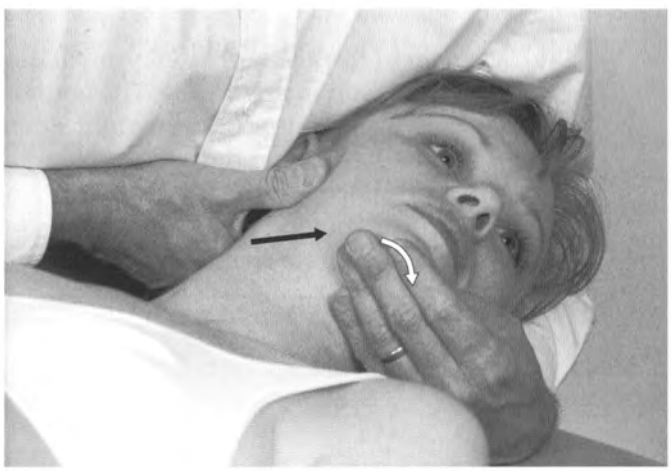

Fig. B1.5.5

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Cervical spine C2–7

Up-slope gliding Chin hold
Patient supine

- **Contact point.** Posterolateral aspect of right C4 articular pillar.
- **Applicator.** Lateral border, proximal or middle phalanx.
- **Patient positioning.** Supine with the neck in a neutral relaxed position.
- **Operator stance.** Head of couch, feet spread slightly.
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Chin hold.** Ensure your left forearm is over or slightly anterior to the ear.
- **Vertex contact.** Optional.
- **Positioning for thrust.** Step to the right and stand across the right corner of the couch. Introduce primary leverage of rotation left (Fig. B1.5.3) and a small degree of secondary leverage of sidebending right. Keep the right elbow close to the couch in order to maintain the contact point on the posterolateral aspect of the C4 articular pillar (Fig. B1.5.4).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the patient's left eye. Simultaneously, apply a slight, rapid increase of rotation of the head and neck to the left with no increase of sidebending to the right (Fig. B1.5.5).

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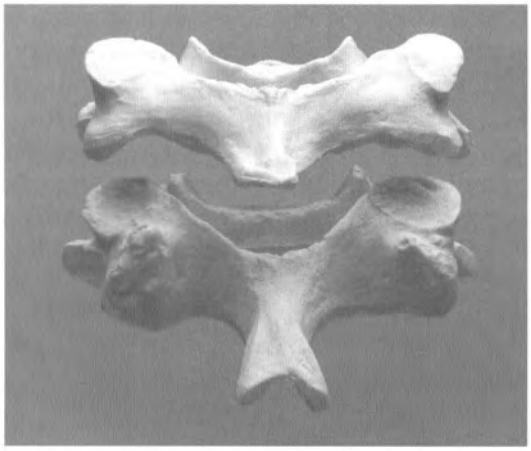
Cervical spine C2–7

Up-slope gliding Cradle hold
Patient supine

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use an upward and forward gliding thrust, parallel to the apophysial joint plane, to produce cavitation at C4–5 on the right (see below)



1 Contact point — Posterolateral aspect of the right articular pillar of C4.

2 Applicator — Lateral border, proximal or middle phalanx of operator's right index finger.

3 Patient positioning — Supine with the neck in a neutral relaxed position. If necessary, remove or adjust pillow height. The technique should not normally be executed in any significant degree of flexion or extension.

4 Operator stance — Head of couch, feet spread slightly. Adjust couch height so that you can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact point — Place fingers of both hands gently under the occiput. Lift the head to throw the articular pillars into prominence. Rotate the head slightly to the left, taking its weight in your left hand. Remove your right hand from the occiput and palpate the right articular pillar of C4 with the tip of your right index finger. Slowly but firmly slide your right forefinger downwards (towards the couch) along the articular pillar until it approximates the middle or proximal phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.

6 Fixation of contact point — Keep your right index finger firmly pressed upon the contact point while you flex the other fingers and thumb of the right hand so as to clasp the back of the neck and thereby lock the applicator in position. You must now keep the applicator on the contact point until the technique is complete. Keeping the hands in position, return the head to the neutral position.

7 Cradle hold — Keep your left hand under the head and spread the fingers out for maximum contact. Keep the patient's ear resting in the palm of the your left hand. Flex the left wrist, allowing you to cradle the patient's head in your palm, flexed wrist and anterior aspect of forearm. Keep your right index finger firmly on the contact point and press the right palm against the occiput. The weight of the patient's head and neck is now balanced between your left and right hands with the cervical positioning controlled by the converging pressures of your two hands and arms. When treating the lower cervical segments, the middle or distal phalanx may be used as the applicator.

8 Vertex contact — None in this technique.

9 Positioning for thrust

The elbows are held close to or only slightly away from your sides. This is an essential feature of the cradle hold method. Stand easily upright at the head of the couch and do not step to the right as in the chin hold method.

(a) Primary leverage of rotation. Maintaining all holds and contact points, complete the rotation of the head and neck to the left until tension is palpated at the contact point. Supination of the left wrist and forearm and simultaneous pronation of the right wrist and forearm achieve the rotation movement (Fig. B1.6.1). Do not to lose firm pressure on the contact point. Do not force rotation; take it up fully but carefully. A common mistake is to use insufficient primary leverage of head and neck rotation.

Fig. B1.6.1

(b) Secondary leverage. Add a very small degree of sidebending to the right, down to and including C4. This is achieved by moving the right arm a little forward and the left arm a little back or by rotating the trunk and upper body to the left (Fig. B1.6.2). *Note*: strong sidebending will lock the neck.

Fig. B1.6.2

10 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. You make these final adjustments by slight movements of your ankles, knees, hips and trunk, not by altering the position of the hands or arms.

11 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

12 Delivering the thrust

Apply a HVLA thrust to the right articular pillar of C4. The thrust is upwards and towards the midline in the direction of the patient's left eye, parallel to the apophysial joint plane (Fig. B1.6.3). This thrust is generated by rapid pronation of your right forearm. Simultaneously, apply a slight rapid increase of rotation of the head and neck to the left, but do not increase sidebending leverages. The increase of rotation to the left is accomplished by slight supination of the left wrist and forearm and is coordinated to match the thrust upon the contact point. This is a HVLA 'flick' type thrust. Coordination between the left and right hands and forearms is critical.

Fig. B1.6.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

SUMMARY

Cervical spine C2–7

Up-slope gliding Cradle hold
Patient supine

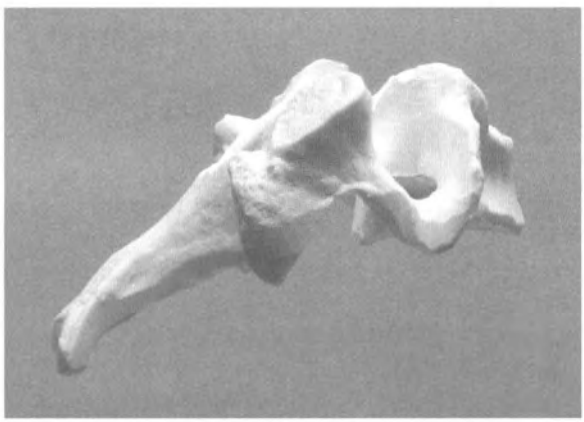
- **Contact point.** Posterolateral aspect of the right C4 articular pillar.
- **Applicator.** Lateral border, proximal or middle phalanx.
- **Patient positioning.** Supine with the neck in a neutral relaxed position.
- **Operator stance.** Head of couch, feet spread slightly.
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Cradle hold.** The weight of the patient's head and neck is balanced between your left and right hands with cervical positioning controlled by the converging pressures.
- **Vertex contact.** None.
- **Positioning for thrust.** Stand upright at the head of the couch. The elbows are held close to or only slightly away from your sides. Introduce primary leverage of rotation to the left (Fig. B1.6.1) and a small degree of secondary leverage of sidebending right (Fig. B1.6.2). Maintain the contact point on the posterolateral aspect of the C4 articular pillar.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the patient's left eye. Simultaneously, apply a slight, rapid increase of rotation of the head and neck to the left with no increase of sidebending to the right (Fig. B1.6.3).

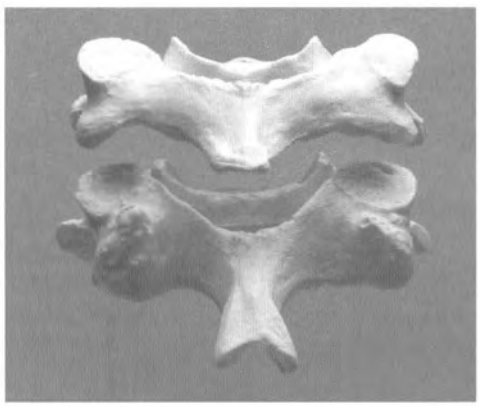
1.7

Cervical spine C2–7

Up-slope gliding Cradle hold Patient supine Reversed primary and secondary leverage

In certain circumstances the operator might wish to perform an up-slope gliding thrust but minimize the extent of head and neck rotation
Assume somatic dysfunction (A-R-T-T) is identified and you wish to use an upward and forward gliding thrust, parallel to the apophysial joint plane, to produce cavitation at C4–5 on the right (see below)





1	**Contact point**	Posterolateral aspect of the right articular pillar of C4.
2	**Applicator**	Lateral border, proximal or middle phalanx of operator's right index finger.
3	**Patient positioning**	Supine with the neck in a neutral relaxed position. If necessary, remove or adjust pillow height. The technique should not normally be executed in any significant degree of flexion or extension.
4	**Operator stance**	Head of couch, feet spread slightly. Adjust couch height so that you can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.
5	**Palpation of contact point**	Place fingers of both hands gently under the occiput. Lift the head to throw the articular pillars into prominence. Rotate the head slightly to the left, taking its weight in your left hand. Remove your right hand from the occiput and palpate the right articular pillar of C4 with the tip of your right index finger. Slowly but firmly slide your right forefinger downwards (towards the couch) along the articular pillar until it approximates the middle or proximal phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.
6	**Fixation of contact point**	Keep your right index finger firmly pressed upon the contact point while you flex the other fingers and thumb of the right hand so as to clasp the back of the neck and thereby lock the applicator in position. You must now keep the applicator on the contact point until the technique is complete. Keeping the hands in position, return the head to the neutral position.
7	**Cradle hold**	Keep your left hand under the head and spread the fingers out for maximum contact. Keep the patient's ear resting in the palm of the your left hand. Flex the left wrist, allowing you to cradle the patient's head in your palm, flexed wrist and anterior aspect of forearm. Keep your right index finger firmly on the contact point and press the right palm against the occiput. The weight of the patient's head and neck is now balanced between your left and right hands, with the cervical positioning controlled by the converging pressures of your two hands and arms. When treating the lower cervical segments, the middle or distal phalanx may be used as the applicator.
8	**Vertex contact**	None in this technique.

9 Positioning for thrust

The intent with this technique is to perform an up-slope gliding thrust but to limit the amount of head and neck rotation. This modification requires a greater emphasis upon the use of sidebending to achieve joint locking. It is critical that the direction of thrust be parallel to the apophysial joint plane in an up-slope direction. There should be no exaggeration of the sidebending leverage.

The elbows are held close to or only slightly away from your sides. This is an essential feature of the cradle hold method. Stand easily upright at the head of the couch and do not step to the right as in the chin hold method.

(a) Primary leverage of sidebending. Maintaining all holds and contact points, gently introduce sidebending of the head and neck to the right until tension is palpated at the contact point (Fig. B1.7.1). To introduce the right sidebending, the operator pivots slightly via the legs and trunk so that the trunk and upper body rotate to the left, enabling the hands and arms to remain in position. Do not lose firm contact with your contact point on the articular pillar of C4. A common mistake is to use insufficient primary leverage of head and neck sidebending.

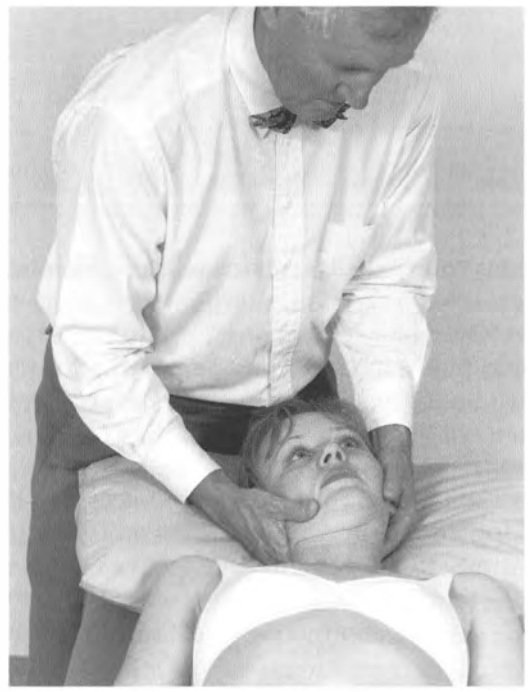


Fig. B1.7.1

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

(b) Secondary leverage. Add a little rotation to the left, down to and including C4 (Fig. B1.7.2). This requires extensive practice before one develops a refined 'tension sense'. Movement of your hands and forearms introduces the rotation.

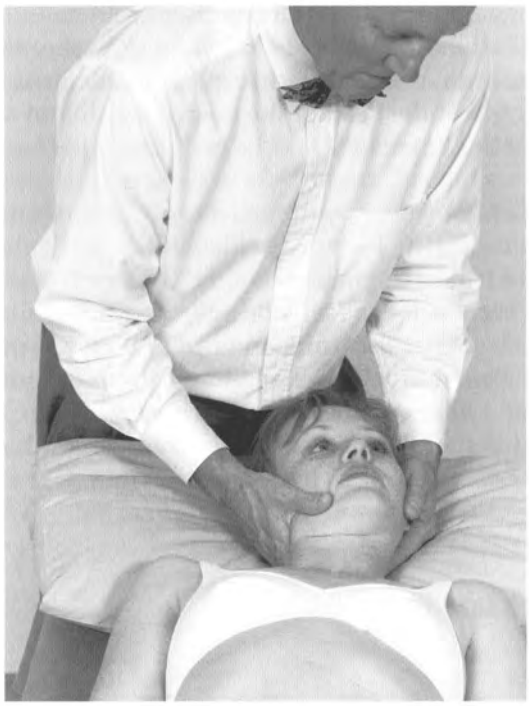


Fig. B1.7.2

10 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. You make these final adjustments by slight movements of your ankles, knees, hips and trunk, not by altering the position of the hands or arms.

11 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

12 Delivering the thrust

Apply a HVLA thrust to the right articular pillar of C4. The thrust is upwards and towards the midline in the direction of the patient's left eye, parallel to the apophysial joint plane (Fig. B1.7.3). This thrust is generated by rapid pronation of your right forearm. Simultaneously, apply a slight rapid increase of rotation of the head and neck to the left. A key element in this technique is to avoid exaggeration of the primary leverage of sidebending when the thrust is applied. The increase of rotation to the left is accomplished by slight supination of left wrist and forearm and coordinated to match the thrust upon the contact point. This is a HVLA 'flick' type thrust. Coordination between the left and right hands and forearms is critical.

Fig. B1.7.3

It must be appreciated that the use of sidebending as a primary leverage is predicated upon the operator's desire to limit the amount of head and neck rotation. Generally, when sidebending is used as a primary leverage, the aim will be to thrust in a down-slope direction. Exaggeration of the sidebending leverage in this technique must be avoided. Sidebending enhances locking but does not assist with an up-slope gliding thrust. The thrust in this technique is accompanied by slight exaggeration of the secondary leverage of rotation and is directed towards the patient's opposite eye.

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

SUMMARY

Cervical spine C2–7

Up-slope gliding Cradle hold
Patient supine Reversed primary and secondary leverage

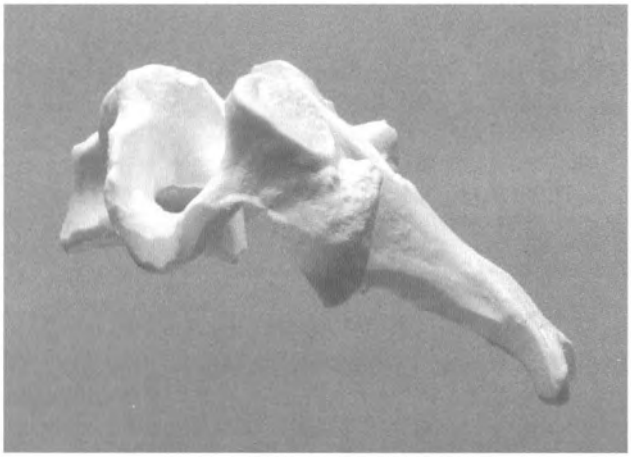
- **Contact point.** Posterolateral aspect of the right C4 articular pillar.
- **Applicator.** Lateral border, proximal or middle phalanx.
- **Patient positioning.** Supine with the neck in a neutral relaxed position.
- **Operator stance.** Head of couch, feet spread slightly.
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Cradle hold.** The weight of the patient's head and neck is now balanced between your left and right hands with cervical positioning controlled by the converging pressures.
- **Vertex contact.** None.
- **Positioning for thrust.** Stand upright at the head of the couch. The elbows are held close to or only slightly away from your sides. Introduce primary leverage of sidebending to the right (Fig. B1.7.1) and a small degree of secondary leverage of rotation left (Fig. B1.7.2). Maintain the contact point on the posterolateral aspect of the C4 articular pillar.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the patient's left eye. Simultaneously, apply a slight rapid increase of rotation of the head and neck to the left with no increase of sidebending to the right (Fig. B1.7.3). A key element in this technique is to avoid exaggeration of the primary leverage of sidebending when the thrust is applied. The use of sidebending as a primary leverage is predicated upon the operator's desire to limit the amount of head and neck rotation.

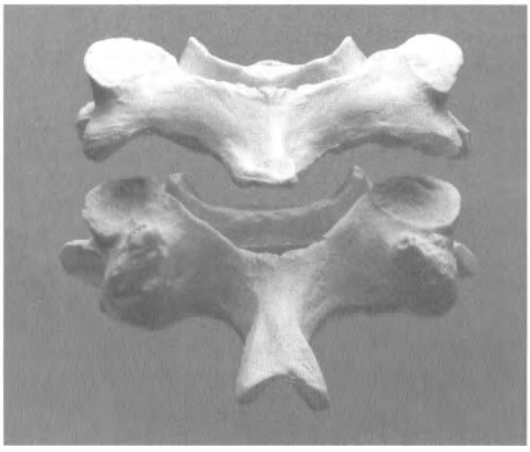
1.8

Cervical spine C2–7

Up-slope gliding Patient sitting Operator standing in front

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use an upward and forward thrust, parallel to the apophysial joint plane, to produce joint cavitation at C4–5 on the left (see below)





1 Contact point Posterolateral aspect of the left articular pillar of C4.

2 Applicator Palmar aspect, proximal or middle phalanx of operator's right index or middle finger.

3 Patient positioning Sitting with the neck in a neutral relaxed position. The neck should not be in any significant amount of flexion or extension.

4 Operator stance Stand in front and to the right of the patient, feet spread slightly. Adjust couch height so that you can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust (Fig. B1.8.1).

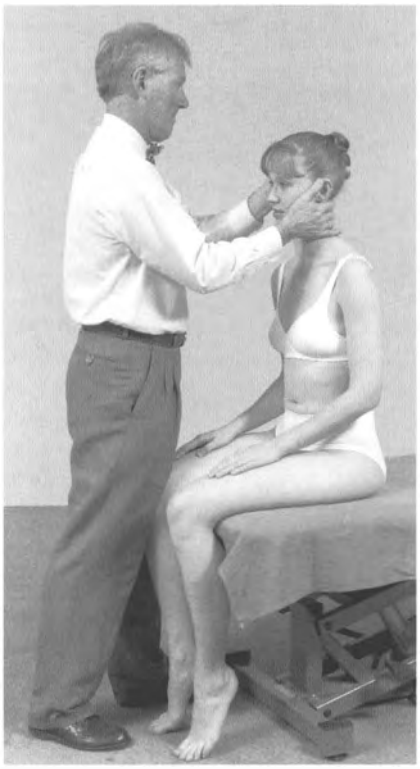


Fig. B1.8.1

5 Palpation of contact point

Place the fingers and palm of your left hand against the patient's right occiput and neck, gently covering the patient's right ear. Use the index or middle finger of your right hand to palpate the patient's left articular pillar of C4. Slowly but firmly slide your applicator along the articular pillar of C4 until it approximates the proximal or middle phalanx (Fig. B1.8.2). Several sliding pressures may be necessary to establish close approximation to the contact point.

Fig. B1.8.2

6 Fixation of contact point

Keep your right index or middle finger firmly pressed upon the contact point while you spread the other fingers and thumb of the right hand to securely support the head, mandible and neck, thereby locking the applicator in position. You must now keep the applicator on the contact point until the technique is complete. The weight of the head and neck is now balanced between your left and right hands, with the cervical spine positioning controlled by the converging pressures of your two hands.

7 Positioning for thrust

The elbows are held close to or only slightly away from your sides.

(a) Primary leverage. Ensure that the patient's head is securely supported between your two hands. Maintaining all holds and contact points, rotate the head and neck to the right until tension is palpated at the contact point (Fig. B1.8.3). Do not lose contact between your applicator and the articular pillar of C4. Do not force rotation; take it up fully but carefully. A common mistake is to use insufficient primary leverage of head and neck rotation.

Fig. B1.8.3

(b) Secondary leverage. Add a very small degree of sidebending to the left, down to and including C4. *Note*: strong sidebending will lock the neck. Slight movements of the operator's forearms, shoulders and trunk introduce the sidebending.

8 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. It is important to keep your elbows close to your sides. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. You make these final adjustments by slight movements of your legs and trunk, not by altering the position of the hands or arms.

9 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

10 Delivering the thrust

Apply a HVLA thrust to the left articular pillar of C4. The thrust is upwards and towards the midline in the direction of the patient's right eye, parallel to the apophysial joint plane (Fig. B1.8.4). Simultaneously, apply a slight, rapid increase of rotation to the right, but do not increase sidebending leverages. This is a HVLA 'flick' type thrust. Coordination between the left and right hands and arms is critical.

Fig. B1.8.4

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Cervical spine C2–7

Up-slope gliding Patient sitting
Operator standing in front

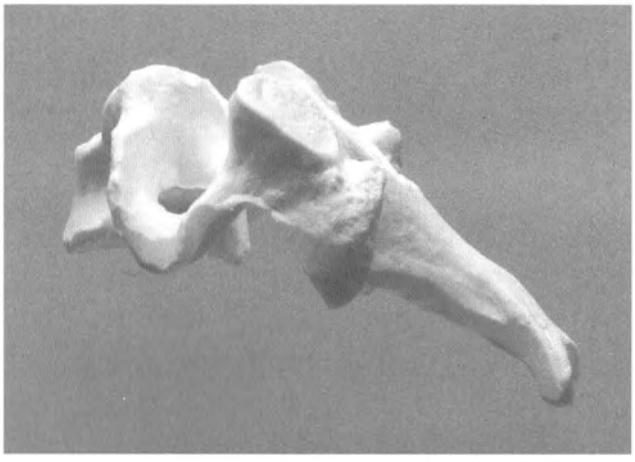
- **Contact point.** Posterolateral aspect of the left C4 articular pillar.
- **Applicator.** Palmar aspect, proximal or middle phalanx.
- **Patient positioning.** Sitting with the neck in a neutral relaxed position.
- **Operator stance.** In front and to the right of the patient, feet spread slightly (Fig. B1.8.1).
- **Palpation of contact point.**
- **Fixation of contact point.** Keep your right index or middle finger firmly pressed upon the contact point while you spread the other fingers and thumb of the right hand to securely support the head, mandible and neck (Fig. B1.8.2).
- **Positioning for thrust.** Stand upright with the elbows held close to or only slightly away from your sides. Introduce primary leverage of rotation to the right (Fig. B1.8.3) and a small degree of secondary leverage of sidebending left. Maintain the contact point on the posterolateral aspect of the C4 articular pillar.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the patient's right eye. Simultaneously, apply a slight, rapid increase of rotation of the head and neck to the right with no increase of sidebending to the left (Fig. B1.8.4). Coordination between both hands and arms is critical.

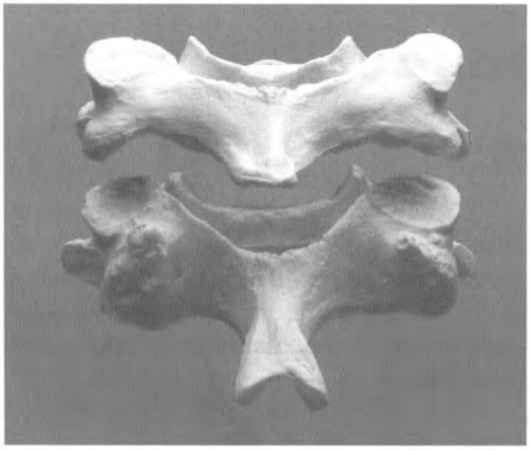
1.9

Cervical spine C2–7

Up-slope gliding Patient sitting Operator standing to the side

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use an upward and forward gliding thrust, parallel to the apophysial joint plane, to produce cavitation at C4–5 on the left (see below)





1 Contact point

Posterolateral aspect of the left articular pillar of C4.

2 Applicator

Palmar aspect, proximal or middle phalanx of operator's right index or middle finger.

3 Patient positioning

Sitting with the neck in a neutral relaxed position. The neck should not be in any significant amount of flexion or extension.

4 Operator stance

Stand to the right of the patient, feet spread slightly. Adjust couch height so that you can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust (Fig. B1.9.1).

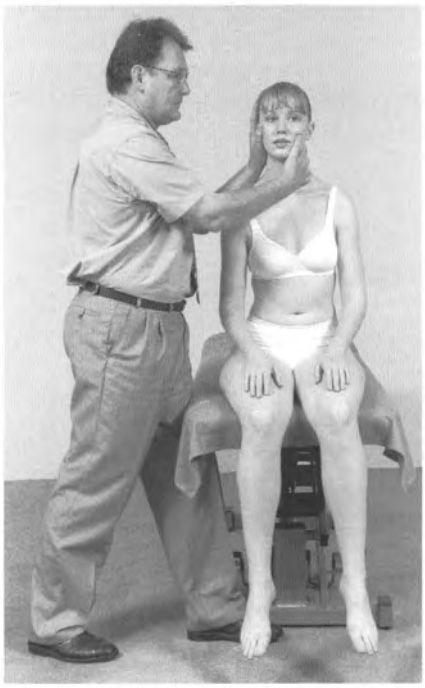


Fig. B1.9.1

5 Palpation of contact point

Place the fingers and palm of your left hand over the right side of the patient's head and neck, gently covering the right ear. Reach in front of the patient with your right hand and palpate the left articular pillar of C4 with the tip of your right index or middle finger. Slowly but firmly slide your applicator along the articular pillar of C4 until it approximates the proximal or middle phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.

6 Fixation of contact point

Keep your right index or middle finger firmly pressed upon the contact point while you spread the other fingers and thumb of the right hand to securely support the head, mandible and neck, thereby locking the applicator in position. You must now keep the applicator on the contact point until the technique is complete. The weight of the head and neck is now balanced between your left and right hands, with the cervical spine positioning controlled by the converging pressures of your two hands.

7 Positioning for thrust

The elbows are held close to or only slightly away from your sides.

(a) Primary leverage. Ensure that the patient's head is securely supported between your two hands. Maintaining all holds and contact points, rotate the head and neck to the right until tension is palpated at the contact point (Fig. B1.9.2). Do not lose contact between your applicator and the articular pillar of C4. Do not force rotation; take it up fully but carefully. A common mistake is to use insufficient primary leverage of head and neck rotation.

Fig. B1.9.2

(b) Secondary leverage. Add a very small degree of sidebending to the left, down to and including C4. *Note*: strong sidebending will lock the neck. Slight movements of the operator's forearms, shoulders and trunk introduce the sidebending.

8 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. It is important to keep your elbows close to your sides. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. You make these final adjustments by slight movements of your legs and trunk, not by altering the position of the hands or arms.

9 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

10 Delivering the thrust

Apply a HVLA thrust to the left articular pillar of C4. The thrust is upwards and towards the midline in the direction of the patient's right eye, parallel to the apophysial joint plane (Fig. B1.9.3). Simultaneously, apply a slight, rapid increase of rotation to the right, but do not increase sidebending leverages. This is a HVLA 'flick' type thrust. Coordination between the left and right hands and arms is critical.

Fig. B1.9.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Cervical spine C2–7

Up-slope gliding Patient sitting
Operator standing to the side

- **Contact point.** Posterolateral aspect of the left C4 articular pillar.
- **Applicator.** Palmar aspect, proximal or middle phalanx.
- **Patient positioning.** Sitting with the neck in a neutral relaxed position.
- **Operator stance.** To the right of the patient, feet spread slightly (Fig. B1.9.1).
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Positioning for thrust.** Stand upright with the elbows held close to or only slightly away from your sides. Introduce primary leverage of rotation to the right (Fig. B1.9.2) and a small degree of secondary leverage of sidebending left. Maintain the contact point on the posterolateral aspect of the left C4 articular pillar.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the patient's right eye. Simultaneously, apply a slight, rapid increase of rotation of the head and neck to the right with no increase of sidebending left (Fig. B1.9.3). Coordination between both hands and arms is critical.

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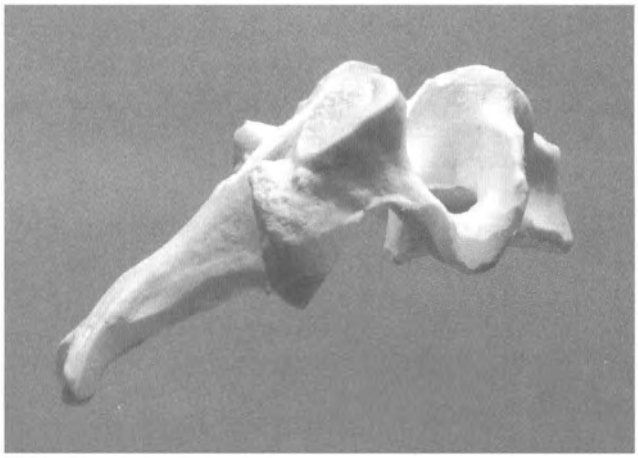
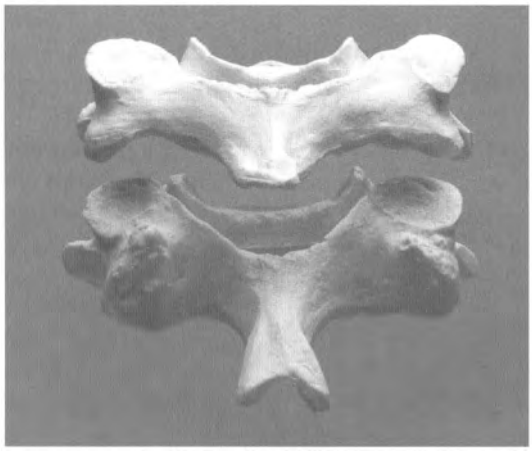
Cervical spine C2–7

Down-slope gliding Chin hold
Patient supine

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a downward and backward gliding thrust, parallel to the apophysial joint plane, to produce cavitation at C4–5 on the right (see below)





1 Contact point — Lateral aspect of the right articular pillar of C4.

2 Applicator — Lateral border, proximal or middle phalanx of operator's right index finger.

3 Patient positioning — Supine with the neck in a neutral relaxed position. If necessary, remove pillow or adjust pillow height. The neck should not be in any significant amount of flexion or extension.

4 Operator stance — Head of couch, feet spread slightly. Adjust couch height so that you can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact point — Place fingers of both hands gently under the occiput. Rotate the head to the left, taking its weight in your left hand. Remove your right hand from the occiput and palpate the right articular pillar of C4 with the tip of your index or middle finger. Slowly but firmly slide your right index finger downwards (towards the couch) along the articular pillar until it approximates the middle or proximal phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.

6 Fixation of contact point — Keep your right index finger firmly pressed upon the contact point while you flex the other fingers and thumb of the right hand so as to clasp the back of the neck and thereby lock the applicator in position. You must now keep the applicator on the contact point until the technique is complete. Keeping the hands in position, return the head to the neutral position.

7 Chin hold — Keeping your right hand in position, slide the left hand slowly and carefully forwards until the fingers lightly clasp the chin. Ensure that your left forearm is over or slightly anterior to the ear. Placing the forearm on or behind the ear puts the neck into too much flexion. The head is now controlled by balancing forces between the right palm and left forearm. Maintain the applicator in position.

8 Vertex contact — Move your body forward slightly so that your chest is in contact with the vertex of the patient's head. The head is now securely cradled between your left forearm, the flexed left elbow, the right palm and your chest. Vertex contact is often useful in a heavy, stiff or difficult case but can, on occasions, be omitted.

9 Positioning for thrust

Step slightly to the right, keeping the hands firmly in position and taking care not to lose pressure on the contact point. This introduces an element of cervical sidebending to the right. Straighten your right wrist so that the radius and first metacarpal are in line. Align your body and right arm for the thrust plane which is caudad in the direction of the patient's left shoulder and downwards towards the couch.

(a) Primary leverage of sidebending. Maintaining all holds and contact points, sidebend the patient's head and neck to the right until tension is palpated at the contact point (Fig. B1.10.1). The operator pivoting slightly, via the legs and trunk, introduces the right sidebending, so that the trunk and upper body rotate to the left, enabling the hands and arms to remain in position. Do not attempt to introduce sidebending by moving the hands or arms alone, as this will lead to loss of contact and inaccurate technique. Do not lose firm contact with your contact point on the articular pillar of C4. A common mistake is to use insufficient primary leverage of head and neck sidebending.

Fig. B1.10.1

(b) Secondary leverage. Add a little rotation to the left, down to and including C4 (Fig. B1.10.2). This requires extensive practice before one develops a refined 'tension sense'. Movement of your hands and forearms introduces the rotation.

Fig. B1.10.2

10 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. You make these final adjustments by slight movements of your ankles, knees, hips and trunk, not by altering the position of the hands or arms.

11 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

12 Delivering the thrust

Apply a HVLA thrust to the right articular pillar of C4. The direction of thrust is caudad in the direction of the patient's left shoulder and downwards towards the couch, parallel to the apophysial joint plane. Simultaneously, apply a slight, rapid increase of sidebending of the head and neck to the right but do not increase the rotation leverage (Fig. B1.10.3). The increase of sidebending is induced by a slight rotation of the operator's trunk and upper body to the left. A very rapid contraction of the flexors and adductors of the right shoulder joint induce the thrust; if necessary, trunk and lower limb movement may be incorporated.

Fig. B1.10.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

SUMMARY

Cervical spine C2–7

Down-slope gliding Chin hold
Patient supine

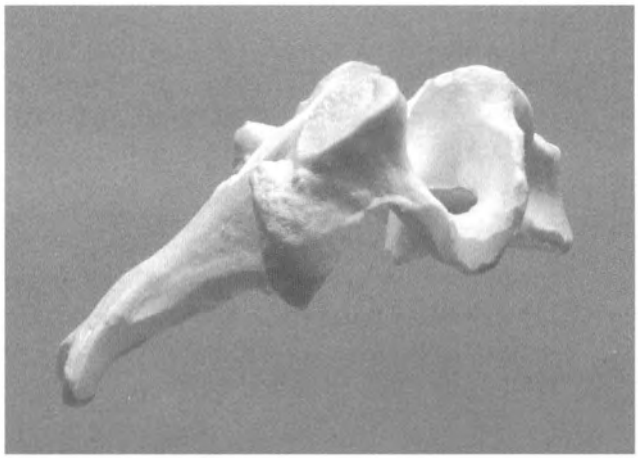
- **Contact point.** Lateral aspect of the right C4 articular pillar.
- **Applicator.** Lateral border, proximal or middle phalanx.
- **Patient positioning.** Supine with the neck in a neutral relaxed position.
- **Operator stance.** Head of couch, feet spread slightly.
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Chin hold.** Ensure your left forearm is over or slightly anterior to the ear.
- **Vertex contact.** Optional but often useful.
- **Positioning for thrust.** Step slightly to the right. Introduce primary leverage of sidebending right (Fig. B1.10.1) and a small degree of secondary leverage of rotation left (Fig. B1.10.2). Align your body and right arm for the thrust plane, which is caudad in the direction of the patient's left shoulder and downwards towards the couch.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the patient's left shoulder and downwards towards the couch. Simultaneously, apply a slight, rapid increase of sidebending of the head and neck to the right with no increase of rotation to the left (Fig. B1.10.3).

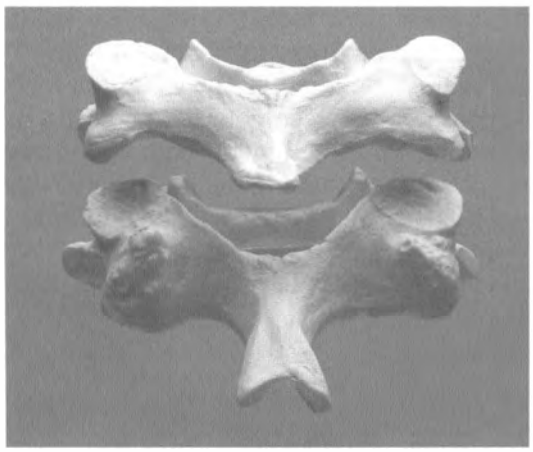
1.11

Cervical spine C2–7

Down-slope gliding Cradle hold
Patient supine

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a downward and backward gliding thrust, parallel to the apophysial joint plane, to produce cavitation at C4–5 on the right (see below)





1	**Contact point**	The lateral aspect of the right articular pillar of C4.
2	**Applicator**	Lateral border, proximal or middle phalanx of operator's right index finger.
3	**Patient positioning**	Supine with the neck in a neutral relaxed position. If necessary, remove pillow or adjust pillow height. The neck should not be in any significant amount of flexion or extension.
4	**Operator stance**	Head of couch, feet spread slightly. Adjust couch height so that you can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.
5	**Palpation of contact point**	Place fingers of both hands gently under the occiput. Rotate the head to the left, taking its weight in your left hand. Remove your right hand from the occiput and palpate the right articular pillar of C4 with the tip of your index or middle finger. Slowly but firmly slide your right index finger downwards (towards the couch) along the articular pillar until it approximates the middle or proximal phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.
6	**Fixation of contact point**	Keep the right index finger firmly pressed on the contact point while you flex the other fingers and thumb of the right hand so as to clasp the back of the neck and thereby lock the applicator in position. You must now keep the applicator on the contact point until the technique is complete. Keeping the hands in position, return the head to the neutral position.
7	**Cradle hold**	Keep the left hand under the head and spread the fingers out for maximum contact; keep the patient's ear resting in the palm of the your left hand. Flex the left wrist, allowing you to cradle the patient's head in your palm, flexed wrist and anterior aspect of forearm. Keep your right index finger firmly on the contact point and press the right palm against the occiput. The weight of the patient's head and neck is now balanced between your left and right hands, with the cervical positioning controlled by the converging pressures of your two hands and arms. When treating the lower cervical segments, the middle or distal phalanx may be used as the applicator.
8	**Vertex contact**	None in this technique.

9 Positioning for thrust

The elbows are held close to or only slightly away from your sides. This is an essential feature of the cradle hold method. Stand easily upright at the head of the couch and do not step to the right as in the chin hold method.

(a) Primary leverage of sidebending. Maintaining all holds and contact points, gently introduce sidebending of the head and neck to the right until tension is palpated at the contact point (Fig. B1.11.1). To introduce the right sidebending, the operator pivots slightly via the legs and trunk so that the trunk and upper body rotate to the left, enabling the hands and arms to remain in position. Do not lose firm contact with your contact point on the articular pillar of C4. A common mistake is to use insufficient primary leverage of head and neck sidebending.

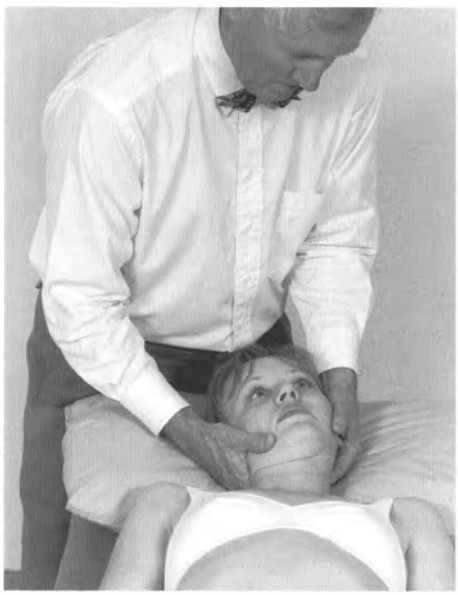


Fig. B1.11.1

(b) Secondary leverage. Add a little rotation to the left, down to and including C4 (Fig. B1.11.2). This requires extensive practice before one develops a refined 'tension sense'. Movement of your hands and forearms introduces the rotation.

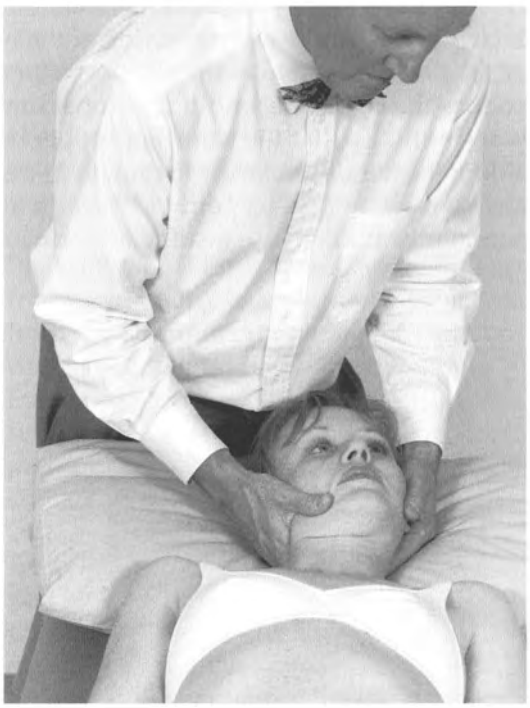


Fig. B1.11.2

10 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. You make these final adjustments by slight movements of your ankles, knees, hips and trunk, not by altering the position of the hands or arms.

11 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

Note that the final thrust is directed in a downward and backward direction parallel to the facet joint plane. The thrust is directed towards the patient's left shoulder as illustrated. The primary leverage is sidebending to the right and the secondary (lesser leverage) is rotation to the left.

12 Delivering the thrust

Apply a HVLA thrust to the right articular pillar of C4. The direction of thrust is caudad in the direction of the patient's left shoulder and downwards towards the couch, parallel to the apophysial joint plane (Fig. B1.11.3). The operator rotating the trunk and upper body to the left, enabling the hands and arms to remain in position on the cervical spine, generates the thrust. Simultaneously, apply a very slight, rapid increase of sidebending of the head and neck to the right but do not increase the rotation leverage.

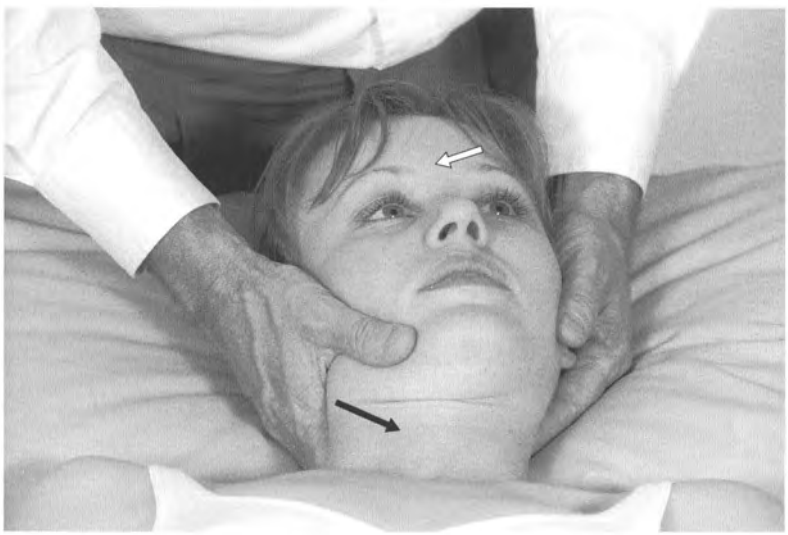


Fig. B1.11.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

SUMMARY

Cervical spine C2–7

Down-slope gliding Cradle hold
Patient supine

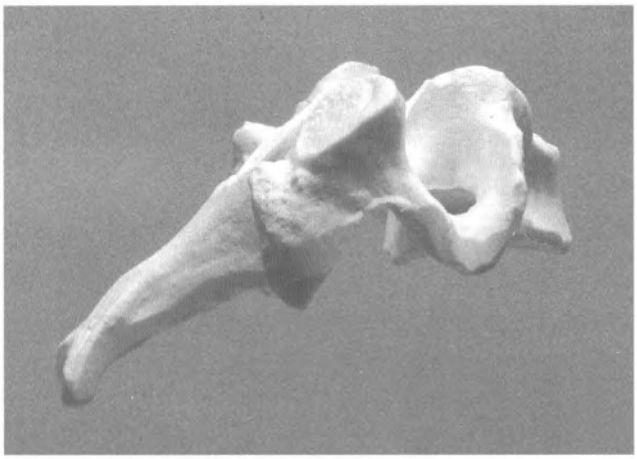
- **Contact point.** Lateral aspect of the right C4 articular pillar.
- **Applicator.** Lateral border, proximal or middle phalanx.
- **Patient positioning.** Supine with the neck in a neutral relaxed position.
- **Operator stance.** Head of couch, feet spread slightly.
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Cradle hold.** The weight of the patient's head and neck is balanced between your left and right hands with cervical positioning controlled by the converging pressures.
- **Vertex contact.** None.
- **Positioning for thrust.** Stand upright at the head of the couch. The elbows are held close to or only slightly away from your sides. Introduce primary leverage of sidebending to the right (Fig. B1.11.1) and a small degree of secondary leverage of rotation left (Fig. B1.11.2). Maintain the contact point on the lateral aspect of the right C4 articular pillar.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the patient's left shoulder and downwards towards the couch. Simultaneously, apply a slight, rapid increase of sidebending of the head and neck to the right with no increase of rotation to the left (Fig. B1.11.3).

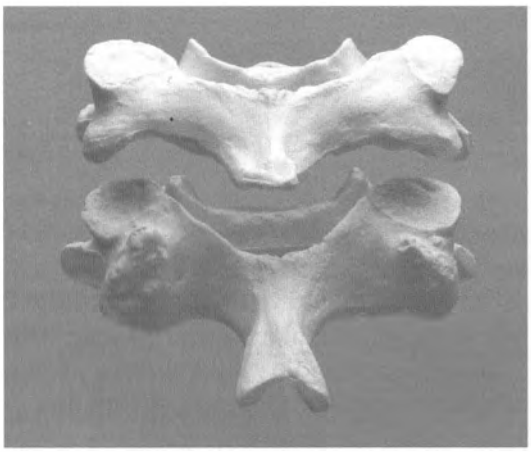
1.12

Cervical spine C2–7

Down-slope gliding Patient sitting Operator standing to the side

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a downward and backward gliding thrust, parallel to the apophysial joint plane, to produce cavitation at C4–5 on the right (see below)





1 Contact point

Lateral aspect of the right articular pillar of C4.

2 Applicator

Palmar aspect, proximal or middle phalanx of operator's left index or middle finger.

3 Patient positioning

Sitting with the neck in a neutral relaxed position. The neck should not be in any significant amount of flexion or extension.

4 Operator stance

Stand to the left of the patient, feet spread slightly. Adjust couch height so that you can stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust (Fig. B1.12.1).

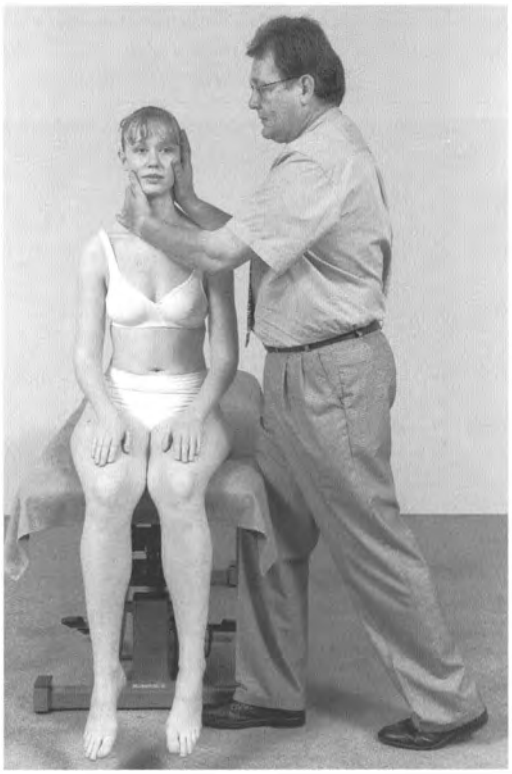


Fig. B1.12.1

5 Palpation of contact point

Place the fingers and palm of your right hand over the left side of the patient's head and neck, gently covering the left ear. Reach in front of the patient with your left hand and palpate the right articular pillar of C4 with the tip of your left index or middle finger. Slowly but firmly slide your applicator along the articular pillar of C4 until it approximates the proximal or middle phalanx. Several sliding pressures may be necessary to establish close approximation to the contact point.

6 Fixation of contact point

Keep your left index or middle finger firmly pressed upon the contact point while you spread the other fingers and thumb of the left hand to securely support the head, mandible and neck, thereby locking the applicator in position. You must now keep the applicator on the contact point until the technique is complete. The weight of the head and neck is now balanced between your right and left hands, with the cervical spine positioning controlled by the converging pressures of your two hands.

7 Positioning for thrust

The elbows are held close to or only slightly away from your sides.

(a) Primary leverage. Ensure that the patient's head is securely supported between your two hands. Maintaining all holds and contact points sidebend the head and neck to the right until tension is palpated at the contact point (Fig. B1.12.2). Do not lose contact between your applicator and the articular pillar of C4. Do not force sidebending; take it up fully but carefully. A common mistake is to use insufficient primary leverage of head and neck sidebending.

Fig. B1.12.2

(b) Secondary leverage. Add a very small degree of rotation to the left, down to and including C4. Slight movements of the operator's hands and arms introduce the rotation.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

8 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. It is important to keep your elbows close to your sides. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort.

9 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust and can cause embarrassing proximity to the patient. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

10 Delivering the thrust

Apply a HVLA thrust to the right articular pillar of C4. The thrust is caudad and towards the patient's left shoulder, parallel to the apophysial joint plane (Fig. B1.12.3). Simultaneously, apply a slight, rapid increase of sidebending to the right but do not increase rotation leverage. This is a HVLA 'flick' type thrust. Coordination between the left and right hands and arms is critical.

Fig. B1.12.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Cervical spine C2–7

Down-slope gliding Patient sitting
Operator standing to the side

- **Contact point.** Lateral aspect of the right C4 articular pillar.
- **Applicator.** Palmar aspect, proximal or middle phalanx.
- **Patient positioning.** Sitting with the neck in a neutral relaxed position.
- **Operator stance.** To the left of the patient, feet spread slightly (Fig. B1.12.1).
- **Palpation of contact point.**
- **Fixation of contact point.**
- **Positioning for thrust.** Stand upright with the elbows held close to or only slightly away from your sides. Introduce primary leverage of sidebending to the right (Fig. B1.12.2) and a small degree of secondary leverage of rotation left. Maintain the contact point on the lateral aspect of the right C4 articular pillar.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is caudad and towards the patient's left shoulder. Simultaneously, apply a slight, rapid increase of sidebending of the head and neck to the right with no increase of rotation to the left (Fig. B1.12.3). Coordination between both hands and arms is critical.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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1.13

Cervicothoracic spine C7–T3

Rotation gliding Patient prone Operator at side of couch

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a rotation gliding thrust, parallel to the apophysial joint plane, to produce cavitation at the T2–3 apophysial joint (Figs B1.13.1, B1.13.2)

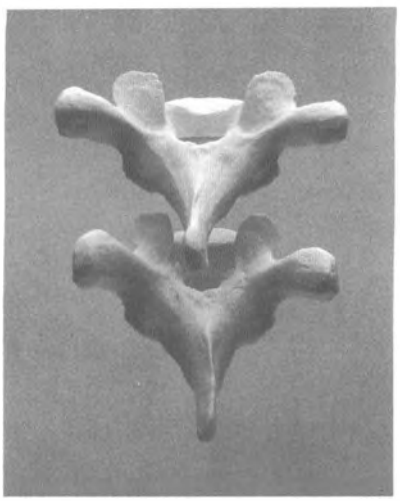

Fig. B1.13.1

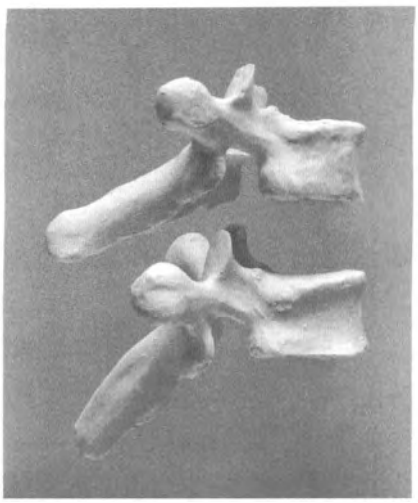

Fig. B1.13.2

1 Contact point Right side of spinous process of T3.

2 Applicator Thumb of right hand.

3 Patient positioning Patient lying prone with the head and neck turned to the left and arms hanging over the edge of the couch or against the patient's sides (Fig. B1.13.3). Introduce a small amount of sidebending to the right by gently moving the patient's head to the right while in the rotated position. Do not introduce too much sidebending.

Fig. B1.13.3

4 Operator stance

Stand on the right side of the patient facing towards the head of the couch.

5 Palpation of contact point

Locate the spinous process of T3. Place the thumb of your right hand gently but firmly against the right side of this spinous process. Spread the fingers of your right hand to rest over the patient's right trapezius muscle with your fingertips resting on the patient's right clavicle (Fig. B1.13.4). Ensure that you have good contact and will not slip off the spinous process of T3 when you apply a force against it. Maintain this contact point.

Fig. B1.13.4

6 Positioning for thrust

Keeping your position at the side of the couch, gently place your left hand against the left side of the patient's head. This hand will control the rotation and sidebending leverages. Increase rotation of the patient's head and neck to the left by applying gentle pressure to the patient's head until a sense of tension is palpated at the contact point. Move your right forearm so that it lines up with your thumb against the spinous process of T3 and forms an angle of approximately 90° at the elbow (Fig. B1.13.5).

Fig. B1.13.5

7 Adjustments to achieve appropriate pre-thrust tension

Ensure the patient remains relaxed. Maintaining all holds, make any necessary changes in extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. Make these final adjustments by altering the pressure and direction of forces between the left hand against the patient's head and your right thumb at the contact point.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm and your body position is well controlled. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

9 Delivering the thrust

Apply a HVLA thrust to the spinous process of T3 in the direction of the patient's left shoulder joint. Simultaneously, apply a slight, rapid increase of head and neck rotation to the left with your left hand (Fig. B1.13.6). The thrust induces local rotation of the T3 vertebra, focusing forces at the T2–3 segment. You must not overemphasize the thrust with your left hand against the patient's head. Your left hand stabilizes the leverages and maintains the position of the head against the thrust imposed upon the contact point. The thrust is induced by a very rapid contraction of the shoulder adductors.

Fig. B1.13.6

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Cervicothoracic spine C7–T3

Rotation gliding Patient prone
Operator at side of couch

- **Contact point.** Right side of T3 spinous process.
- **Applicator.** Thumb of right hand.
- **Patient positioning.** Prone with the head rotated to the left and arms hanging over the edge of the couch or against the patient's sides (Fig. B1.13.3). Introduce a small amount of sidebending to the right. Do not introduce too much sidebending.
- **Operator stance.** Right side of the patient facing towards the head of the couch.
- **Palpation of contact point.** Place the thumb of your right hand against the right side of the spinous process of T3. Spread the fingers of your right hand to rest over the patient's trapezius muscle and clavicle (Fig. B1.13.4).
- **Positioning for thrust.** Place your left hand against the left side of the patient's head. Increase rotation of the head and neck to the left until a sense of tension is palpated at the contact point. Move your right forearm so that it lines up with your thumb against the spinous process of T3 and forms an angle of approximately 90° at the elbow (Fig. B1.13.5).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** Thrust is directed towards the patient's left shoulder joint. Simultaneously, apply a slight rapid increase of head and neck rotation to the left with your left hand (Fig. B1.13.6). You must not overemphasize the thrust with your left hand against the patient's head.

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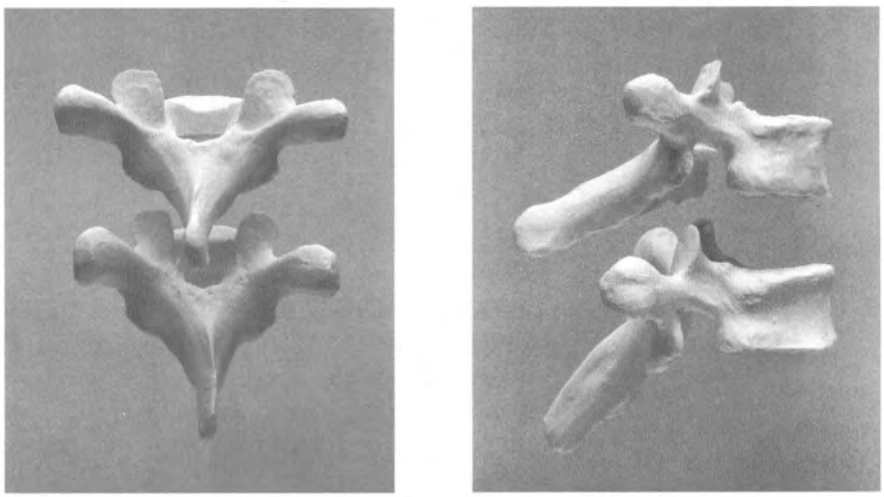
1.14 Cervicothoracic spine C7–T3

Rotation gliding Patient prone Operator at head of couch

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a rotation gliding thrust, parallel to the apophysial joint plane, to produce cavitation at the T2–3 apophysial joint (see below)



1	**Contact point**	Transverse process of T3 on the left.
2	**Applicator**	Hypothenar eminence of left hand.
3	**Patient positioning**	Patient prone with the point of the chin resting on the couch and the arms hanging over the edge of the couch or against the patient's sides. Introduce a small amount of sidebending to the right by gently lifting and moving the patient's chin to the right (Fig. B1.14.1). Do not introduce too much sidebending.
4	**Operator stance**	Head of the couch, feet spread slightly. Stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.

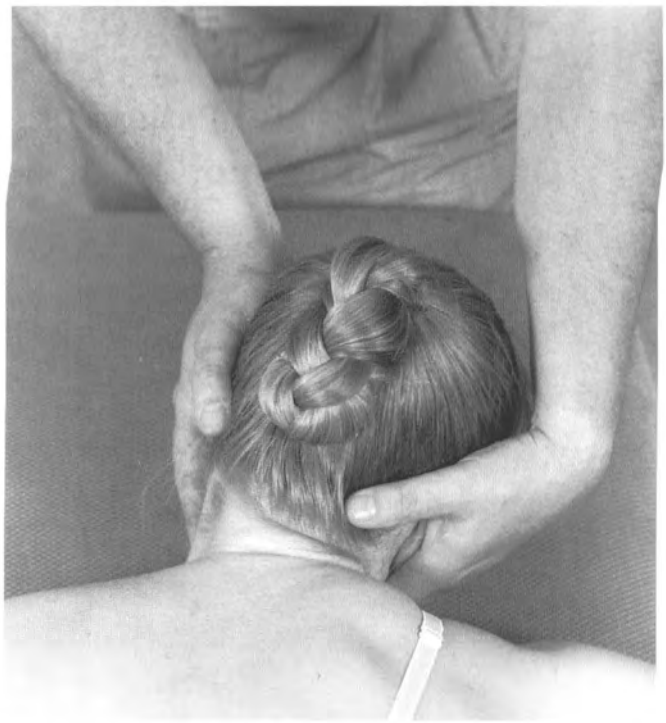


Fig. B1.14.1

5 Palpation of contact point

Locate the transverse process of T3 on the left. Place the hypothenar eminence of your left hand gently but firmly against the transverse process of T3 on the left. Ensure that you have good contact and will not slip across the skin or superficial musculature when you apply a caudad and downward force towards the couch against the transverse process of T3. Maintain this contact point.

6 Positioning for thrust

Keeping your position at the head of the couch, gently place your right hand against the left side of the patient's head and neck. While maintaining the right sidebending introduced earlier, begin to rotate the cervical and upper thoracic spine to the left by applying gentle pressure to the left side of the patient's head and neck with your right hand (Fig. B1.14.2). Maintaining all holds and pressures, complete the rotation of the patient's head and neck until a sense of tension is palpated at your left hypothenar eminence. Keep firm pressure against the contact point.

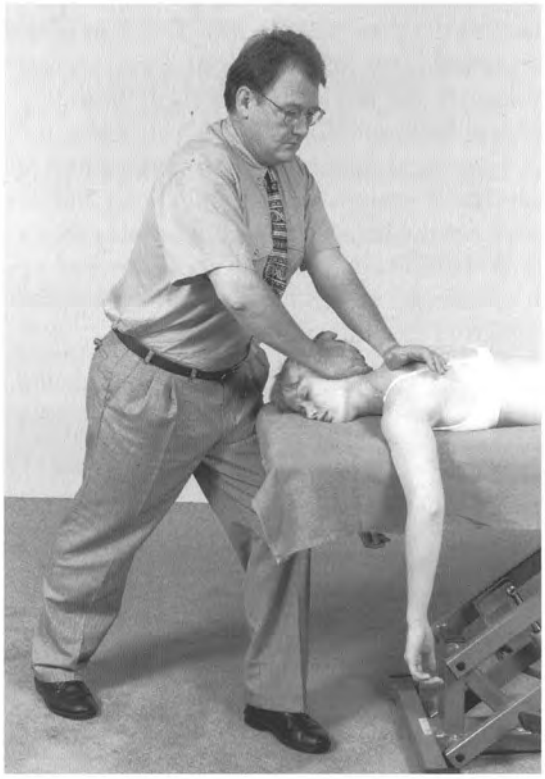


Fig. B1.14.2

7 Adjustments to achieve appropriate pre-thrust tension

Ensure the patient remains relaxed. Maintaining all holds, make any necessary changes in extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. You make these final adjustments by altering the pressure and direction of forces between the right hand against the patient's head and neck and your left hypothenar eminence against the contact point.

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm and that your body position is well controlled. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

9 Delivering the thrust

Apply a HVLA thrust to the left transverse process of T3 down towards the couch and in the direction of the patient's left axilla. Simultaneously, apply a slight, rapid increase of head and neck rotation to the left with your right hand (Fig. B1.14.3). The thrust induces local rotation of the T3 vertebra, focusing forces at the T2–3 segment. You must not overemphasize the thrust with your right hand against the patient's head and neck. Your right hand stabilizes the leverages and maintains the position cervical spine against the thrust imposed upon the contact point. The thrust is induced by a very rapid contraction of the triceps, shoulder adductors and internal rotators.

Fig. B1.14.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Cervicothoracic spine C7–T3

Rotation gliding Patient prone
Operator at head of couch

- **Contact point.** Left T3 transverse process.
- **Applicator.** Hypothenar eminence of the left hand.
- **Patient positioning.** Patient prone with the chin resting on the couch and the arms hanging over the edge of the couch or against the patient's sides. Introduce sidebending to the right (Fig. B1.14.1). Do not introduce too much sidebending.
- **Operator stance.** Head of the couch, feet spread slightly.
- **Palpation of contact point.** Place your hypothenar eminence against the transverse process of T3 on the left.
- **Positioning for thrust.** Place your right hand against the left side of the patient's head and neck. Rotate the cervical and upper thoracic spine to the left by applying pressure to the left side of the patient's head and neck with your right hand until a sense of tension is palpated at the contact point (Fig. B1.14.2).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is in the direction of the patient's left axilla and down towards the couch. Simultaneously, apply a slight rapid increase of head and neck rotation to the left with your right hand (Fig. B1.14.3). You must not overemphasize the thrust with your right hand against the patient's head.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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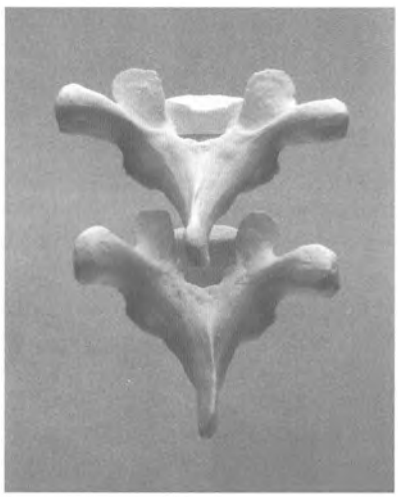
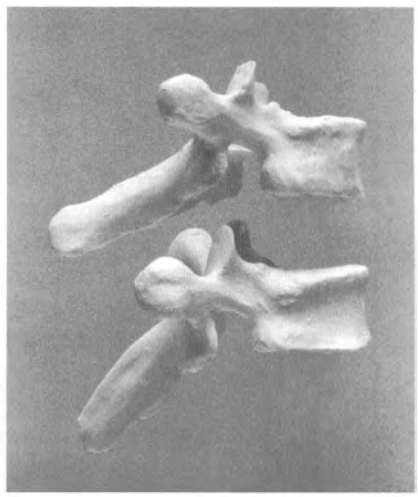
1.15

Cervicothoracic spine C7–T3

Sidebending gliding Patient sitting

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a sidebending gliding thrust, parallel to the apophysial joint plane, to produce cavitation at the T2–3 apophysial joint (see below)





1	**Contact point**	Left side of the spinous process of T2.
2	**Applicator**	Thumb of left hand.
3	**Patient positioning**	Patient sitting with back towards the operator.
4	**Operator stance**	Stand behind the patient.

5 Palpation of contact point

Locate the spinous process of T2. Place the thumb of your left hand gently but firmly against the left side of this spinous process. Spread the fingers of your left hand to rest over the patient's left trapezius muscle with your fingertips resting on the patient's left clavicle (Fig. B1.15.1). Ensure that you have good contact and will not slip off the spinous process of T2 when you apply a force against it. Maintain this contact point.

Fig. B1.15.1

6 Positioning for thrust

Keeping your position behind the patient place your right hand and forearm alongside the right side of the patient's head and neck and gently rest the palm of your hand over the top of the patient's head (Fig. B1.15.2). Ensure that your forearm remains anterior to, and just over, the patient's ear. This hand will introduce and control the rotation and sidebending leverages.

Use your left hand to slightly rotate the patient's trunk to the left while using your right hand to introduce head and neck rotation to the right until a sense of tension is palpated at the contact point (Fig. B1.15.3). Now gently introduce cervical sidebending to the left by allowing the patient's body weight to fall slightly to the right. Keeping the patient's head centred over the sacrum, guide the neck into left sidebending with your right arm against the right side of the patient's head. A vertex compression force can be added to assist in localizing forces to the T2–3 segment. Ensure that your applicator thumb forms a straight line with your left forearm.

7 Adjustments to achieve appropriate pre-thrust tension

Ensure the patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. Make these final adjustments by balancing the pressure and direction of forces between the left hand against the contact point and the right hand and forearm against the patient's head and neck.

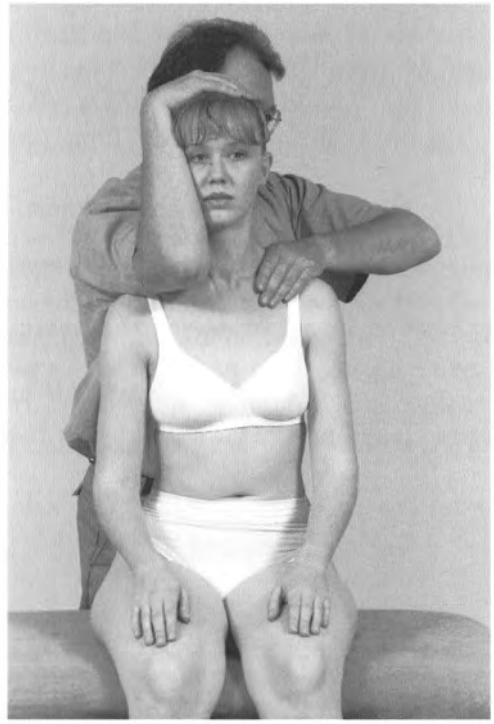


Fig. B1.15.2

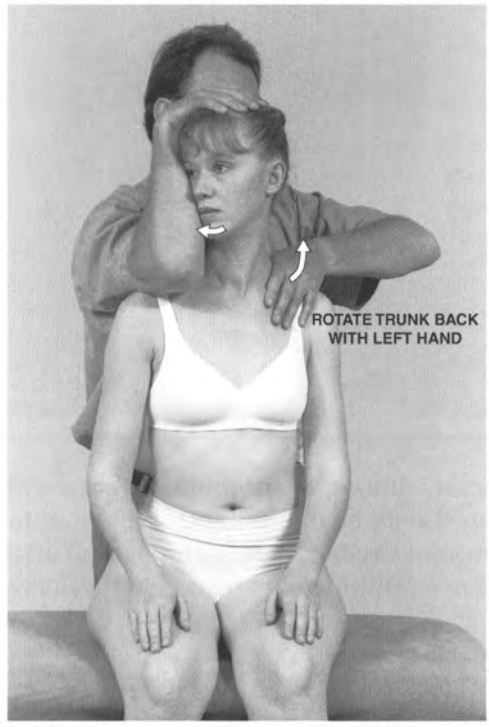


Fig. B1.15.3

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm and that the patient's body weight and position are well controlled. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

9 Delivering the thrust

Apply a HVLA thrust to the left side of the spinous process of T2 in the direction of the patient's right axilla. At the same time, slightly increase head and neck sidebending to the left with your right arm (Fig. B1.15.4). The thrust on the spinous process of T2 and the slight increase in neck sidebending to the left focus forces at the T2–3 segment and cause cavitation at that level. The thrust is induced by a very rapid contraction of the shoulder adductors.

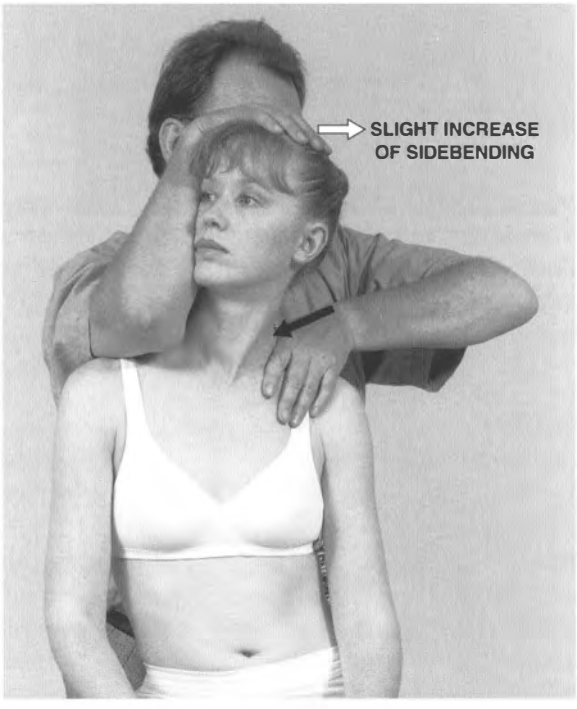


Fig. B1.15.4

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Cervicothoracic spine C7–T3

Sidebending gliding Patient sitting

- **Contact point.** Left side of the T2 spinous process.
- **Applicator.** Thumb of left hand.
- **Patient positioning.** Patient sitting with back towards the operator.
- **Operator stance.** Behind the patient.
- **Palpation of contact point.** Place your left thumb against the left side of the T2 spinous process. Spread the fingers of your left hand to rest over the patient's trapezius muscle and clavicle (Fig. B1.15.1).
- **Positioning for thrust.** Place your right hand and forearm alongside the right side of the patient's head and neck (Fig. B1.15.2). Use your left hand to slightly rotate the patient's trunk to the left whilst using your right hand to introduce head and neck rotation to the right (Fig. B1.15.3). Introduce left sidebending to the cervical spine, localizing forces to the T2–3 segment. Ensure that your applicator thumb forms a straight line with your left forearm.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed towards the patient's right axilla. Simultaneously, apply a slight, rapid increase of head and neck sidebending to the left (Fig. B1.15.4).

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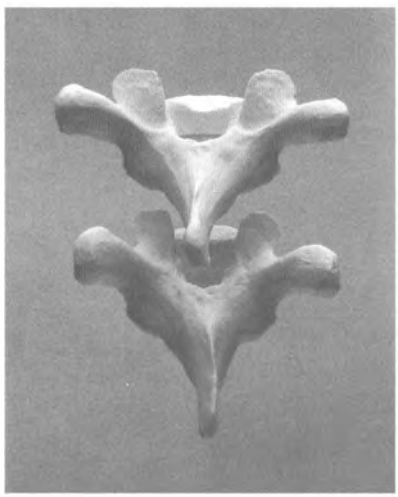
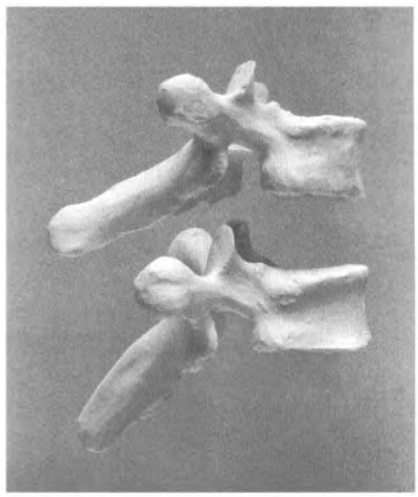
1.16

Cervicothoracic spine C7–T3

Sidebending gliding Patient side-lying

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a sidebending gliding thrust, parallel to the apophysial joint plane, to produce cavitation at the T2–3 apophysial joint (see below)





1	**Contact point**	Right side of the spinous process of T2.
2	**Applicator**	Thumb of left hand.
3	**Patient positioning**	Patient lying on the left side. Flex the patient's knees and hips for stability.
4	**Operator stance**	Stand facing the patient and gently place your right arm under the head, lightly spreading your fingers around the patient's occiput. The head should now be cradled in your right arm with your upper arm against the patient's forehead and your forearm and hand supporting the head and neck.

5 Palpation of contact point

Locate the spinous process of T2. Place the thumb of your left hand gently but firmly against the right side of this spinous process. Spread the fingers of your left hand to enable firm contact of your thumb. This will ensure that you have good contact and will not slip off the spinous process when you apply a force against it. Maintain this contact point but do not press too hard, as it can be uncomfortable.

6 Positioning for thrust

Using your right arm, sidebend the patient's head and neck to the right until a sense of tension is palpable at the contact point. This sidebending is achieved by gently lifting the patient's head, within the cradle of your right arm (Fig. B1.16.1).

Fig. B1.16.1

Gently introduce cervical rotation to the left until a sense of tension is palpated at the contact point (Fig. B1.16.2). If necessary, you may add a compression force to the patient's shoulder girdle, from your chest, to stabilize the upper torso before applying the thrust.

Fig. B1.16.2

7 Adjustments to achieve appropriate pre-thrust tension

Ensure the patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the contact point. The patient should not be aware of any pain or discomfort. Make these final adjustments by balancing the pressure and direction of forces between the left hand against the contact point and the right hand and forearm against the patient's head and neck.

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm and that your body position is well controlled. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

9 Delivering the thrust

Apply a HVLA thrust to the spinous process of T2 down towards the couch in the direction of the patient's left shoulder. The thrust is accompanied by a simultaneous downward application of force with your chest to the patient's right shoulder girdle. At the same time, introduce a slight increase in head and neck sidebending to the right with your right arm (Fig. B1.16.3). The thrust on the spinous process of T2 and slight increase in neck sidebending to the right focus forces at the T2–3 segment and cause cavitation at that level. Do not apply excessive sidebending at the time of the thrust as this can cause strain and discomfort.

Fig. B1.16.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

SUMMARY

Cervicothoracic spine C7–T3

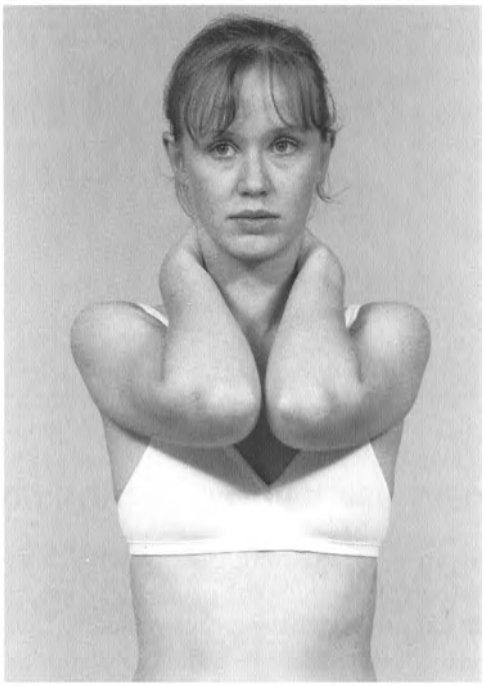
Sidebending gliding Patient side-lying

- **Contact point.** Right side of T2 spinous process.
- **Applicator.** Thumb of left hand.
- **Patient positioning.** Patient lying on the left side. Flex the patient's knees and hips for stability.
- **Operator stance.** Facing the patient. Place your right arm under the patient's head, supporting the patient's occiput.
- **Palpation of contact point.** Place the thumb of your left hand against the right side of the spinous process of T2.
- **Positioning for thrust.** Using your right arm, sidebend the patient's head and neck to the right (Fig. B1.16.1). Introduce cervical rotation to the left until a sense of tension is palpated at the contact point (Fig. B1.16.2).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is in the direction of the patient's left shoulder and down towards the couch. The thrust is accompanied by a downward application of force with your chest to the patient's right shoulder girdle. Simultaneously, apply a slight rapid increase of head and neck sidebending to the right with your right arm (Fig. B1.16.3). Do not apply excessive sidebending.

2 Section 2 Thoracic spine and rib cage

PATIENT UPPER BODY POSITIONING FOR SITTING AND SUPINE TECHNIQUES

There are a variety of upper body holds available. The hold selected for any particular technique is that which enables the operator to effectively localize forces to a specific segment of the spine or rib cage and deliver a high-velocity low-amplitude (HVLA) force in a controlled manner. Patient comfort must be a major consideration in selecting the most appropriate hold.



OPERATOR LOWER HAND POSITION FOR SUPINE TECHNIQUES

There are a variety of hand positions that can be adopted. The hand position selected for any particular technique is that which enables the operator to effectively localize forces to a specific segment of the spine or rib cage and deliver a HVLA force in a controlled manner. Patient comfort must be a major consideration in selecting the most appropriate hand position.

- Neutral hand position (Fig. B2.0.6)
- Clenched hand position (Fig. B2.0.7)
- Open fist (Fig. B2.0.8)
- Open fist with towel (Fig. B2.0.9)
- Closed fist (Fig. B2.0.10)
- Closed fist with towel (Fig. B2.0.11)

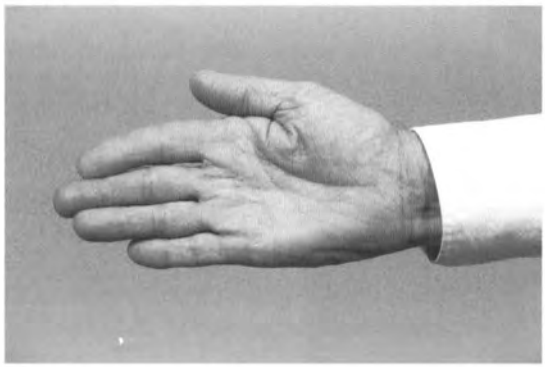


Fig. B2.0.6

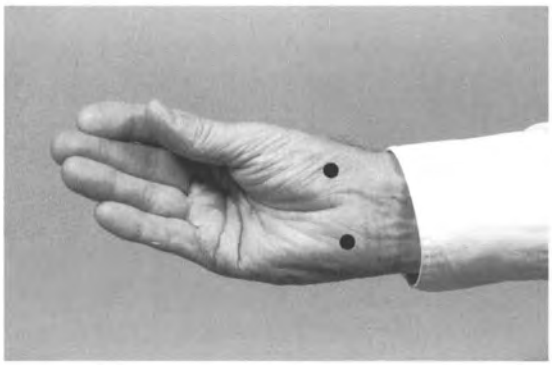


Fig. B2.0.7

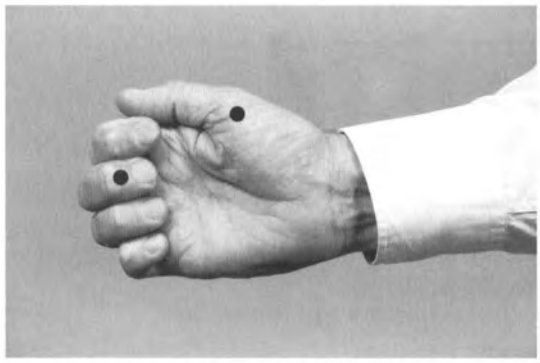


Fig. B2.0.8

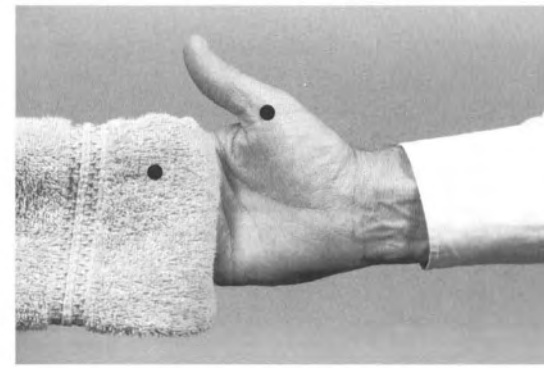


Fig. B2.0.9

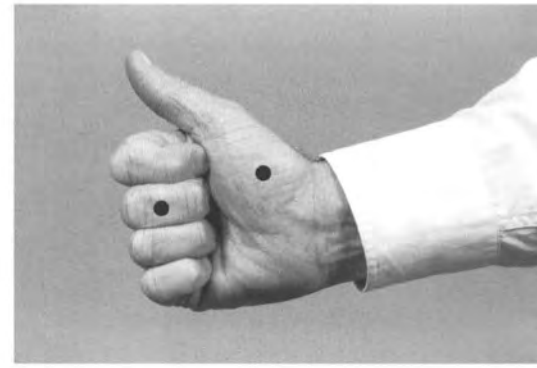


Fig. B2.0.10

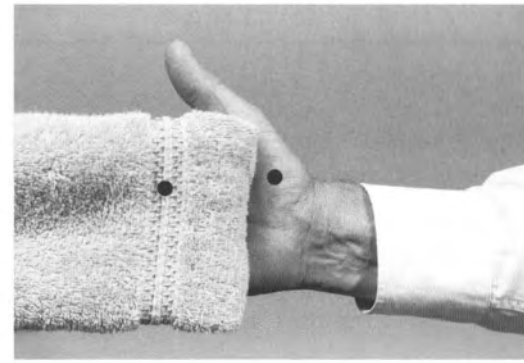


Fig. B2.0.11

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2.1

Thoracic spine T4–9

Extension gliding Patient sitting

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use an extension gliding thrust, parallel to the apophysial joint plane, to produce joint cavitation at T5–6 (Figs B2.1.1, B2.1.2)

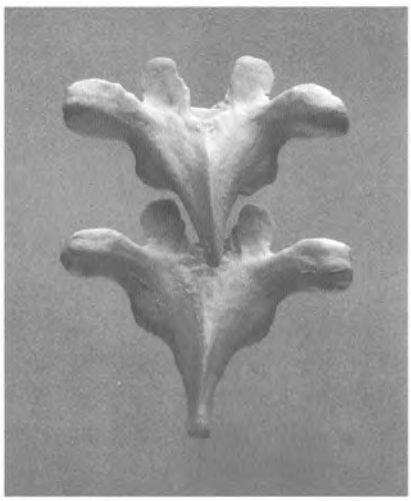

Fig. B2.1.1

Fig. B2.1.2

1 Contact points

(a) Spinous process of T6
(b) Patient's elbows.

2 Applicators

(a) Operator's sternum, with or without cushion or small rolled towel, applied to the T6 spinous process (Fig. B2.1.3)
(b) Operator's flexed fingers, hands and wrists applied to the patient's elbows.

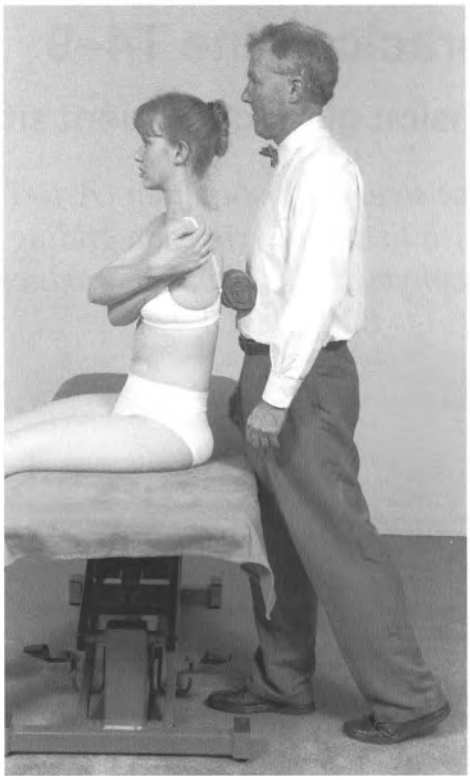

Fig. B2.1.3

3 Patient positioning

Sitting with arms crossed over the chest and hands passed around the shoulders. The arms should be firmly clasped around the body as far as the patient can comfortably reach.

4 Operator stance

Stand directly behind the patient with your feet apart and one leg behind the other. Bend your knees slightly to lower your body.

5 Positioning for thrust

Place the thrusting part of your sternum, with or without a cushion or small rolled towel, firmly against the spinous process of T6. Place your hands over the patient's elbows. Lean forwards with the thrusting part of your chest against the spinous process of T6 (Fig. B2.1.4). Introduce a backwards (compressive) and upwards force to the patient's folded arms. These combined movements introduce local extension to the thoracic spine. By balancing these different leverages, the tension can be localized to the T5–6 segment. Maintaining all holds and pressures, bring the patient backwards until your body weight is evenly distributed between both feet.

Fig. B2.1.4

6 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the T5–6 segment. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the ankles, knees, hips and trunk. A common mistake is to lose the chest compression during the final adjustments.

7 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm and the patient's body weight is well controlled. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

8 Delivering the thrust

The shoulder girdles and thorax of the patient are now a solid mass against which a thrust may be applied. Apply a HVLA thrust towards you and slightly upwards in a cephalad direction via your hands. Simultaneously, apply a HVLA thrust directly forwards against the spinous process of T6 via your sternum (Fig. B2.1.5).

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

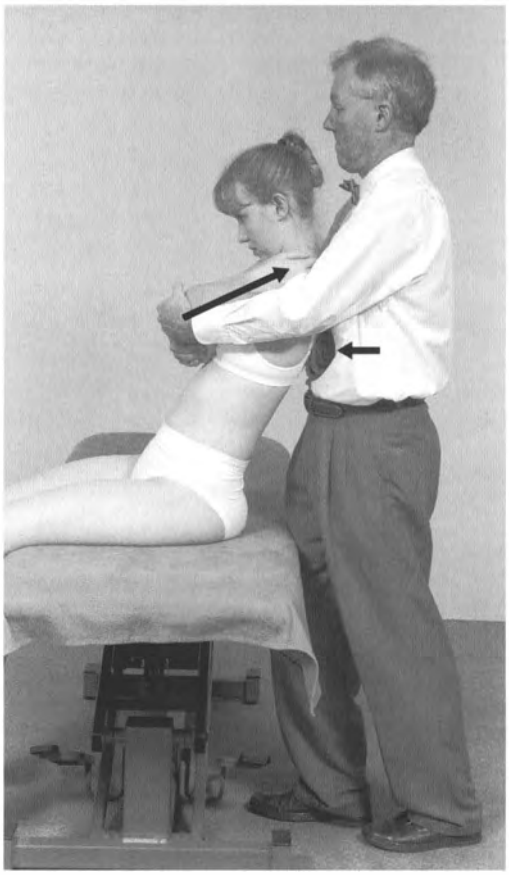

Fig. B2.1.5

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

This technique has many modifications:

- Different shoulder girdle holds can be used.
- Respiration can be used to make the technique more effective.
- A certain degree of momentum is often necessary for success in the technique.

SUMMARY

Thoracic spine T4–9

Extension gliding Patient sitting

- **Contact points:**
  — Spinous process of T6
  — Patient's elbows.

- **Applicators:**
  — Operator's sternum applied to the T6 spinous process (Fig. B2.1.3)
  — Operator's flexed fingers, hands and wrists applied to the patient's elbows.

- **Patient positioning.** Sitting with arms crossed over chest.

- **Operator stance.** Directly behind the patient with your feet apart, knees bent slightly and one leg behind the other.

- **Positioning for thrust.** Lean forwards with the thrusting part of your chest against the spinous process of T6 (Fig. B2.1.4). Introduce a backwards (compressive) and upwards force to the patient's folded arms. Maintaining all holds and pressures, bring the patient backwards until your body weight is evenly distributed between both feet.

- **Adjustments to achieve appropriate pre-thrust tension.**

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** The direction of thrust with your arms is towards you and slightly upwards. Simultaneously, apply a thrust directly forwards against the spinous process of T6 with your sternum (Fig. B2.1.5).

- **Modifications to technique:**
  — Different shoulder girdle holds can be used.
  — Respiration can be used to make the technique more effective.
  — A certain degree of momentum is often necessary for success in the technique.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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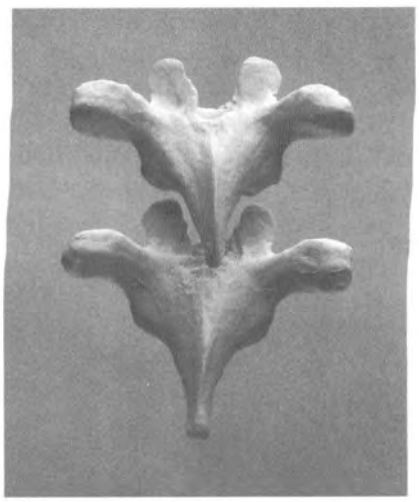
2.2

Thoracic spine T4–9

Flexion gliding Patient supine

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a flexion gliding thrust, parallel to the apophysial joint plane, to produce joint cavitation at T5–6 (see below)



1 Contact points

(a) Transverse processes of T6
(b) Patient's elbows.

2 Applicators

(a) Palm of the operator's right hand, held in a clenched position
(b) Operator's lower sternum or upper abdomen.

3 Patient positioning

Supine with the arms crossed over the chest and hands passed around the shoulders. The arms should be firmly clasped round the body as far as the patient can comfortably reach (Fig. B2.2.1).

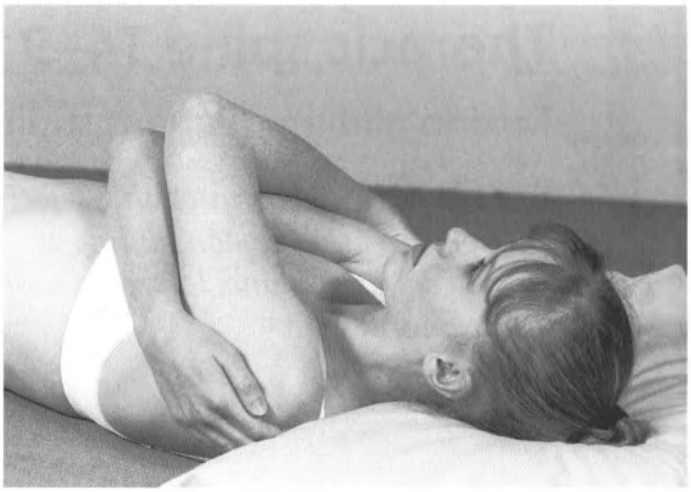


Fig. B2.2.1

4 Operator stance

Stand on the right side of the patient, facing the head of the couch.

5 Positioning for thrust

Reach over the patient with your left hand to take hold of the left shoulder and gently pull it towards you. With your right hand, locate the transverse processes of T6. Now place the clenched palm of your right hand against the transverse processes of T6 (Fig. B2.2.2).

Fig. B2.2.2

Keeping the right hand pressed against the transverse processes of T6, roll the patient back to the supine position. As the patient approaches the supine position, transfer your left hand and forearm to support the patient's head, neck and upper thoracic spine (Fig. B2.2.3).

Fig. B2.2.3

Allow the patient to roll fully into the supine position. Flex the patient's head, neck and upper thoracic spine until tension is localized to the T5–6 segment. Lean over the patient and rest your lower sternum or upper abdomen on the patient's elbows. Initially, a slow but firm pressure is applied with your lower sternum or upper abdomen downward towards the couch. Maintaining this downward leverage, introduce a force in line with the patient's upper arms. By balancing these different leverages, tension can be localized to the T5–6 segment.

6 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the T5–6 segment. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of ankles, knees, hips and trunk. A common mistake is to lose the chest compression during the final adjustments.

7 Immediately pre-thrust

Relax and adjust your balance as necessary. Ensure that your contacts are firm and the patient's head, neck and upper thoracic spine are well controlled. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

8 Delivering the thrust

The shoulder girdles and thorax of the patient are now a solid mass against which a thrust may be applied. Apply a HVLA thrust downwards towards the couch and in a cephalad direction via your lower sternum or upper abdomen. Simultaneously, apply a HVLA thrust with your right hand against the transverse processes in an upward and caudad direction (Fig. B2.2.4).

Fig. B2.2.4

A common fault is to emphasize the thrust via the patient's shoulder girdles at the expense of the thrust against the transverse processes. The hand contacting the transverse processes of T6 must actively participate in the generation of thrust forces.

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

This technique has many modifications:

- Different shoulder girdle holds can be used.
- Different applicators can be used.
- Respiration can be used to make the technique more effective.

SUMMARY

Thoracic spine T4–9

Flexion gliding Patient supine

- **Contact points.**
  — Transverse processes of T6
  — Patient's elbows.

- **Applicators.**
  — Palm of the operator's right hand, held in a clenched position
  — Operator's lower sternum or upper abdomen.

- **Patient positioning.** Supine with arms crossed over chest (Fig. B2.2.1).

- **Operator stance.** To the right side of the patient, facing the couch.

- **Positioning for thrust.** Take hold of the patient's left shoulder and pull it towards you. Place the clenched palm of your right hand against the transverse processes of T6 (Fig. B2.2.2). Roll the patient back to the supine position. As the patient approaches the supine position, transfer your left hand and forearm to support the patient's head, neck and upper thoracic spine (Fig. B2.2.3). Allowing the patient to roll fully into the supine position, flex the head, neck and upper thoracic spine until tension is localized to the T5–6 segment. Apply a firm pressure with your lower sternum or upper abdomen downward towards the couch. Maintaining this downward leverage, introduce a force towards the patient's head in line with the patient's upper arms.

- **Adjustments to achieve appropriate pre-thrust tension.**

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** The direction of thrust is downwards towards the couch and in a cephalad direction via your lower sternum or upper abdomen. Simultaneously, apply a thrust with your right hand against the transverse processes in an upward and caudad direction (Fig. B2.2.4). The hand contacting the transverse processes of T6 must actively participate in the generation of thrust forces.

- **Modifications to technique:**
  — Different shoulder girdle holds can be used.
  — Different applicators can be used.
  — Respiration can be used to make the technique more effective.

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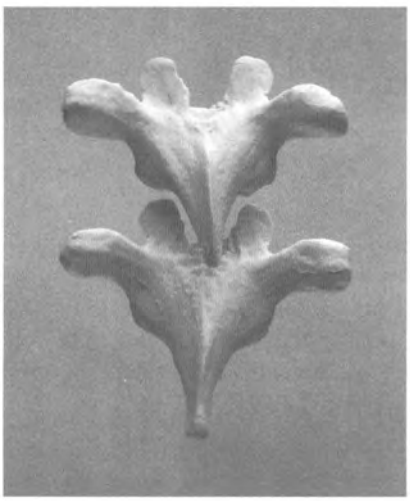
2.3

Thoracic spine T4–9

Rotation gliding Patient supine

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a rotation gliding thrust, parallel to the apophysial joint plane, to produce joint cavitation at T5–6 (see below)



1 Contact points

(a) Left transverse process of T6
(b) Patient's elbows and left forearm.

2 Applicators

(a) Palm of the operator's right hand, held in a clenched position
(b) Operator's lower sternum or upper abdomen.

3 Patient positioning

Supine with the arms crossed over the chest and the hands passed around the shoulders. The left arm is placed over the right arm (Fig. B2.3.1). The arms should be firmly clasped around the body as far as the patient can comfortably reach.

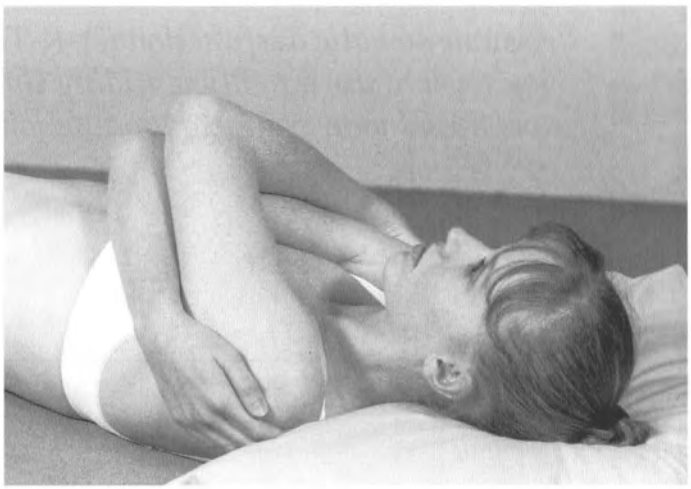


Fig. B2.3.1

4 Operator stance

Stand on the right side of the patient, facing the couch.

5 Positioning for thrust

Reach over the patient with your left hand to take hold of the left shoulder and gently pull the patient's shoulder towards you (Fig. B2.3.2). With your right hand, locate the transverse processes of T6. Now place the thenar eminence of your right hand against the left transverse process of T6 (Fig. B2.3.3).

Fig. B2.3.2

Fig. B2.3.3

Keeping contact with the left transverse process of T6, roll the patient back towards the supine position. Rest your lower sternum or upper abdomen on the patient's elbows and left forearm (Fig. B2.3.4).

Fig. B2.3.4

Initially, a slow but firm pressure is applied with your lower sternum or upper abdomen downward towards the couch. Maintaining this downward leverage, introduce left rotation of the patient's upper thorax by directing forces towards the patient's left shoulder along the line of the patient's left upper arm. By balancing these different leverages, tension can be localized to the T5–6 segment.

6 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the T5–6 segment. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the ankles, knees, hips and trunk. A common mistake is to lose the chest compression during the final adjustments.

7 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm and the patient's body weight is well controlled. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

8 Delivering the thrust

The shoulder girdles and thorax of the patient are now a solid mass against which a thrust may be applied. Apply a HVLA thrust downward towards the couch and in the line of the patient's left upper arm via your lower sternum or upper abdomen. Simultaneously, apply a HVLA thrust with your right thenar eminence upward against the left transverse process of T6 (Fig. B2.3.5). The force is produced by rapid pronation of your right forearm.

Fig. B2.3.5

A common fault is to emphasize the thrust via the patient's shoulder girdles at the expense of the thrust against the left transverse process. The hand contacting the transverse process of T6 must actively participate in the generation of thrust forces.

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

This technique has many modifications:

- Different shoulder girdle holds can be used.
- Different applicators can be used.
- Respiration can be used to make the technique more effective.

SUMMARY

Thoracic spine T4–9

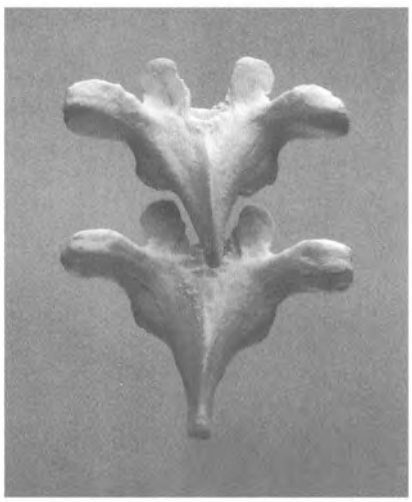
Rotation gliding Patient supine

- **Contact points:**
  — Left transverse process of T6
  — Patient's elbows and left forearm.
- **Applicators:**
  — Palm of the operator's right hand, held in a clenched position.
  — Operator's lower sternum or upper abdomen.
- **Patient positioning.** Supine with arms crossed over the chest (Fig. B2.3.1).
- **Operator stance.** To the right side of the patient, facing the couch.
- **Positioning for thrust.** Take hold of the patient's left shoulder and pull it towards you (Fig. B2.3.2). Place the thenar eminence of your right hand against the left transverse process of T6 (Fig. B2.3.3). Roll the patient back towards the supine position. Rest your lower sternum or upper abdomen on the patient's elbows and left forearm (Fig. B2.3.4). Apply a slow firm pressure with your lower sternum or upper abdomen downward towards the couch. Maintaining this downward leverage, introduce left rotation of the patient's upper thorax by directing forces towards the patient's left shoulder along the line of the patient's left upper arm.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The direction of thrust is downward towards the couch and in the line of the patient's left upper arm via your lower sternum or upper abdomen. Simultaneously, apply a thrust with your right thenar eminence upward against the left transverse process of T6 (Fig. B2.3.5). The force is produced by rapid pronation of your right forearm. The hand contacting the transverse process of T6 must actively participate in the generation of thrust forces.
- **Modifications to technique:**
  — Different shoulder girdle holds can be used.
  — Different applicators can be used.
  — Respiration can be used to make the technique more effective.

2.4 Thoracic spine T4–9

Rotation gliding Patient prone Short lever technique

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a rotation gliding thrust, parallel to the apophysial joint plane, to produce joint cavitation at T5–6 (see below)



1	**Contact points**	Transverse processes of T5 (right applicator) and T6 (left applicator).
2	**Applicators**	Hypothenar eminence of left and right hands.
3	**Patient positioning**	Patient lying prone with the head and neck in a comfortable position and arms hanging over the edge of the couch.

4 Operator stance

Stand at the left side of the patient, feet spread slightly and facing the patient. Stand as erect as possible and avoid crouching as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact points

There are many different ways to perform this technique. This is one approach. Locate the transverse processes of T5 and T6. Place the hypothenar eminence of your right hand against the left transverse process of T5 and establish a firm contact (Fig. B2.4.1). Place the hypothenar eminence of your left hand against the right transverse process of T6 (Fig. B2.4.2). Ensure that you have good contact and will not slip across the skin or superficial musculature when you apply downward and caudad or cephalad forces against the transverse processes. Maintain these contact points.

Fig. B2.4.1

Fig. B2.4.2

6 Positioning for thrust

This is a short lever technique and the velocity of the thrust is critical. Move your centre of gravity over the patient by leaning your body weight forwards onto your arms and hypothenar eminences (Fig. B2.4.3). Shifting your centre of gravity forwards will direct a downward pressure on the transverse processes. You must apply an additional force directed caudad with the left hand and cephalad with the right hand. The final direction of thrust is influenced by the degree of thoracic kyphosis and any pre-existing scoliosis.

Fig. B2.4.3

7 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds and pressure upon the transverse processes, make any necessary changes by introducing very slight components of extension, sidebending and rotation until you sense a state of appropriate tension and leverage at the T5–6 segment. The patient should not be aware of any pain or discomfort.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

9 Delivering the thrust

Apply a HVLA thrust directed in a downward and cephalad direction against the transverse process of T5 while simultaneously applying a thrust downwards and in a caudad direction against the transverse process of T6 (Fig. B2.4.4).

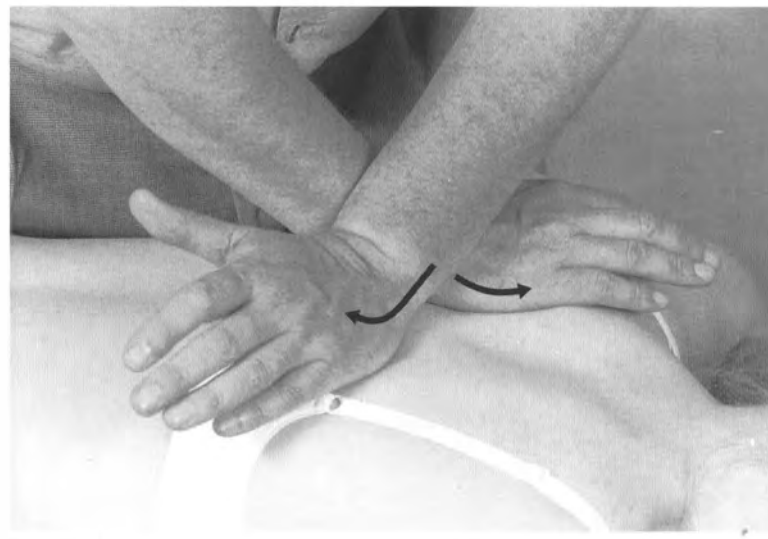


Fig. B2.4.4

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Thoracic spine T4–9

Rotation gliding Patient prone
Short lever technique

- **Contact points.** Transverse processes of T5 (right applicator) and T6 (left applicator).
- **Applicators.** Hypothenar eminence of left and right hands.
- **Patient positioning.** Prone with arms hanging over the edge of the couch.
- **Operator stance.** To the left side of the patient, facing the couch.
- **Palpation of contact points.** Place the hypothenar eminence of your right hand against the left transverse process of T5 and establish a firm contact (Fig. B2.4.1). Place the hypothenar eminence of your left hand against the right transverse process of T6 (Fig. B2.4.2).
- **Positioning for thrust.** This is a short lever technique and the velocity of the thrust is critical. Move your centre of gravity over the patient by leaning your body weight forwards onto your arms and hypothenar eminences (Fig. B2.4.3). Apply an additional force directed caudad with the left hand and cephalad with the right hand.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The direction of thrust is in a downward and cephalad direction against the transverse process of T5 while simultaneously applying a thrust downwards and in a caudad direction against the transverse process of T6 (Fig. B2.4.4).

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2.5 Ribs R1–3

Patient prone

Gliding thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to produce cavitation at the costotransverse joint of the second rib on the right (Figs B2.5.1, B2.5.2)

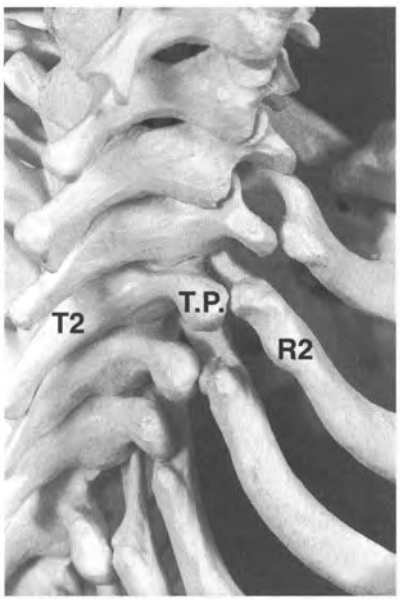

Fig. B2.5.1

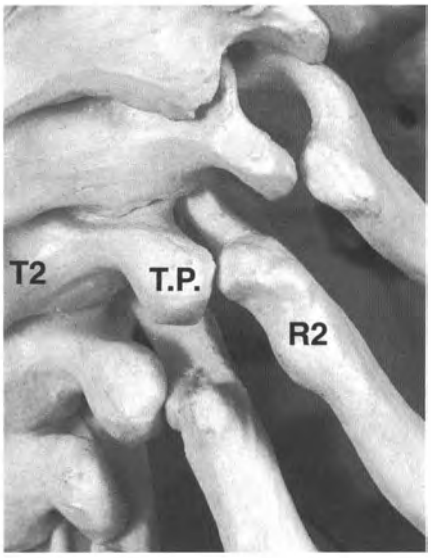

Fig. B2.5.2

1	**Contact point**	Angle of the second rib on the right.
2	**Applicator**	Hypothenar eminence of the right hand.
3	**Patient positioning**	Patient prone with the point of the chin resting on the couch and the arms hanging over the edge of the couch. Introduce a small amount of sidebending to the left by gently lifting and moving the chin to the patient's left (Fig. B2.5.3). Do not introduce too much sidebending.

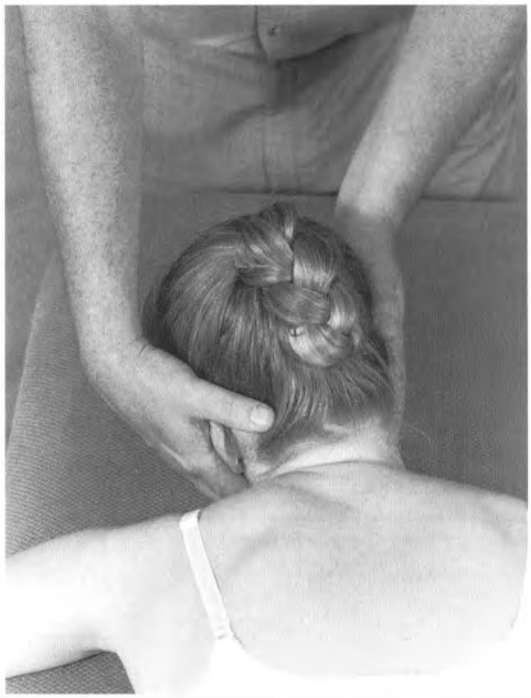

Fig. B2.5.3

4 Operator stance

Head of the couch, feet spread slightly. Stand as erect as possible and avoid crouching over the patient as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact point

Locate the angle of the second rib on the right. Place the hypothenar eminence of your right hand gently, but firmly, against the rib angle. Ensure that you have good contact and will not slip across the skin or superficial musculature when you apply a caudad and downward force towards the couch against the angle of the second rib. Maintain this contact point.

6 Positioning for thrust

Keeping your position at the head of the couch, gently place your left hand against the right side of the patient's head and neck. While maintaining the left sidebending, introduce rotation to the right, in the cervical and upper thoracic spine, by applying gentle pressure to the right side of the patient's head and neck with your left hand (Fig. B2.5.4). Maintaining all holds and pressures, complete the rotation of the patient's head and neck until a sense of tension is palpated at your right hypothenar eminence. Keep firm pressure against the contact point.

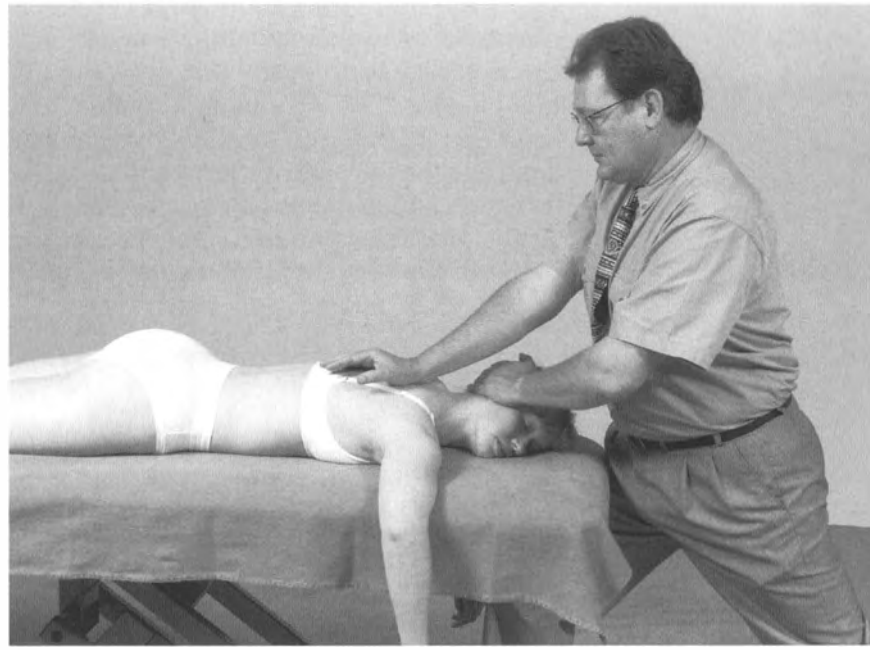

Fig. B2.5.4

7 Adjustments to achieve appropriate pre-thrust tension

Ensure the patient remains relaxed. Maintaining all holds, make any necessary changes in extension, sidebending or rotation until you can sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. You make these final adjustments by altering the pressure and direction of forces between the left hand against the patient's head and neck and your right hypothenar eminence against the contact point.

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm and your body position is well controlled. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

9 Delivering the thrust

Apply a HVLA thrust to the angle of the second rib on the right directed downwards towards the couch and also in a caudad direction towards the patient's right iliac crest. Simultaneously, apply a slight, rapid increase of head and neck rotation to the right with your left hand (Fig. B2.5.5). You must not overemphasize the thrust with the left hand against the patient's head and neck. Your left hand stabilizes the leverages and maintains the position of the head and cervical spine against the thrust imposed upon the contact point. The thrust is induced by a very rapid contraction of the triceps, shoulder adductors and internal rotators.

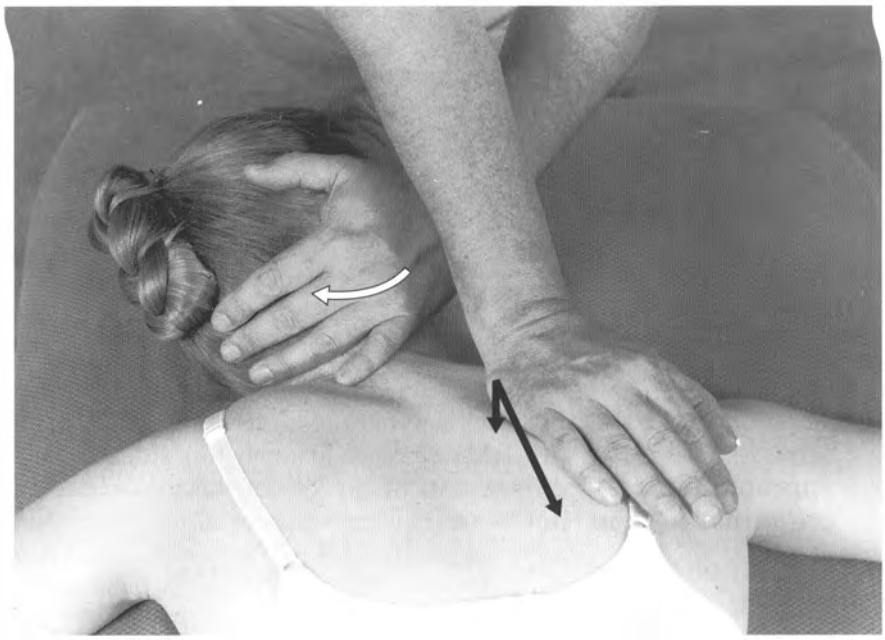

Fig. B2.5.5

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Ribs R1–3

Patient prone Gliding thrust

- **Contact point.** Angle of the right second rib.
- **Applicator.** Hypothenar eminence.
- **Patient positioning.** Patient prone with the chin resting on the couch and arms hanging over the edge of the couch. Introduce sidebending to the left (Fig. B2.5.3). Do not introduce too much sidebending.
- **Operator stance.** Head of the couch, feet spread slightly.
- **Palpation of contact point.** Place your hypothenar eminence against the angle of the second rib on the right. Ensure that you have good contact and will not slip across the skin or superficial musculature when you apply a caudad and downward force towards the couch against the angle of the second rib.
- **Positioning for thrust.** Place your left hand against the right side of the patient's head and neck. Rotate the cervical and upper thoracic spine to the right, by applying pressure to the right side of the patient's head and neck with your left hand until a sense of tension is palpated at the contact point (Fig. B2.5.4).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust to the angle of the second rib on the right is directed downwards towards the couch and also in a caudad direction towards the patient's right iliac crest. Simultaneously, apply a slight, rapid increase of head and neck rotation to the right with your left hand (Fig. B2.5.5). You must not overemphasize the thrust with the left hand against the patient's head and neck.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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2.6

Ribs R4–10

Patient supine

Gliding thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to produce cavitation at the costotransverse joint of the sixth rib on the left (Fig. B2.6.1)

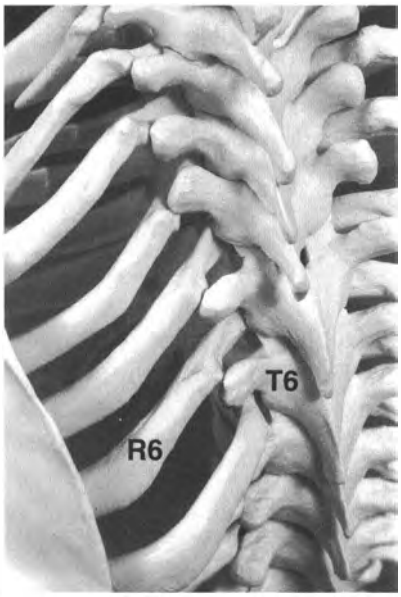


Fig. B2.6.1

1 Contact points

(a) Sixth rib on the left, just lateral to the transverse process of T6
(b) Patient's elbows and left forearm.

2 Applicators

(a) Hypothenar eminence of the operator's right hand
(b) Operator's lower sternum or upper abdomen.

3 Patient positioning

Supine with the arms crossed over the chest and the hands passed around the shoulders. The left arm is placed over the right arm. The arms should be firmly clasped around the body as far as the patient can comfortably reach.

4 Operator stance

Stand on the right side of the patient, facing the couch.

5 Positioning for thrust

Reach over the patient with your left hand to take hold of the left shoulder and gently pull it towards you. With your right hand, locate the sixth rib on the left. Now place the hypothenar eminence of your right hand against the rib just lateral to the transverse process of T6 (Fig. B2.6.2).

Fig. B2.6.2

Keeping contact with the rib, begin rolling the patient back to the supine position (Fig. B2.6.3). Continue until the patient's elbows are directly over your hypothenar eminence. This introduces additional rotation, which is a critical element in the technique.

Fig. B2.6.3

Rest your lower sternum or upper abdomen on the patient's elbows and left forearm. Initially, a slow but firm pressure is applied with your lower sternum or upper abdomen downward towards the couch. Maintaining this downward leverage, introduce left rotation of the patient's upper thorax by directing forces towards the patient's left shoulder along the line of the patient's left upper arm. By balancing these different leverages, tension can be localized to the costotransverse joint of the sixth rib.

6 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending and rotation until you can sense a state of appropriate tension and leverage at the costotransverse joint of the sixth rib. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the ankles, knees, hips and trunk. A common mistake is to lose the chest compression during the final adjustments.

7 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm and the patient's body weight is well controlled. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

8 Delivering the thrust

The shoulder girdles and thorax of the patient are now a solid mass against which a thrust may be applied. Apply a HVLA thrust downward towards the couch and in the line of the patient's left upper arm via your lower sternum or upper abdomen. Simultaneously, apply a HVLA thrust with your right hypothenar eminence upward against the sixth rib (Fig. B2.6.4). The force is produced by rapid supination of your right forearm.

Fig. B2.6.4

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

A common fault is to emphasize the thrust via the patient's shoulder girdles at the expense of the thrust against the sixth rib. The hand contacting the rib must actively participate in the generation of thrust forces.

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Ribs R4–10

Patient supine Gliding thrust

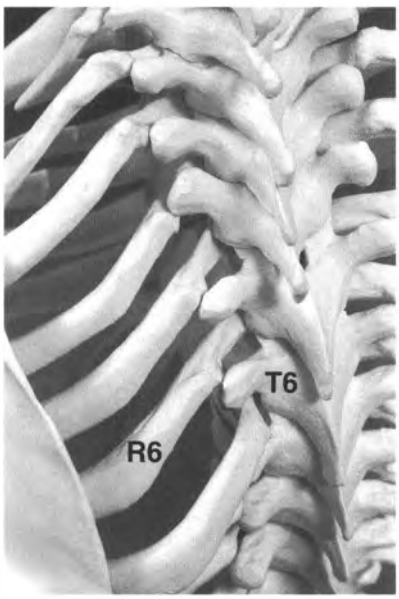
- **Contact points:**
  — Sixth rib on the left, lateral to the transverse process
  — Patient's elbows and left forearm.
- **Applicators:**
  — Hypothenar eminence of the operator's right hand
  — Operator's lower sternum or upper abdomen.
- **Patient positioning.** Supine with arms crossed over the chest.
- **Operator stance.** To the right side of the patient, facing the couch.
- **Positioning for thrust.** Take hold of the patient's left shoulder and pull it towards you. Place the hypothenar eminence of your right hand against the rib just lateral to the left transverse process of T6 (Fig. B2.6.2). Roll the patient back to the supine position (Fig. B2.6.3). Continue until the patient's elbows are directly over your hypothenar eminence. This is a critical element in the technique. Rest your lower sternum or upper abdomen on the patient's elbows and left forearm. Apply a slow firm pressure with your lower sternum or upper abdomen downward towards the couch. Maintaining this downward leverage, introduce left rotation of the patient's upper thorax by directing forces towards the patient's left shoulder along the line of the patient's left upper arm.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The direction of thrust is downward towards the couch and in the line of the patient's left upper arm via your lower sternum or upper abdomen. Simultaneously, apply a thrust with your right hypothenar eminence upward against the sixth rib (Fig. B2.6.4). The force is produced by rapid supination of your right forearm. The hand contacting the rib must actively participate in the generation of thrust forces.

2.7 Ribs R4–10

Patient prone

Gliding thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to produce cavitation at the costotransverse joint of the sixth rib on the left (see below)



1	**Contact points**	Angle of left sixth rib (right applicator). Right transverse process of T6 (left applicator).
2	**Applicators**	Hypothenar eminence of left and right hands.
3	**Patient positioning**	Patient lying prone with the head and neck in a comfortable position and the arms hanging over the edge of the couch.

4 Operator stance

Stand at the left side of the patient, feet spread slightly and facing the patient. Stand as erect as possible and avoid crouching as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact points

There are many different ways to perform this technique. This is one approach. Locate the transverse processes of T6. Place the hypothenar eminence of your right hand against the angle of the patient's left sixth rib and establish a firm contact (Fig. B2.7.1). Place the hypothenar eminence of your left hand against the right transverse process of T6 (Fig. B2.7.2). Ensure that you have good contact and will not slip across the skin or superficial musculature.

Fig. B2.7.1

Fig. B2.7.2

6 Positioning for thrust

This is a short lever technique and as a consequence the velocity of the thrust is critical. Move your centre of gravity over the patient by leaning your body weight forwards onto your arms and hypothenar eminences (Fig. B2.7.3). Shifting your centre of gravity forwards will direct a downward pressure on both the transverse process of T6 and the sixth rib. You must apply an additional force directed cephalad with the right hand against the angle of the sixth rib. The final direction of thrust is influenced by the degree of thoracic kyphosis and any pre-existing scoliosis.

Fig. B2.7.3

7 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in extension, sidebending and rotation until you sense a state of appropriate tension and leverage at the costotransverse joint of the sixth rib. The patient should not be aware of any pain or discomfort.

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

9 Delivering the thrust

Apply a HVLA thrust directed in a downward and cephalad direction against the angle of the sixth rib. It is important to achieve fixation of T6 by maintaining a firm downward pressure against the transverse process of T6 on the right. The thrust is generated by your right hand in contact with the sixth rib (Fig. B2.7.4).

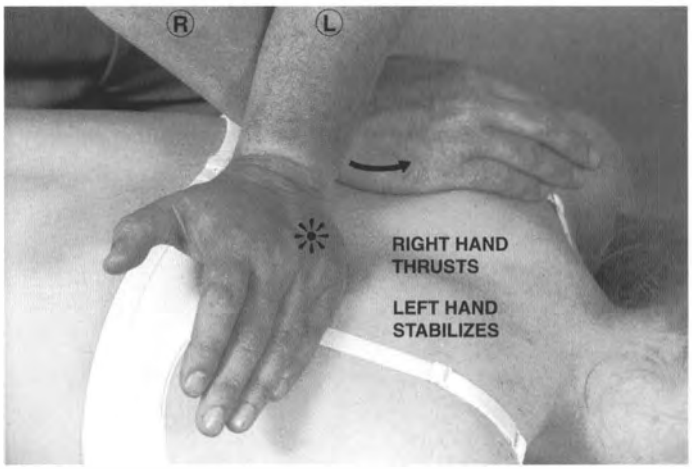


Fig. B2.7.4

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Ribs R4–10

Patient prone Gliding thrust

- **Contact points.** Angle of left sixth rib (right applicator). Right transverse process of T6 (left applicator).
- **Applicators.** Hypothenar eminence of left and right hands.
- **Patient positioning.** Prone with arms hanging over the edge of the couch.
- **Operator stance.** To the left side of the patient, facing the couch.
- **Palpation of contact points.** Place the hypothenar eminence of your right hand against the angle of the patient's left sixth rib and establish a firm contact (Fig. B2.7.1). Place the hypothenar eminence of left hand against the right transverse process of T6 (Fig. B2.7.2).
- **Positioning for thrust.** This is a short lever technique and the velocity of the thrust is critical. Move your centre of gravity over the patient by leaning your body weight forwards onto your arms and hypothenar eminences (Fig. B2.7.3). Apply an additional force directed cephalad with the right hand against the angle of the sixth rib.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The direction of thrust is in a downward and cephalad direction against the angle of the sixth rib. It is important to achieve fixation of T6 by maintaining a firm downward pressure against the transverse process of T6 on the right. The thrust is generated by your right hand in contact with the sixth rib (Fig. B2.7.4).

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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2.8

Ribs R4–10

Patient sitting

Gliding thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to produce cavitation at the costotransverse joint of the right sixth rib (Fig. B2.8.1)

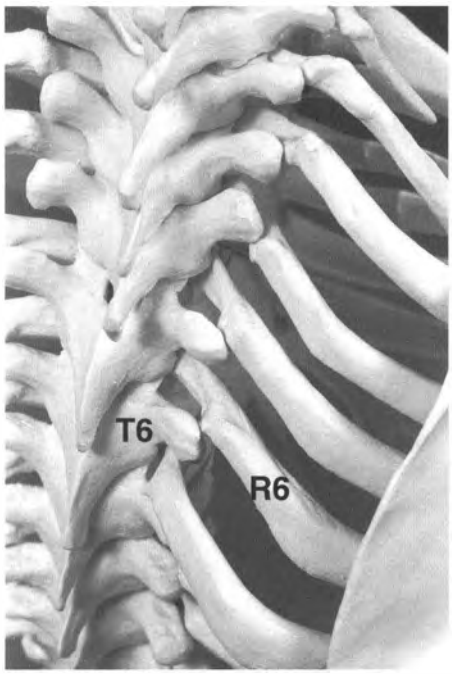

Fig. B2.8.1

1	**Contact point**	Angle of right sixth rib.
2	**Applicator**	Hypothenar eminence of right hand.
3	**Patient positioning**	Sitting astride the treatment couch with the arms crossed over the chest and the hands passed around the shoulders. The arms should be firmly clasped around the body as far as the patient can comfortably reach.

4 Operator stance

Stand behind and slightly to the left of the patient with your feet spread. Pass your left arm across the front of the patient's chest to lightly grip over the patient's right shoulder region (Fig. B2.8.2).

Fig. B2.8.2

5 Positioning for thrust

Translate the patient's trunk to the right and away from you. This opens up the intercostal space between the sixth and seventh ribs (Fig. B2.8.3) and allows better access to the inferior aspect of the sixth rib. Place your right hypothenar eminence on the inferior surface of the angle of the sixth rib. The thorax is now rotated to the left (Fig. B2.8.4). Sidebending to the right is introduced to lock the spine down to T6. The operator maintains as erect a posture as possible. Keep your right hypothenar eminence firmly applied to the sixth rib with your right elbow held close to your body (Fig. B2.8.5).

Fig. B2.8.3

Fig. B2.8.4

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

Fig. B2.8.5

6 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the costotransverse joint of the sixth rib on the right. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips

7 Immediately pre-thrust

Relax and adjust your balance as necessary. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

8 Delivering the thrust

A degree of momentum is necessary to achieve a successful cavitation. Rock the patient into and out of rotation whilst maintaining the other leverages. When you sense a state of appropriate tension and leverage at the sixth rib, apply a HVLA thrust against the inferior aspect of the angle of the rib in a cephalad and anterior direction. Simultaneously, apply slight exaggeration of left trunk rotation (Fig. B2.8.6).

Fig. B2.8.6

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

SUMMARY

Ribs R4–10

Patient sitting Gliding thrust

- **Contact point.** Angle of right sixth rib.
- **Applicator.** Hypothenar eminence of right hand.
- **Patient positioning.** Sitting astride the couch with the arms crossed over the chest and the hands passed around the shoulders.
- **Operator stance.** Behind and slightly to the left of the patient with the feet spread. Pass your left arm across the front of the patient's chest to lightly grip over the patient's right shoulder region (Fig. B2.8.2).
- **Positioning for thrust.** Translate the patient's trunk to the right and away from you (Fig. B2.8.3). Place your right hypothenar eminence on the inferior surface of the angle of the sixth rib. The thorax is now rotated to the left (Fig. B2.8.4). Sidebending to the right is introduced to lock the spine down to T6. The operator maintains as erect a posture as possible. Keep your right hypothenar eminence firmly applied to the sixth rib with your right elbow held close to your body (Fig. B2.8.5).
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** A degree of momentum is necessary to achieve a successful cavitation. The direction of thrust is in a cephalad and anterior direction against the inferior aspect of the angle of the rib. Simultaneously, apply slight exaggeration of left trunk rotation (Fig. B2.8.6).

3 Section 3 Lumbar and thoracolumbar spine

UPPER BODY HOLDS FOR SIDE-LYING TECHNIQUES

All techniques in this manual are described with the operator taking up the axillary hold (Fig. B3.0.1). The hold selected for any particular technique is that which enables the operator to effectively localize forces to a specific segment of the spine and deliver a high-velocity low-amplitude (HVLA) force in a controlled manner. Patient comfort must be a major consideration in selecting the most appropriate hold.

Fig. B3.0.1

Three alternative upper body holds are available:

- Pectoral hold (Fig. B3.0.2).
- Elbow hold (Fig. B3.0.3).
- Upper arm hold (Fig. B3.0.4).

Fig. B3.0.2

Fig. B3.0.3

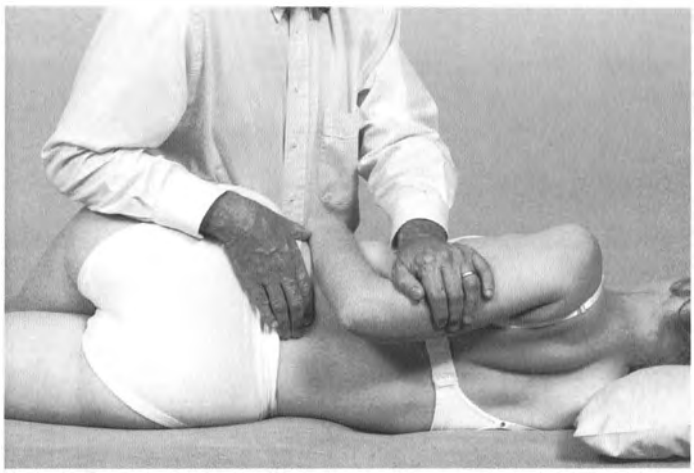

Fig. B3.0.4

LOWER BODY HOLDS FOR SIDE-LYING TECHNIQUES

There are a variety of lower body holds available. The hold selected for any particular technique is that which enables the operator to effectively localize forces to a specific segment of the spine and deliver a HVLA force in a controlled manner. Patient comfort must be a major consideration in selecting the most appropriate hold.

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3.1

Thoracolumbar spine T10–L2

Neutral positioning Patient side-lying

Rotation gliding thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a rotation gliding thrust to produce cavitation at T12–L1 on the left (Figs B3.1.1, B3.1.2)

Fig. B3.1.1

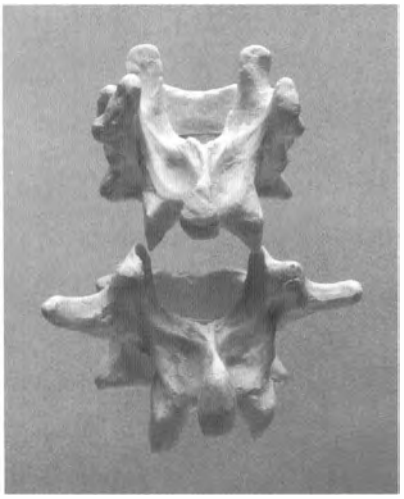


Fig. B3.1.2

1 Patient positioning

Lying on the right side with a pillow to support the head and neck. The upper portion of the couch is raised 10–15° to introduce left sidebending in the lower thoracic and upper lumbar spine. Experienced practitioners may choose to achieve the left sidebending without raising the upper portion of the couch.

Lower body. Straighten the patient's lower (right) leg and ensure that the leg and spine are in a straight line, in a neutral position. Flex the patient's upper hip and knee slightly and place the upper leg just anterior to the lower leg. The lower leg and spine should form as near a straight line as possible, with no flexion at the lower hip or knee.

Upper body. Gently extend the patient's upper shoulder and place the patient's left forearm on the lower ribs. Using your right hand to palpate the T12–L1 interspinous space, introduce left rotation of the patient's upper body down to the T12–L1 segment. This is achieved by gently holding the patient's right elbow with your left hand and pulling it towards you, but also in a cephalad direction towards the head end of the couch. Be careful not to introduce any flexion to the spine during this movement. Left rotation is continued until your palpating hand at the T12–L1 segment begins to sense motion. Take up the axillary hold. This arm controls the upper body rotation.

2 Operator stance

Stand close to the couch with your feet spread and one leg behind the other (Fig. B3.1.3). Maintain an upright posture, facing slightly in the direction of the patient's upper body. Keep your right arm as close to your body as possible.

Fig. B3.1.3

3 Positioning for thrust

Apply your right forearm to the region between gluteus medius and maximus. Your right forearm now controls lower body rotation. Your left forearm should be resting against the patient's upper pectoral and rib cage region and will control upper body rotation. Firstly rotate the patient's pelvis and lumbar spine towards you until motion is palpated at the T12–L1 segment. Rotate the patient's upper body away from you using your left arm until a sense of tension is palpated at the T12–L1 segment. Be careful to avoid undue pressure in the axilla. Finally roll the patient about 10–15° towards you while maintaining the build-up of leverages at the T12–L1 segment.

4 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the T12–L1 segment. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips.

5 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

6 Delivering the thrust

Your left arm against the patient's pectoral region does not apply a thrust but acts as a stabilizer only. Keep the thrusting (right) arm as close to your body as possible. Apply a HVLA thrust with your right forearm against the patient's buttock. The direction of force is down towards the couch accompanied by a slight exaggeration of pelvic rotation towards the operator (Fig. B3.1.4).

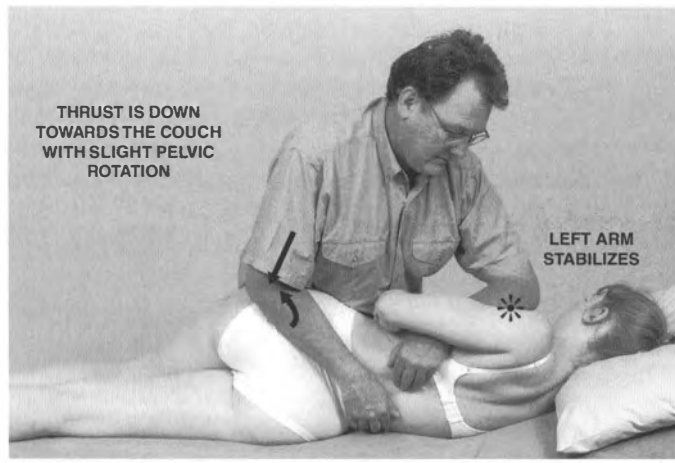


Fig. B3.1.4

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Thoracolumbar spine T10–L2

Neutral positioning Patient side-lying
Rotation gliding thrust

- **Patient positioning.** Right side-lying with the upper portion of the couch raised 10–15° to introduce left sidebending in the lower thoracic and upper lumbar spine.

  Lower body. Right leg and spine in a straight line. Left hip and knee flexed slightly and placed just anterior to the lower leg.

  Upper body. Introduce left rotation of the patient's upper body until your palpating hand at T12–L1 begins to sense motion. Do not introduce any flexion to the spine during this movement. Take up the axillary hold.

- **Operator stance.** Stand close to the couch, feet spread and one leg behind the other. Maintain an upright posture, facing slightly in the direction of the patient's upper body (Fig. B3.1.3).

- **Positioning for thrust.** Place your right forearm in the region between gluteus medius and maximus. Rotate the patient's pelvis and lumbar spine towards you until motion is palpated at the T12–L1 segment. Rotate the patient's upper body away from you until a sense of tension is palpated at the T12–L1 segment. Roll the patient about 10–15° towards you.

- **Adjustments to achieve appropriate pre-thrust tension.**

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** The direction of thrust is down towards the couch accompanied by exaggeration of pelvic rotation towards the operator (Fig. B3.1.4). Your left arm against the patient's axillary region does not apply a thrust but acts as a stabilizer only.

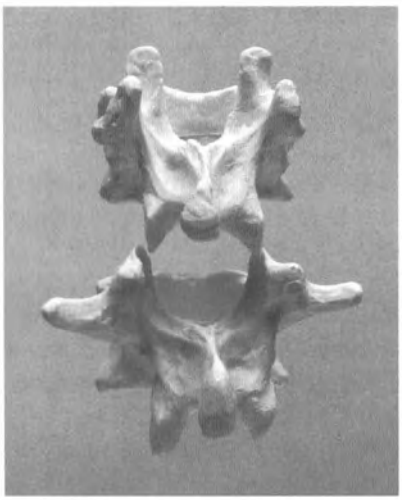
3.2

Thoracolumbar spine T10–L2

Flexion positioning Patient side-lying

Rotation gliding thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a rotation gliding thrust to produce cavitation at T12–L1 on the left (see below)



1 Patient positioning

Lying on the left side with a pillow to support the head and neck. A small pillow, or rolled towel, should be placed under the patient's waist to introduce left sidebending in the thoracolumbar spine. Experienced practitioners may choose to achieve the left sidebending without the use of a small pillow or rolled towel.

Lower body. Straighten the patient's lower (left) leg at the knee joint while keeping the left hip flexed. Flex the patient's upper hip and knee. Rest the upper flexed knee upon the edge of the couch, anterior to the left thigh, and place the patient's right foot behind the left calf. This position provides stability to the lower body.

Upper body. Gently extend the patient's upper shoulder and place the patient's right forearm on the lower ribs. Using your left hand to palpate the T12–L1 interspinous space, introduce right rotation of the patient's upper body down to the T12–L1 segment. Rotation with flexion positioning is achieved by gently holding the patient's left elbow with your right hand and pulling it towards you, but also in an caudad direction towards the foot end of the couch. Left rotation is continued until your palpating hand at the T12–L1 segment begins to sense motion. Take up the axillary hold. This arm controls the upper body rotation.

2 Operator stance

Stand close to the couch with your feet spread and one leg behind the other. Maintain an upright posture, facing slightly in the direction of the patient's upper body. Keep your left arm as close to your body as possible.

3 Positioning for thrust

Apply the palmar aspect of your left forearm to the sacrum and posterior superior iliac spine. Your left forearm now controls lower body rotation. Your right forearm should be resting against the patient's upper pectoral and rib cage region and will control upper body rotation. Firstly rotate the patient's pelvis and lumbar spine towards you until motion is palpated at the T12–L1 segment. Rotate the patient's upper body away from you using your right arm until a sense of tension is palpated at the T12–L1 segment. Be careful to avoid undue pressure in the axilla. Finally roll the patient about 10–15° towards you while maintaining the build-up of leverages at the T12–L1 segment.

4 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the T12–L1 segment. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips.

5 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

6 Delivering the thrust

Your right arm against the patient's pectoral region does not apply a thrust but acts as a stabilizer only. Keep the thrusting (left) arm as close to your body as possible. Apply a HVLA thrust with your left forearm against the patient's sacrum and posterior superior iliac spine. The direction of force is down towards the couch accompanied by slight exaggeration of pelvic rotation towards the operator (Fig. B3.2.1).

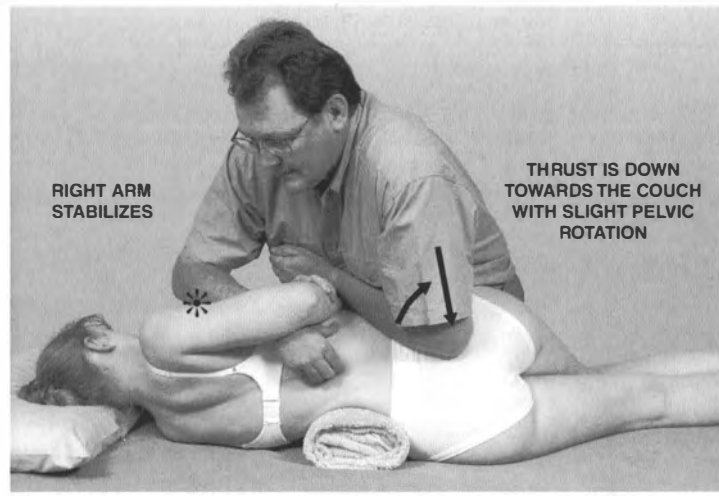


Fig. B3.2.1

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Thoracolumbar spine T10–L2

Flexion positioning Patient side-lying
Rotation gliding thrust

- **Patient positioning.** Left side-lying with a small pillow or rolled towel placed under the patient's waist to introduce left sidebending in the thoracolumbar spine.

  Lower body. Left hip flexed with knee extended. Right hip and knee flexed with patient's right foot behind the left calf.

  Upper body. Introduce right rotation of the patient's upper body until your palpating hand at T12–L1 begins to sense motion. Introduce flexion to the spine during this movement. Take up the axillary hold.

- **Operator stance.** Stand close to the couch, feet spread and one leg behind the other. Maintain an upright posture, facing slightly in the direction of the patient's upper body.

- **Positioning for thrust.** Place the palmar aspect of your left forearm against the patient's sacrum and posterior superior iliac spine. Rotate the patient's pelvis and lumbar spine towards you until motion is palpated at the T12–L1 segment. Rotate the patient's upper body away from you until a sense of tension is palpated at the T12–L1 segment. Roll the patient about 10–15° towards you.

- **Adjustments to achieve appropriate pre-thrust tension.**

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** The direction of thrust is down towards the couch accompanied by exaggeration of pelvic rotation towards the operator (Fig. B3.2.1). Your right arm against the patient's axillary region does not apply a thrust but acts as a stabilizer only.

3.3

Lumbar spine L1–5

Neutral positioning Patient side-lying

Rotation gliding thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a rotation gliding thrust to produce cavitation at L3–4 on the right (Figs B3.3.1, B3.3.2)

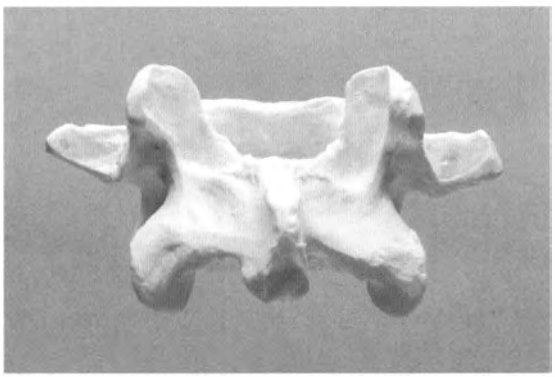


Fig. B3.3.1

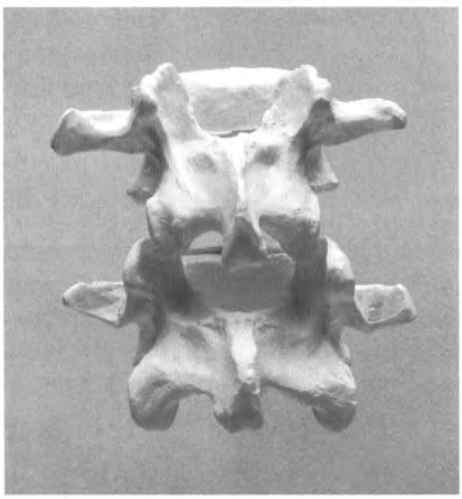


Fig. B3.3.2

1 Patient positioning

Lying on the left side with a pillow to support the head and neck.

Lower body. Straighten the patient's lower leg and ensure that the leg and spine are in a straight line, in a neutral position. Flex the patient's upper hip and knee slightly and place the upper leg just anterior to the lower leg. The lower leg and spine should form as near a straight line as possible, with no flexion at the lower hip or knee.

Upper body. Gently extend the patient's upper shoulder and place the patient's right forearm on the lower ribs. Using your left hand to palpate the L3–4 interspinous space, introduce right rotation of the patient's upper body down to the L3–4 segment. This is achieved by gently holding the patient's left elbow with your right hand and pulling it towards you, but also in a cephalad direction towards the head end of the couch (Fig. B3.3.3). Be careful not to introduce any flexion to the spine during this movement. Right rotation is continued until your palpating hand at the L3–4 segment begins to sense motion. Take up the axillary hold. This arm controls the upper body rotation.

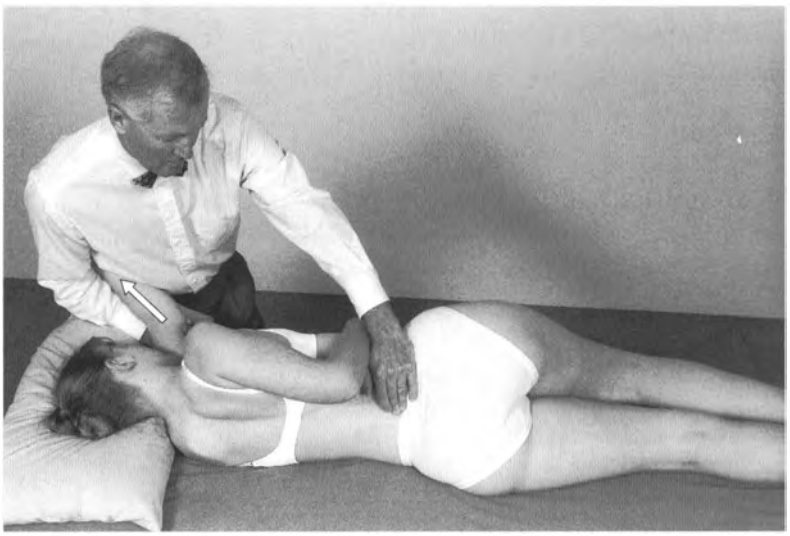


Fig. B3.3.3

2 Operator stance

Stand close to the couch with your feet spread and one leg behind the other (Fig. B3.3.4). Maintain an upright posture, facing slightly in the direction of the patient's upper body. Keep your left arm as close to your body as possible.

Fig. B3.3.4

3 Positioning for thrust

Apply your left forearm to the region between gluteus medius and maximus. Your left forearm now controls lower body rotation. Your right forearm should be resting against the patient's upper pectoral and rib cage region and will control upper body rotation. Firstly rotate the patient's pelvis and lumbar spine towards you until motion is palpated at the L3–4 segment. Rotate the patient's upper body away from you using your right arm until a sense of tension is palpated at the L3–4 segment. Be careful to avoid undue pressure in the axilla. Finally roll the patient about 10–15° towards you while maintaining the build-up of leverages at the L3–4 segment.

4 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the L3–4 segment. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

5 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

6 Delivering the thrust

Your right arm against the patient's pectoral region does not apply a thrust but acts as a stabilizer only. Keep the thrusting (left) arm as close to your body as possible. Apply a HVLA thrust with your left forearm against the patient's buttock. The direction of force is down towards the couch accompanied by slight exaggeration of pelvic rotation towards the operator (Fig. B3.3.5).

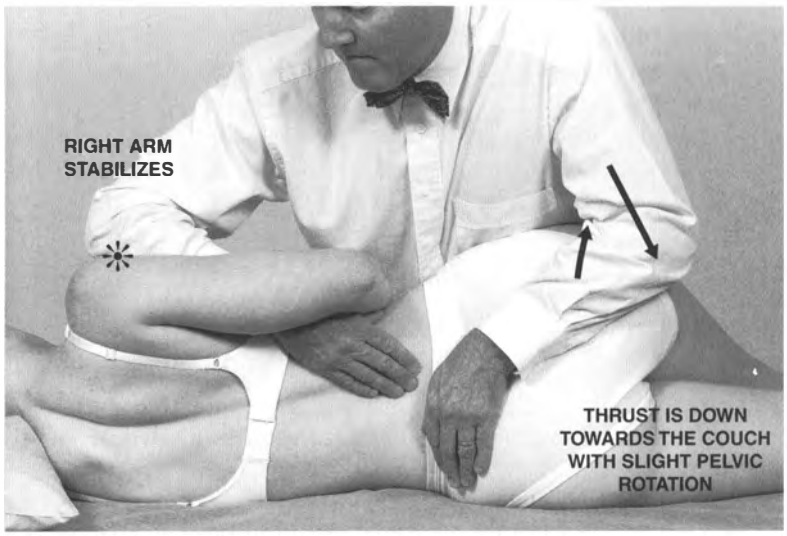


Fig. B3.3.5

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Lumbar spine L1–5

Neutral positioning Patient side-lying
Rotation gliding thrust

- **Patient positioning.** Left side-lying.

  Lower body. Left leg and spine in a straight line. Right hip and knee flexed slightly and placed just anterior to the lower leg.

  Upper body. Introduce right rotation of the patient's upper body until your palpating hand at L3–4 begins to sense motion. Do not introduce any flexion to the spine during this movement (Fig. B3.3.3). Take up the axillary hold.

- **Operator stance.** Stand close to the couch, feet spread and one leg behind the other. Maintain an upright posture, facing slightly in the direction of the patient's upper body (Fig. B3.3.4).

- **Positioning for thrust.** Place your left forearm in the region between gluteus medius and maximus. Rotate the patient's pelvis and lumbar spine towards you until motion is palpated at the L3–4 segment. Rotate the patient's upper body away from you until a sense of tension is palpated at the L3–4 segment. Roll the patient about 10–15° towards you.

- **Adjustments to achieve appropriate pre-thrust tension.**

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** The direction of thrust is down towards the couch accompanied by exaggeration of pelvic rotation towards the operator (Fig. B3.3.5). Your right arm against the patient's axillary region does not apply a thrust but acts as a stabilizer only.

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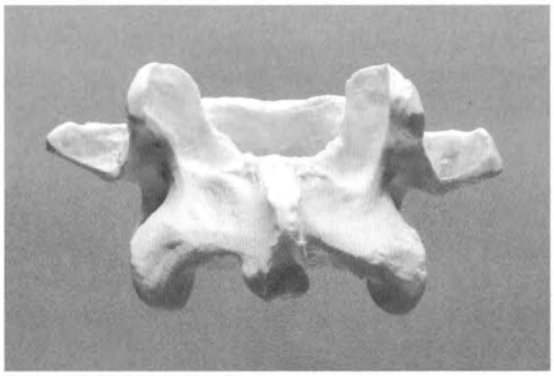
3.4

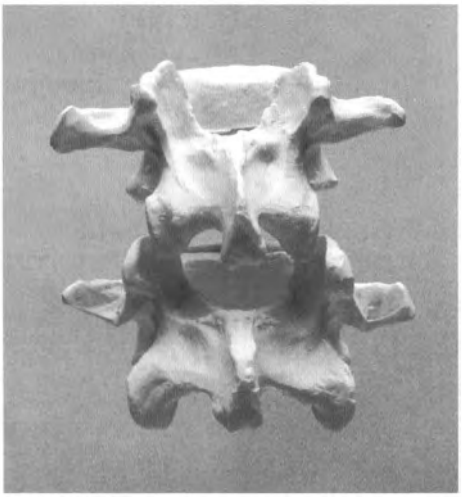
Lumbar spine L1–5

Flexion positioning Patient side-lying

Rotation gliding thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a rotation gliding thrust to produce cavitation at L3–4 on the right (see below)





1 Patient positioning

Lying on the left side with a pillow to support the head and neck. A small pillow, or rolled towel, should be placed under the patient's waist to introduce left sidebending in the lumbar spine. Experienced practitioners may choose to achieve the left sidebending without the use of a small pillow or rolled towel.

Lower body. Straighten the patient's lower (left) leg at the knee joint while keeping the left hip flexed. Flex the patient's upper hip and knee. Rest the upper flexed knee upon the edge of the couch, anterior to the left thigh, and place the patient's right foot behind the left calf. This position provides stability to the lower body.

Upper body. Gently extend the patient's upper shoulder and place the patient's right forearm on the lower ribs. Using your left hand to palpate the L3–4 interspinous space, introduce right rotation of the patient's upper body down to the L3–4 segment. Rotation with flexion positioning is achieved by gently holding the patient's left elbow with your right hand and pulling it towards you, but also in an caudad direction towards the foot end of the couch (Fig. B3.4.1). Right rotation is continued until your palpating hand at the L3–4 segment begins to sense motion. Take up the axillary hold. This arm controls the upper body rotation.

Fig. B3.4.1

2 Operator stance

Stand close to the couch with your feet spread and one leg behind the other (Fig. B3.4.2). Maintain an upright posture, facing slightly in the direction of the patient's upper body. Keep your left arm as close to your body as possible.

Fig. B3.4.2

3 Positioning for thrust

Apply your left forearm to the region between gluteus medius and maximus. Your left forearm now controls lower body rotation. Your right forearm should be resting against the patient's upper pectoral and rib cage region and will control upper body rotation. Firstly rotate the patient's pelvis and lumbar spine towards you until motion is palpated at the L3–4 segment. Rotate the patient's upper body away from you using your right arm until a sense of tension is palpated at the L3–4 segment. Be careful to avoid undue pressure in the axilla. Finally roll the patient about 10–15° towards you while maintaining the build-up of leverages at the L3–4 segment.

4 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the L3–4 segment. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips.

5 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

6 Delivering the thrust

Your right arm against the patient's pectoral region does not apply a thrust but acts as a stabilizer only. Keep the thrusting (left) arm as close to your body as possible. Apply a HVLA thrust with your left forearm against the patient's buttock. The direction of force is down towards the couch accompanied by a slight exaggeration of pelvic rotation towards the operator (Fig. B3.4.3).

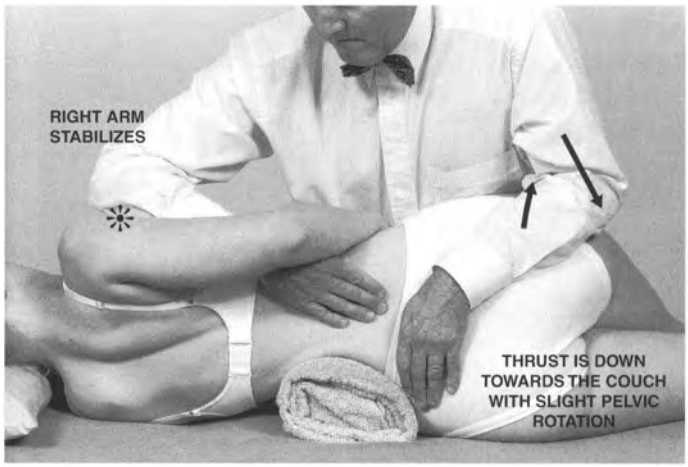


Fig. B3.4.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Lumbar spine L1–5

Flexion positioning Patient side-lying
Rotation gliding thrust

- **Patient positioning.** Left side-lying with a small pillow or rolled towel placed under the patient's waist to introduce left sidebending in the lumbar spine.

  Lower body. Left hip flexed with knee extended. Right hip and knee flexed with the patient's right foot behind the left calf.

  Upper body. Introduce right rotation of the patient's upper body until your palpating hand at L3–4 begins to sense motion. Introduce flexion to the spine during this movement (Fig. B3.4.1). Take up the axillary hold.

- **Operator stance.** Stand close to the couch, feet spread and one leg behind the other. Maintain an upright posture, facing slightly in the direction of the patient's upper body (Fig. B3.4.2).

- **Positioning for thrust.** Place your left forearm in the region between gluteus medius and maximus. Rotate the patient's pelvis and lumbar spine towards you until motion is palpated at the L3–4 segment. Rotate the patient's upper body away from you until a sense of tension is palpated at the L3–4 segment. Roll the patient about 10–15° towards you.

- **Adjustments to achieve appropriate pre-thrust tension.**

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** The direction of thrust is down towards the couch accompanied by exaggeration of pelvic rotation towards the operator (Fig. B3.4.3). Your right arm against the patient's axillary region does not apply a thrust but acts as a stabilizer only.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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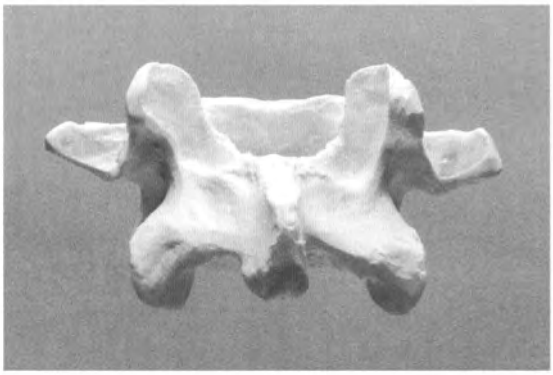
3.5

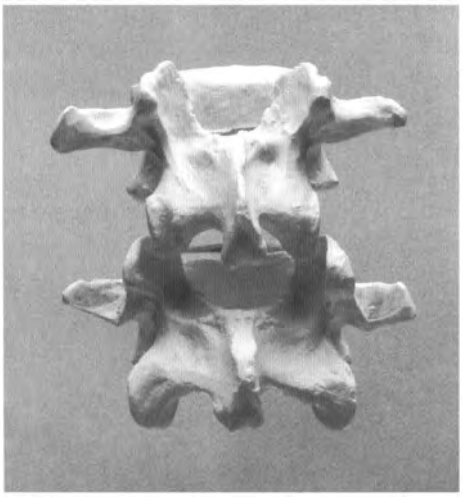
Lumbar spine L1–5

Neutral positioning Patient sitting

Rotation gliding thrust

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a rotation gliding thrust to produce cavitation at L3–4 on the left (see below)





1 Patient positioning

Sitting on the treatment couch with the arms folded. The patient should be encouraged to maintain an erect posture.

2 Operator stance

Stand behind and slightly to the right of the patient with your feet spread. Pass your right arm across the front of the patient's chest to lightly grip the patient's left thorax (Fig. B3.5.1).

Fig. B3.5.1

3 Positioning for thrust

Place your left hypothenar eminence to the right side of the spinous process of L3 and introduce right sidebending to the patient's thoracic and upper lumbar spine (Fig. B3.5.2). The thoracic and upper lumbar spine is now rotated to the right to lock the spine down to but not including L3. The operator maintains as erect a posture as possible. Keep your left hypothenar eminence firmly applied to the spinous process of L3 with your left arm held close to your body.

Fig. B3.5.2

4 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the L3–4 segment. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips.

5 Immediately pre-thrust

Relax and adjust your balance as necessary. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

6 Delivering the thrust

A degree of momentum in necessary to achieve a successful cavitation. It is desirable for the momentum component of the thrust to be restricted to one plane of motion and this should be rotation. Rock the patient into and out of rotation while maintaining the sidebending and flexion/extension positioning. When close to full rotation, you will sense a state of appropriate tension and leverage at the L3–4 segment, at which point you apply a HVLA thrust against the spinous process of L3. The thrust is directed to the spinous process of L3 and accompanied by a slight exaggeration of right rotation (Fig. B3.5.3).

Fig. B3.5.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Lumbar spine L1–5

Neutral positioning Patient sitting
Rotation gliding thrust

- **Patient positioning.** Sitting erect.
- **Operator stance.** Behind and slightly to the right of the patient with your right arm across the front of the patient's chest (Fig. B3.5.1).
- **Positioning for thrust.** Place your left hypothenar eminence to the right side of the spinous process of L3 and introduce right sidebending to the patient's thoracic and upper lumbar spine (Fig. B3.5.2). The thoracic and upper lumbar spine is now rotated to the right to lock the spine down to but not including L3.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust is directed to the spinous process of L3 and accompanied by exaggeration of right rotation (Fig. B3.5.3). A degree of momentum is necessary to achieve a successful cavitation. The momentum component of the thrust should be in the direction of rotation.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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3.6

Lumbosacral joint (L5–S1)

Patient side-lying

Thrust direction is dependent upon apophysial joint plane*

Assume somatic dysfunction (A-R-T-T) is identified and you wish to use a gliding thrust to produce cavitation at L5–S1 on the right (Figs B3.6.1, B3.6.2)

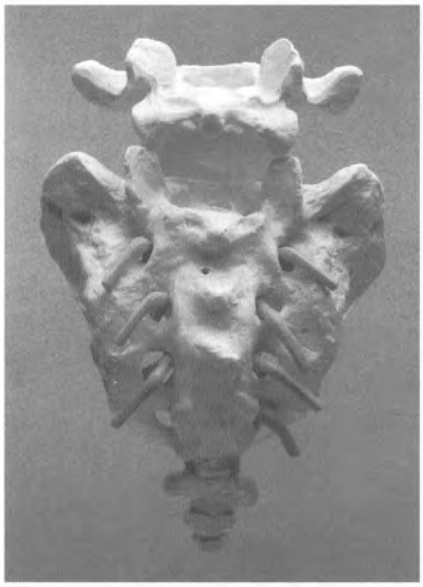

Fig. B3.6.1

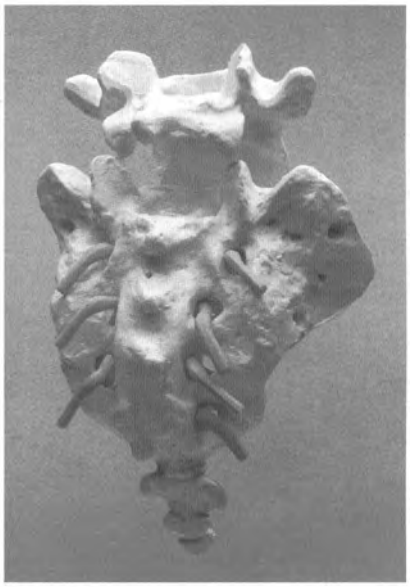

Fig. B3.6.2

*The condition where joints are asymmetrically orientated is referred to as articular tropism. The lumbosacral zygapophysial joints would normally be orientated at approximately 45° with respect to the sagittal plane. There is considerable individual variation and you will encounter patients with lumbosacral apophysial joint planes that range between sagittal and coronal orientation. The variation in apophysial joint plane means that considerable palpatory skill is required to accurately localize forces at the lumbosacral joint and determine the most suitable direction of thrust.

1 Patient positioning

Lying on the left side with a pillow to support the head and neck.

Lower body. Straighten the patient's lower (left) leg at the knee joint while placing the left hip in approximately 20° of flexion. Flex the patient's upper knee and place the patient's right foot behind the left lower leg (Fig. B3.6.3). This position provides stability to the lower body.

Fig. B3.6.3

Upper body. Gently extend the patient's upper shoulder and place the patient's right forearm on the lower ribs. Using your left hand to palpate the L5–S1 interspinous space, introduce right rotation of the patient's upper body down to the L5–S1 segment. This is achieved by gently holding the patient's left elbow with your right hand and pulling it towards you, but also in a cephalad direction towards the head end of the couch. Be careful not to introduce any flexion to the spine during this movement. Right rotation is continued until your palpating hand at the L5–S1 segment begins to sense motion. Take up the axillary hold. This arm controls the upper body rotation.

2 Operator stance

Stand close to the couch with your feet spread and one leg behind the other. Maintain an upright posture, facing slightly in the direction of the patient's upper body. Keep your left arm as close to your body as possible.

3 Positioning for thrust

Apply your left forearm to the region between gluteus medius and maximus. Your left forearm now controls lower body rotation. Your right hand rests on the patient's right axillary area. This will control upper body rotation. Firstly apply pressure to the patient's pelvis until motion is palpated at the L5–S1 segment. Rotate the patient's upper body away from you using your right arm until a sense of tension is palpated at the L5–S1 segment. Finally, roll the patient about 10–15° towards you while maintaining the build-up of leverages at the L5–S1segment.

4 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you can sense a state of appropriate tension and leverage at the L5–S1 segment. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips.

5 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up; looking down impedes the thrust. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

6 Delivering the thrust

Your right arm against the patient's axillary region does not apply a thrust but acts as a stabilizer only (Fig. B3.6.4). Keep the thrusting (left) arm as close to your body as possible. Apply a HVLA thrust with your left forearm against the patient's buttock. The direction of thrust is variable depending on the apophysial joint plane. Commonly the direction of thrust approximates to a line along the long axis of the patient's right femur (Fig. B3.6.5).

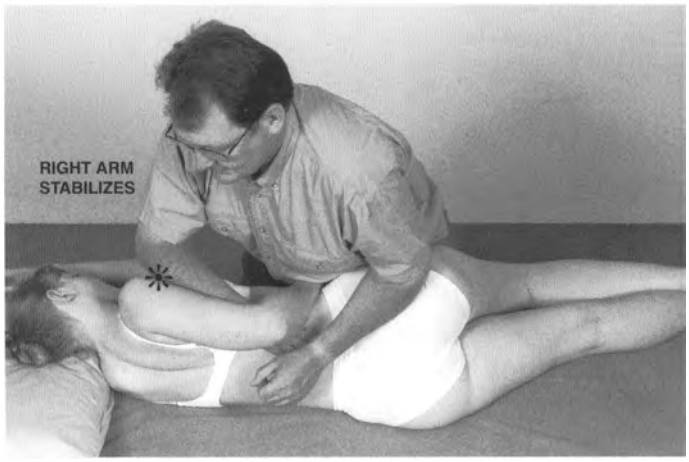

Fig. B3.6.4

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

Fig. B3.6.5

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary to achieve joint cavitation. A common fault arises from the use of excessive amplitude with insufficient velocity of thrust.

SUMMARY

Lumbosacral Joint (L5–S1)

Side-lying
Thrust direction is dependent upon apophysial joint plane

- **Patient positioning.** Left side-lying.

  Lower body. Left hip in approximately 20° of flexion with knee extended. Right hip and knee flexed (Fig. B3.6.3).

  Upper body. Introduce right rotation of the patient's upper body until your palpating hand at the L5–S1 segment begins to sense motion. Do not introduce any flexion to the spine during this movement. Take up the axillary hold.

- **Operator stance.** Stand close to the couch, feet spread and one leg behind the other. Maintain an upright posture, facing slightly in the direction of the patient's upper body.

- ***Positioning for thrust.*** *Place your left forearm in the region between* gluteus medius and maximus. Apply pressure to the patient's pelvis until motion is palpated at the L5–S1 segment. Rotate the patient's upper body away from you until a sense of tension is palpated at the L5–S1 segment. Roll the patient about 10–15° towards you.

- **Adjustments to achieve appropriate pre-thrust tension.**

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** Your right arm against the patient's axillary region does not apply a thrust but acts as a stabilizer only (Fig. B3.6.4). The direction of thrust is variable depending on the apophysial joint plane. Commonly the thrust is along the long axis of the patient's right femur (Fig. B3.6.5).

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

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PART

C

HVLA thrust techniques – pelvis

CONTENTS

1 Sacroiliac joint: left innominate posterior; patient prone
2 Sacroiliac joint: right innominate posterior; patient side-lying
3 Sacroiliac joint: left innominate anterior; patient supine
4 Sacroiliac joint: sacral base anterior; patient side-lying
5 Sacrococcygeal joint: coccyx anterior; patient side-lying
References

Introduction

The sacroiliac joint as a source of pain and dysfunction is a subject of controversy.[1–4] Many authors implicate the sacroiliac joint as a possible cause of low back pain,[5–13] but there is disagreement as to the exact prevalence of sacroiliac joint pain within the low back pain population. While many practitioners believe the sacroiliac joint is a source of pain and dysfunction and treat perceived sacroiliac lesions, there is no general agreement concerning the different diagnostic tests and their validity in determining somatic dysfunction of the pelvis.[13–19]

Various models of sacroiliac motion have been proposed and there have been a number of studies relating to mobility in the sacroiliac joint,[20–22] but the precise nature of normal motion remains unclear.[1,4,23] There is significant variation in sacroiliac joint movement between individuals and within individuals when mobility of one sacroiliac joint is compared with the other side. Mobility alters with age and can increase during pregnancy.

A number of manual medicine texts[24–31] refer to the use of high-velocity low-amplitude (HVLA) thrust techniques to the joints of the pelvis, but there is little evidence that cavitation is uniformly associated with these procedures. When an audible release does occur, its site of origin remains open to speculation. Studies undertaken to measure the effects of manipulation upon the sacroiliac joints provide contradictory findings. Alteration in pelvic tilt was identified post-manipulation

in one study of patients with low back pain,[32] while roentgen stereophotogrammetric analysis was unable to detect altered position of the sacroiliac joint post-manipulation despite normalization of different types of clinical tests.[33]

Many practitioners believe that HVLA techniques applied to the sacroiliac joint can be associated with good clinical outcomes. As a result, many clinicians continue to use HVLA techniques to treat somatic dysfunction of the joints of the pelvis.

Somatic dysfunction is identified by the A-R-T-T of diagnosis:

- A – relates to asymmetry
- R – relates to range of motion
- T – relates to tissue texture changes
- T – relates to tissue tenderness.

Part C describes in detail five high-velocity low-amplitude techniques for the pelvis. All techniques are described using a variable height manipulation couch.

After making a diagnosis of somatic dysfunction and prior to proceeding with a thrust, it is recommended the following checklist be used for each of the techniques described in this section:

- Have I excluded all contraindications?
- Have I explained to the patient what I am going to do?
- Do I have informed consent?
- Is the patient well positioned and comfortable?
- Am I in a comfortable and balanced position?
- Do I need to modify any pre-thrust physical or biomechanical factors?
- Have I achieved appropriate pre-thrust tissue tension?
- Am I relaxed and confident to proceed?
- Is the patient relaxed and willing for me to proceed?

1

Sacroiliac joint

Left innominate posterior Patient prone

Assume somatic dysfunction (A-R-T-T) is identified and you wish to thrust the left innominate anteriorly

1 Contact points

(a) Left posterior superior iliac spine (PSIS)
(b) Anterior aspect of left lower thigh.

2 Applicators

(a) Hypothenar eminence of right hand
(b) Palmar aspect of left hand.

3 Patient positioning

Patient lying prone in a comfortable position.

4 Operator stance

Stand at the right side of the patient, feet spread slightly and facing the patient. Stand as erect as possible and avoid crouching as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact points

Place the hypothenar eminence of your right hand against the inferior aspect of the left PSIS. Ensure that you have good contact and will not slip across the skin or superficial musculature. Place the palmar aspect of your left hand gently under the anterior aspect of the left thigh just proximal to the knee.

6 Positioning for thrust

Lift the patient's left leg into extension and slight adduction (Fig. C.1.1). Avoid introducing extension into the lumbar spine. Apply a force directed downwards towards the couch and slightly cephalad to fix your right hand against the inferior aspect of the PSIS.

Move your centre of gravity over the patient by leaning your body weight forwards onto your right arm and hypothenar eminence. Shifting your centre of gravity forwards assists firm contact point pressure on the PSIS.

Fig. C.1.1

7 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in hip extension, adduction and rotation. Simultaneously, adjust the direction of pressure applied to the PSIS until applicator forces are balanced and you sense a state of appropriate tension and leverage at the left sacroiliac joint. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips.

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

9 Delivering the thrust

Apply a HVLA thrust with your right hand directed against the PSIS in a curved plane towards the couch. Simultaneously, apply slight exaggeration of hip extension with your left hand (Fig. C.1.2). It is important that you do not overemphasize hip extension at the time of thrust. The aim of this technique is to achieve anterior rotation of the left innominate and movement at the left sacroiliac joint. The direction of thrust will alter between patients as a result of the wide variation in sacroiliac anatomy and biomechanics.

Fig. C.1.2

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary.

Note: The dimensions for the arrows are not a pictorial representation of the amplitude or force of the thrust

SUMMARY

Sacroiliac joint

Left innominate posterior Patient prone
Thrust anteriorly

- **Contact points:**
  — Left posterior superior iliac spine (PSIS)
  — Anterior aspect of left lower thigh.
- **Applicators:**
  — Hypothenar eminence of right hand
  — Palmar aspect of left hand.
- **Patient positioning.** Prone in a comfortable position.
- **Operator stance.** To right side of patient, facing the couch.
- **Palpation of contact points.** Place the hypothenar eminence of your right hand against the inferior aspect of the left PSIS. Place the palmar aspect of your left hand under the anterior aspect of the left thigh proximal to the knee.
- **Positioning for thrust.** Lift left leg into extension and slight adduction (Fig. C.1.1). Avoid introducing extension into the lumbar spine. Apply a force directed downwards towards the couch and slightly cephalad to fix your right hand against the inferior aspect of the PSIS.
- **Adjustments to achieve appropriate pre-thrust tension.** Make any necessary changes in hip extension, adduction and rotation. Simultaneously, adjust the direction of pressure applied to the PSIS.
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The thrust against the PSIS is in a curved plane towards the couch and accompanied by slight exaggeration of hip extension (Fig. C.1.2).

2

Sacroiliac joint

Right innominate posterior
Patient side-lying

Assume somatic dysfunction (A-R-T-T) is identified and you wish to thrust the right innominate anteriorly

1 Patient positioning

Lying on the left side with a pillow to support the head and neck. The upper portion of the couch is raised 30–35° to introduce right sidebending in the lower thoracic and upper lumbar spine.

Lower body. Straighten the patient's lower leg and ensure that the leg and spine are in a straight line, in a neutral position. Flex the patient's upper hip to approximately 90°. Flex the patient's upper knee and place the heel of the foot just anterior to the knee of the lower leg. The lower leg and spine should form as near a straight line as possible with no flexion at the lower hip or knee.

Upper body. Gently extend the patient's upper shoulder and place the patient's right forearm on the lower ribs. Using your left hand to palpate the L5–S1 interspinous space, introduce right rotation of the patient's trunk, down to and including the L5–S1 segment. This is achieved by gently holding the patient's left elbow with your right hand and pulling it towards you, but also in a cephalad direction towards the head end of the couch. Be careful not to introduce any flexion to the spine during this movement. Now modify the pectoral hold by positioning the patient's upper arm behind the thorax.

2 Operator stance

Stand close to the couch with your feet spread and one leg behind the other. Ensure that the patient's upper knee is placed between your legs. This will enable you to make the necessary adjustments to achieve the appropriate pre-thrust tension (Fig. C.2.1). Maintain an upright posture, facing in the direction of the patient's upper body.

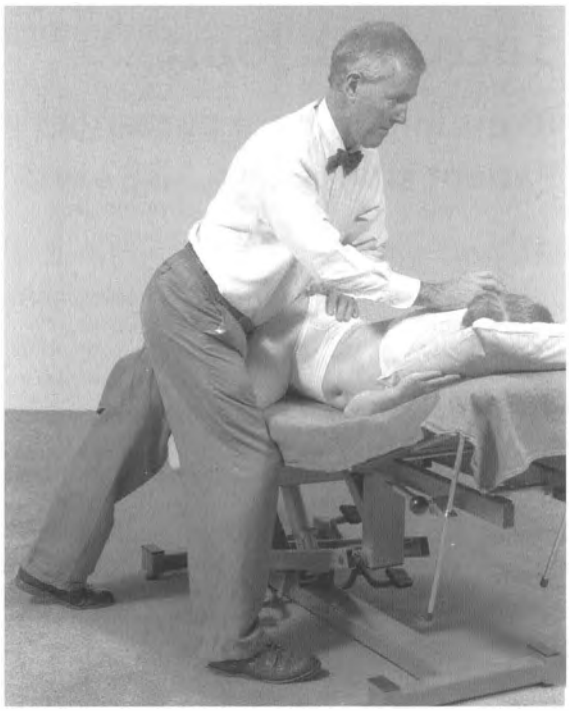

Fig. C.2.1

3 Positioning for thrust

Apply the heel of your left hand to the inferior aspect of the posterior superior iliac spine (PSIS). Your right hand should be resting against the patient's upper pectoral and rib cage region. Gently rotate the patient's trunk away from you using your right hand until you achieve spinal locking. Avoid applying direct pressure to the glenohumeral joint. Finally, roll the patient about 10–15° towards you while maintaining the build-up of leverages.

4 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in hip flexion and adduction. Simultaneously, adjust the direction of pressure applied to the PSIS until the forces are balanced and you sense a state of appropriate tension and leverage at the right sacroiliac joint. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips.

5 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure your contacts are firm. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

6 *Delivering the thrust*

Apply a HVLA thrust with the heel of your left hand directed against the PSIS in a curved plane towards you (Fig. C.2.2). Your right arm against the patient's pectoral region does not apply a thrust but acts as a stabilizer only. The aim of this technique is to achieve anterior rotation of the right innominate and movement at the right sacroiliac joint. The direction of thrust will alter between patients as a result of the wide variation in sacroiliac anatomy and biomechanics.

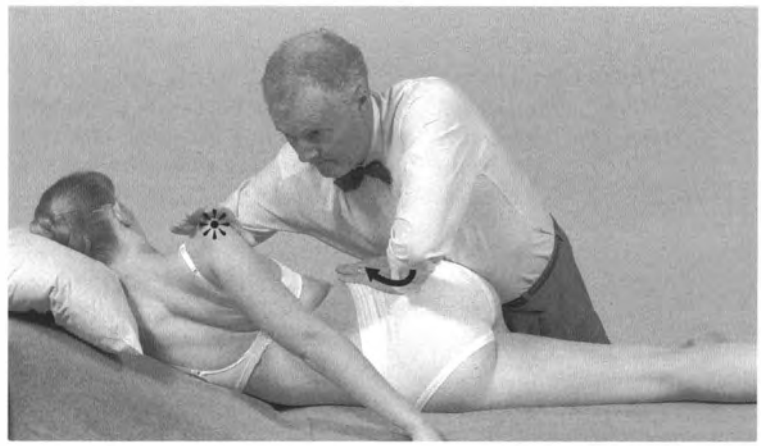

Fig. C.2.2

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary.

SUMMARY

Sacroiliac joint

Right innominate posterior Patient side-lying Thrust anteriorly

- **Patient positioning.** Left side-lying with the upper portion of the couch raised 30–35° to introduce right sidebending in the lower thoracic and upper lumbar spine.

  Lower body. Left leg and spine in a straight line. Right hip flexed to approximately 90°. Right knee flexed and heel of right foot placed just anterior to knee of lower leg.

  Upper body. Introduce right rotation of the patient's upper body down to and including L5–S1. Do not introduce any flexion to the spine during this movement. Modify the pectoral hold by positioning the patient's upper arm behind the thorax.

- **Operator stance.** Stand close to the couch, feet spread and one leg behind the other. Ensure that the patient's upper knee is placed between your legs (Fig. C.2.1). Maintain an upright posture facing in the direction of the patient's upper body.

- **Positioning for thrust.** Apply the heel of your left hand to the inferior aspect of the PSIS. Rotate the patient's upper body away from you until spinal locking is achieved. Roll the patient about 10–15° towards you.

- **Adjustments to achieve appropriate pre-thrust tension.** Make any necessary changes in hip flexion and adduction. Simultaneously, adjust direction of pressure applied to the PSIS.

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** The thrust against the PSIS is in a curved plane towards you (Fig. C.2.2). Your right arm against the patient's pectoral region does not apply a thrust but acts as a stabilizer only.

3

Sacroiliac joint

Left innominate anterior Patient supine

Assume somatic dysfunction (A-R-T-T) is identified and you wish to thrust the left innominate posteriorly

1 Contact points

(a) Left anterior superior iliac spine (ASIS)
(b) Posterior aspect of left shoulder girdle.

2 Applicators

(a) Palm of right hand
(b) Palmar aspect of left hand and wrist.

3 Patient positioning

Patient lying supine in a comfortable position. Move the patient's pelvis towards their right. Move the feet and shoulders in the opposite direction to introduce left sidebending of the trunk. Place the patient's left foot and ankle on top of the right ankle. Ask the patient to clasp their fingers behind the neck (Fig. C.3.1).

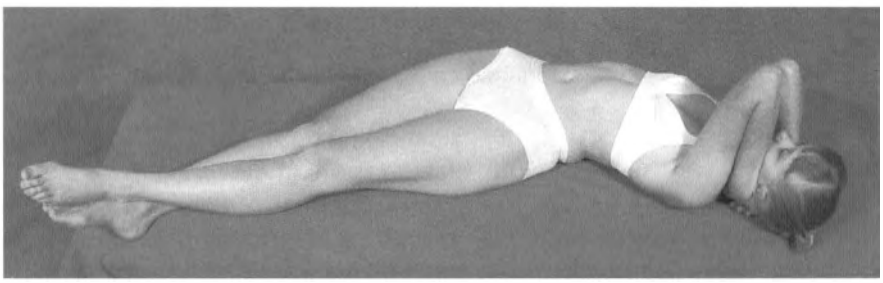

Fig. C.3.1

4 Operator stance

Stand at the right side of the patient, feet spread slightly and facing the couch. Stand as erect as possible and avoid crouching as this will limit the technique and restrict delivery of the thrust.

5 Palpation of contact points

Place the palm of your right hand over the ASIS. Ensure that you have good contact and will not slip across the skin or superficial musculature. Place the palmar aspect of your left hand and wrist gently over the posterior aspect of the left shoulder girdle.

6 Positioning for thrust

Rotate the patient's trunk to the right and towards you. It is critical to maintain the left trunk sidebending introduced during initial positioning. Apply a force directed downwards towards the couch and slightly cephalad to fix your right hand against the inferior aspect of the ASIS (Fig. C.3.2).

Fig. C.3.2

Move your centre of gravity over the patient by leaning your body weight forwards onto your right arm and hand. Shifting your centre of gravity forwards assists firm contact point pressure on the ASIS.

7 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in trunk rotation, flexion and sidebending. Simultaneously, adjust the direction of pressure applied to the ASIS until applicator forces are balanced and you sense a state of appropriate tension and leverage. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of the shoulders, trunk, ankles, knees and hips.

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure that your contacts are firm. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

9 Delivering the thrust

Apply a HVLA thrust with your right hand directed against the ASIS in a curved plane towards the couch (Fig. C.3.3). Your left forearm, wrist and hand over the patient's shoulder girdle do not apply a thrust but act as stabilizers only. The aim of this technique is to achieve posterior rotation of the left innominate and movement at the left sacroiliac joint. The direction of thrust will alter between patients as a result of the wide variation in sacroiliac anatomy and biomechanics.

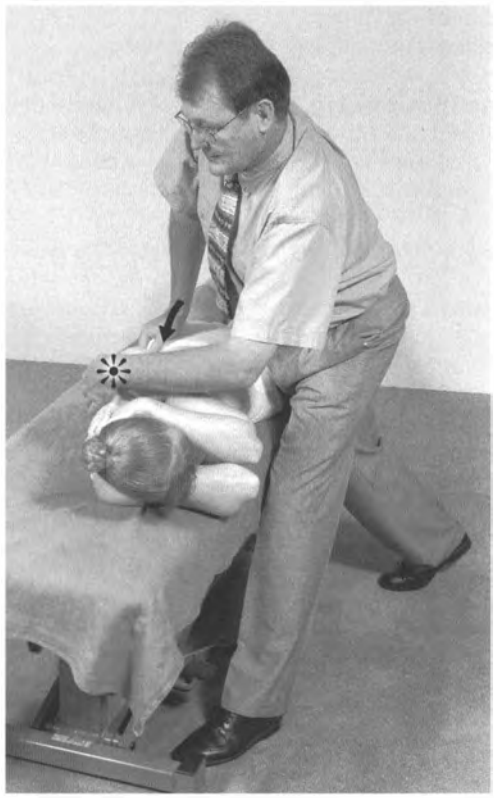

Fig. C.3.3

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary.

SUMMARY

Sacroiliac joint

Left innominate anterior Patient supine
Thrust posteriorly

- **Contact points:**
  — Left anterior superior iliac spine (ASIS)
  — Posterior aspect of left shoulder girdle.

- **Applicators:**
  — Palm of right hand
  — Palmar aspect of left hand and wrist.

- **Patient positioning.** Supine. Move patient's pelvis towards the right. Move feet and shoulders in the opposite direction to introduce left sidebending of the trunk. Place the patient's left foot and ankle on top of the right ankle. Ask the patient to clasp fingers behind the neck (Fig. C.3.1).

- **Operator stance.** To the right side of the patient, facing the couch.

- **Palpation of contact points.** Place the palm of your right hand over the ASIS. Place the palmar aspect of your left hand and wrist over the posterior aspect of the left shoulder girdle.

- **Positioning for thrust.** Rotate the patient's trunk to the right. Maintain left trunk sidebending. Apply a force directed downwards towards the couch and slightly cephalad to fix your right hand against the inferior aspect of the ASIS (Fig. C.3.2).

- **Adjustments to achieve appropriate pre-thrust tension.** Make any necessary changes in trunk rotation, flexion and sidebending. Simultaneously, adjust direction of pressure applied to the ASIS.

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** The thrust against the ASIS is in a curved plane towards the couch (Fig. C.3.3). Your left forearm, wrist and hand over the patient's shoulder girdle do not apply a thrust but act as stabilizers only.

4 Sacroiliac joint

Sacral base anterior Patient side-lying

Assume somatic dysfunction (A-R-T-T) is identified and you wish to thrust the apex of the sacrum anteriorly

1 Patient positioning

Lying on the right side with a pillow to support the head and neck.

Lower body. Straighten the patient's lower leg and ensure that the leg and spine are in a straight line, in a neutral position. Flex the patient's upper hip and knee slightly and place the upper leg just anterior to the lower leg. The lower leg and spine should form as near a straight line as possible with no flexion at the lower hip or knee.

Upper body. Gently extend the patient's upper shoulder and place the patient's left forearm on the lower ribs. Using your right hand to palpate the L5–S1 interspinous space, introduce left rotation of the patient's trunk down to and including the L5–S1 segment. This is achieved by gently holding the patient's right elbow with your left hand and pulling it towards you, but also in a cephalad direction towards the head end of the couch. Be careful not to introduce any flexion to the spine during this movement. Take up the axillary hold. This arm controls and maintains trunk rotation.

2 Operator stance

Stand close to the couch with your feet spread and one leg behind the other. Maintain an upright posture, facing slightly in the direction of the patient's upper body.

3 Positioning for thrust

Apply the palmar aspect of your right forearm to the apex of the sacrum. Ensure that contact is below the second sacral segment. Your left forearm should be resting against the patient's upper pectoral and rib cage region and will control and maintain trunk rotation. Gently rotate the patient's trunk away from you using your left forearm until you achieve spinal locking. Be careful to avoid undue pressure in the axilla. Finally, roll the patient about 10–15° towards you while maintaining the build-up of leverages.

4 Adjustments to achieve appropriate pre-thrust tension

Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending or rotation until you are confident that full spinal locking is achieved. The patient should not be aware of any pain or discomfort. Make these final adjustments by slight movements of your shoulders, trunk, ankles, knees and hips.

5 Immediately pre-thrust

Relax and adjust your balance as necessary. Keep your head up and ensure contacts are firm. An effective HVLA technique is best achieved if both the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

6 Delivering the thrust

Apply a HVLA thrust with your right forearm against the apex of the sacrum in a curved plane towards you (Fig. C.4.1). Your left arm against the patient's pectoral region does not apply a thrust but acts as a stabilizer only. The aim of this technique is to achieve a counter-nutation movement of the sacrum.

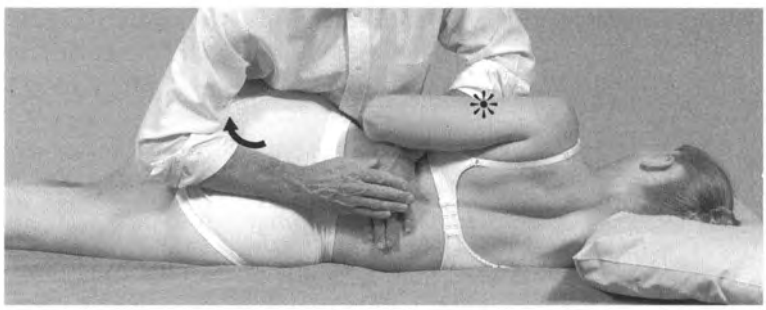

Fig. C.4.1

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary.

SUMMARY

Sacroiliac joint

Sacral base anterior Patient side-lying
Thrust apex anteriorly

- **Patient posi**

  Lower body. Right leg and spine in a straight line. Left hip and knee flexed slightly and placed just anterior to the lower leg.

  Upper body. Introduce left rotation of the patient's trunk down to and including the L5–S1 segment. Do not introduce any flexion to the spine during this movement. Take up the axillary hold.

- **Operator stance.** Stand close to the couch, feet spread and one leg behind the other. Maintain an upright posture, facing slightly in the direction of the patient's upper body.

- **Positioning for thrust.** Apply the palmar aspect of your right forearm to the apex of the sacrum. Ensure that contact is below the second sacral segment. Your left forearm should be resting against the patient's upper pectoral and rib cage region. Rotate the patient's trunk away from you using your left forearm until you achieve spinal locking. Roll the patient about 10–15° towards you.

- **Adjustments to achieve appropriate pre-thrust tension.**

- **Immediately pre-thrust.** Relax and adjust your balance.

- **Delivering the thrust.** The thrust against the apex of the sacrum is in a curved plane towards you (Fig. C.4.1). Your left arm against the patient's pectoral region does not apply a thrust but acts as a stabilizer only.

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5 Sacrococcygeal joint

Coccyx anterior Patient side-lying

Assume somatic dysfunction (A-R-T-T) is identified and you wish to thrust the coccyx posteriorly

The operator must exercise care and attention to ensure that the patient is fully informed as to the nature of this procedure. This technique involves both assessment and treatment via a rectal approach. It is assumed that the operator will examine the anal and rectal region to determine if there are any contraindications to performing this procedure. This technique can be used either as a means of gently articulating the sacrococcygeal joint or applying a HVLA thrust to the coccyx. Coccydynia can be severe and the choice of technique depends as much upon patient comfort as perceived efficacy of approach. Practitioners should become familiar with articulating the sacrococcygeal joint before attempting a thrust to the coccyx.

1 Contact points

(a) Anterior aspect of the coccyx through the posterior wall of the rectum
(b) Posterior aspect of the coccyx.

2 Applicators

(a) Lubricated index finger of operator's gloved right hand
(b) Thumb of operator's gloved right hand.

3 Patient positioning

Lying in the left lateral position with the maximal amount of flexion of the hips, knees and spine consistent with patient comfort. The patient should be fully undressed so that access to the anal canal is possible. The buttocks should be at the edge of the couch.

4 Operator stance

Stand behind the patient, approximately at the level of the patient's hip joints, facing the couch and patient's back.

5 Palpation of contact points

The operator should be wearing a pair of suitable gloves with lubricant smeared over the right index finger. The patient must be informed that a finger within the rectum will cause a sensation similar to that of opening the bowels. Ask the patient to relax and place the index finger of your right hand against the anal margin (Fig. C.5.1A). With steady pressure, insert your right index finger into the patient's anal canal in a cephalic and slightly anterior direction (Fig. C.5.1B). The finger will pass through the anal sphincter and into the rectum. If the patient has difficulty relaxing, ask him/her to bear down as if opening the bowels and gently slip your finger past the anal sphincter and into the rectum. Once through the anal sphincter, the direction of the rectum is cephalic and posteriorly along the curve of the coccyx and sacrum. At this stage an examination of the rectum should be undertaken. For male patients this would include examination of the prostate gland.

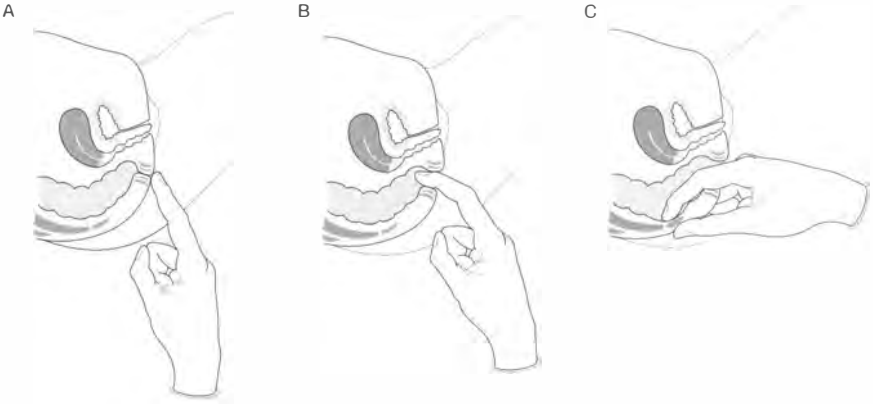

Fig. C.5.1 Sacrococcygeal joint. **A:** The index finger is placed against the anal margin. **B:** The finger is inserted as shown. **C:** After examination of the rectum, the coccyx is held between the index finger internally and the thumb externally.

The palpating right index finger identifies the sacrum and coccyx through the posterior wall of the rectum. Place the distal phalanx of the right index finger against the anterior surface of the coccyx immediately below the sacrococcygeal joint. Use the thumb of your right hand externally to identify the posterior aspect of the coccyx between the buttocks. The coccyx is now gently held between your index finger internally and thumb externally (Fig. C.5.1C). Gentle pressure is applied in a number of directions to determine undue tenderness or any reproduction of the patient's familiar symptoms. The mobility and position of the coccyx relative to the sacrum is also noted.

6 Fixation of contact points

Keep your right index finger on the anterior aspect of the coccyx while applying pressure against the posterior aspect of the coccyx with your right thumb. The fixation is gentle but firm with less pressure against the anterior surface of the coccyx.

7 Adjustments to achieve appropriate pre-thrust tension

The operator should be in a position to move the coccyx through a range of motion and in different planes. Ensure your patient remains relaxed. Maintaining all holds, make any necessary changes in flexion, extension, sidebending and rotation of the coccyx until you sense a state of appropriate tension and leverage at the sacrococcygeal joint.

8 Immediately pre-thrust

Relax and adjust your balance as necessary. Ensure that your contacts are firm. An effective HVLA technique is best achieved if the operator and patient are relaxed and not holding themselves rigid. This is a common impediment to achieving effective cavitation.

9 Delivering the thrust

Apply a HVLA thrust towards you in a curved plane (Fig. C.5.2).

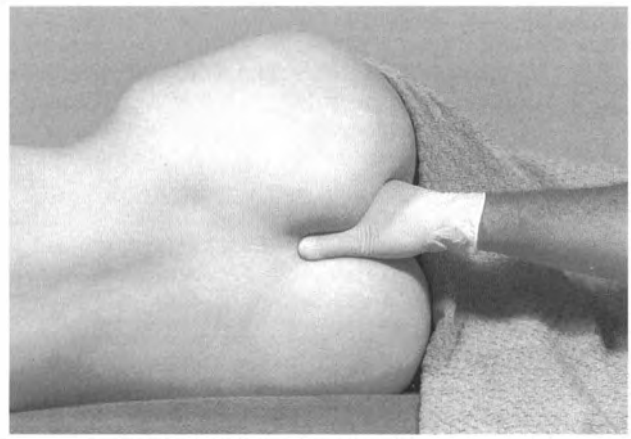

Fig. C.5.2

The thrust, although very rapid, must never be excessively forcible. The aim should be to use the absolute minimum of force necessary.

SUMMARY

Sacrococcygeal joint

Coccyx anterior Patient side-lying
Thrust posteriorly

- **Contact points:**
  — Anterior aspect of the coccyx
  — Posterior aspect of the coccyx.
- **Applicators:**
  — Lubricated index finger of operator's gloved right hand
  — Thumb of operator's gloved right hand.
- **Patient positioning.** Left lateral position with flexion of the hips, knees and spine.
- **Operator stance.** Behind the patient.
- **Palpation of contact points.** Place the index finger of right hand against the anal margin (Fig. C.5.1A). Insert your right index finger into the anal canal in a cephalic and anterior direction (Fig C.5.1B). The palpating index finger identifies the sacrum and coccyx through the posterior wall of the rectum. Place the distal phalanx of the right index finger against the anterior surface of the coccyx. Identify the posterior aspect of the coccyx between the buttocks. The coccyx is now gently held between your right index finger internally and thumb externally (Fig C.5.1C).
- **Fixation of contact points.** Keep right index finger on the anterior aspect of the coccyx while applying pressure against the posterior aspect of the coccyx with your right thumb.
- **Adjustments to achieve appropriate pre-thrust tension.**
- **Immediately pre-thrust.** Relax and adjust your balance.
- **Delivering the thrust.** The direction of thrust is towards you in a curved plane (Fig C.5.2).

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PART

D

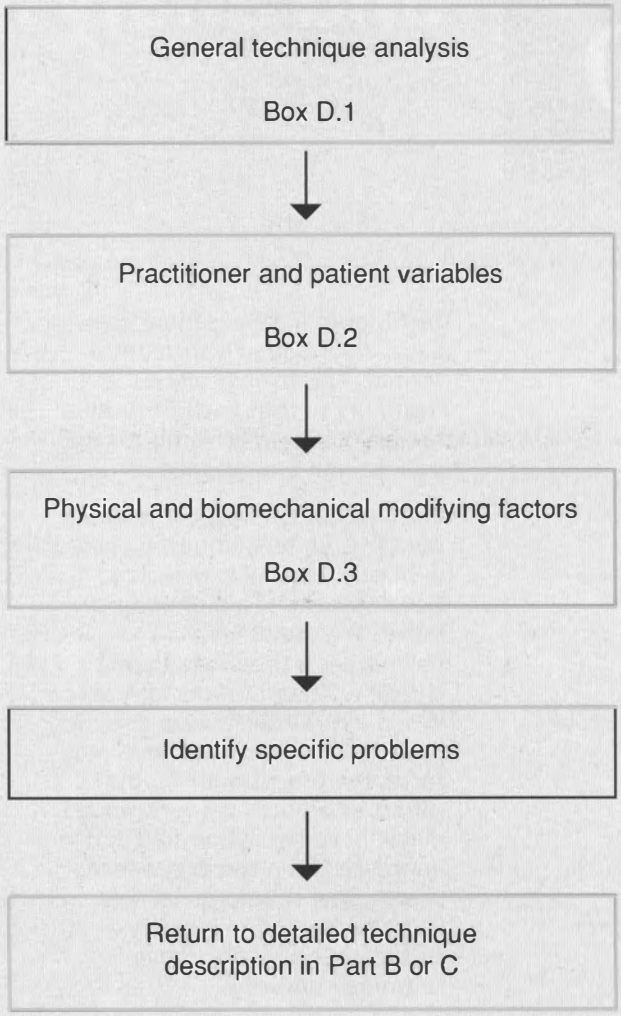
Technique failure and analysis

Techniques in this manual have been described in a structured format. This format allows flexibility so that each technique can be modified to suit both the patient and practitioner.

Competence and expertise in the use of HVLA techniques increase with practice and experience. Development of a high level of skill in the use of HVLA techniques is predicated upon critical reflection of performance. When a HVLA technique does not produce cavitation with minimal force, the practitioner should reflect upon how the technique might have been modified and improved. Even the experienced practitioner should review each HVLA technique to identify factors that might improve technique delivery.

Inability to achieve cavitation with minimal force may arise for a number of reasons and can be reviewed under three broad headings:

- *General technique analysis*
  - — Incorrect selection of technique
  - — Inadequate localization of forces
  - — Ineffective thrust
- *Practitioner and patient variables*
  - — Patient comfort and cooperation
  - — Patient positioning
  - — Practitioner comfort and confidence
  - — Practitioner posture
- *Physical and biomechanical modifying factors*
  - — Primary leverage
  - — Secondary leverages
  - — Contact point pressure
  - — Identification of appropriate pre-thrust tension
  - — Direction of thrust
  - — Velocity of thrust
  - — Amplitude of thrust
  - — Force of thrust
  - — Arrest of technique.


General technique analysis
Box D.1
Practitioner and patient variables
Box D.2
Physical and biomechanical modifying factors
Box D.3
Identify specific problems
Return to detailed technique description in Part B or C

Box D.1 General technique analysis

Incorrect sel

- Practitioner too small and patient too large
- Practitioner has physical limitations that limit effective delivery of technique
- Practitioner inexperienced with selected technique
- Inability to position patient due to pain, discomfort or physical limitations
- Patient apprehension

Inadequate localization of forces

- Incorrect application of primary leverage
- Incorrect application of secondary leverages
- Inability to recognize appropriate pre-thrust tension

Ineffective thrust

- Loss of contact point pressure
- Poor bimanual coordination
- Incorrect direction of thrust
- Inadequate velocity of thrust
- Incorrect amplitude of thrust
- Incorrect force of thrust
- Loss of leverage at time of thrust
- Poor practitioner posture
- Practitioner not relaxed
- Failure to arrest thrust and leverage adequately
- Lack of practitioner confidence

Box D.2 Practitioner and patient variables

Common faults

- Patient not comfortably positioned
- Patient not relaxed
- Rough patient handling
- Rushing technique
- Poor practitioner posture
- Lack of practitioner confidence

Checklist

Patient comfort and cooperation
Dependent upon:

- Confidence and trust in practitioner
- Patient experience of previous successful HVLA technique
- Slow, firm and gentle patient handling
- Confident and reassuring approach by practitioner
- Explanation of technique and informed consent
- Optimal patient positioning

Patient positioning
Dependent upon:

- Appropriate positioning to match patient's physical and medical condition
- Correct identification of primary leverage and secondary leverages
- Pain-free positioning
- Appropriate use of pillows and treatment couch adjustment

Practitioner comfort and confidence
Dependent upon:

- Establishing a working diagnosis
- Selecting a technique to match patient's physical and medical condition
- Confidence that the technique will improve and not worsen the patient's symptoms
- Previous experience and success with the selected HVLA technique
- Optimal practitioner posture

Practitioner posture
Dependent upon:

- Using as wide a base as possible
- Not relying solely upon arm strength and speed
- Using your body where possible to generate thrust force
- Not stooping or bending over the patient
- Keeping your own spine erect
- Optimal treatment couch height

Box D.3 Physical and biomechanical modifying factors

Common faults

- Insufficient primary leverage
- Too much secondary leverage — locking often results from the over-application of secondary leverages. This can occur during the build-up of leverages or at the point of thrust
- Loss of contact point pressure immediately pre-thrust
- Not identifying appropriate pre-thrust tension and leverage prior to thrust — if in doubt about optimum pre-thrust tension, attempt multiple light thrusts
- Incorrect direction of thrust — the thrust should be in a direction that is comfortable for the patient. Multiple light thrusts can assist in the identification of the appropriate direction of thrust
- Insufficient velocity of thrust
- Too much amplitude — this is often a consequence of too much force and/or poor control
- Too much force
- Insufficient arrest of technique — this is often a consequence of poor practitioner coordination and control

Checklist

- Primary leverage
- Secondary leverages
- Contact point pressure
- Identification of appropriate pre-thrust tension
- Direction of thrust
- Velocity of thrust
- Amplitude of thrust
- Force of thrust
- Arrest of technique

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