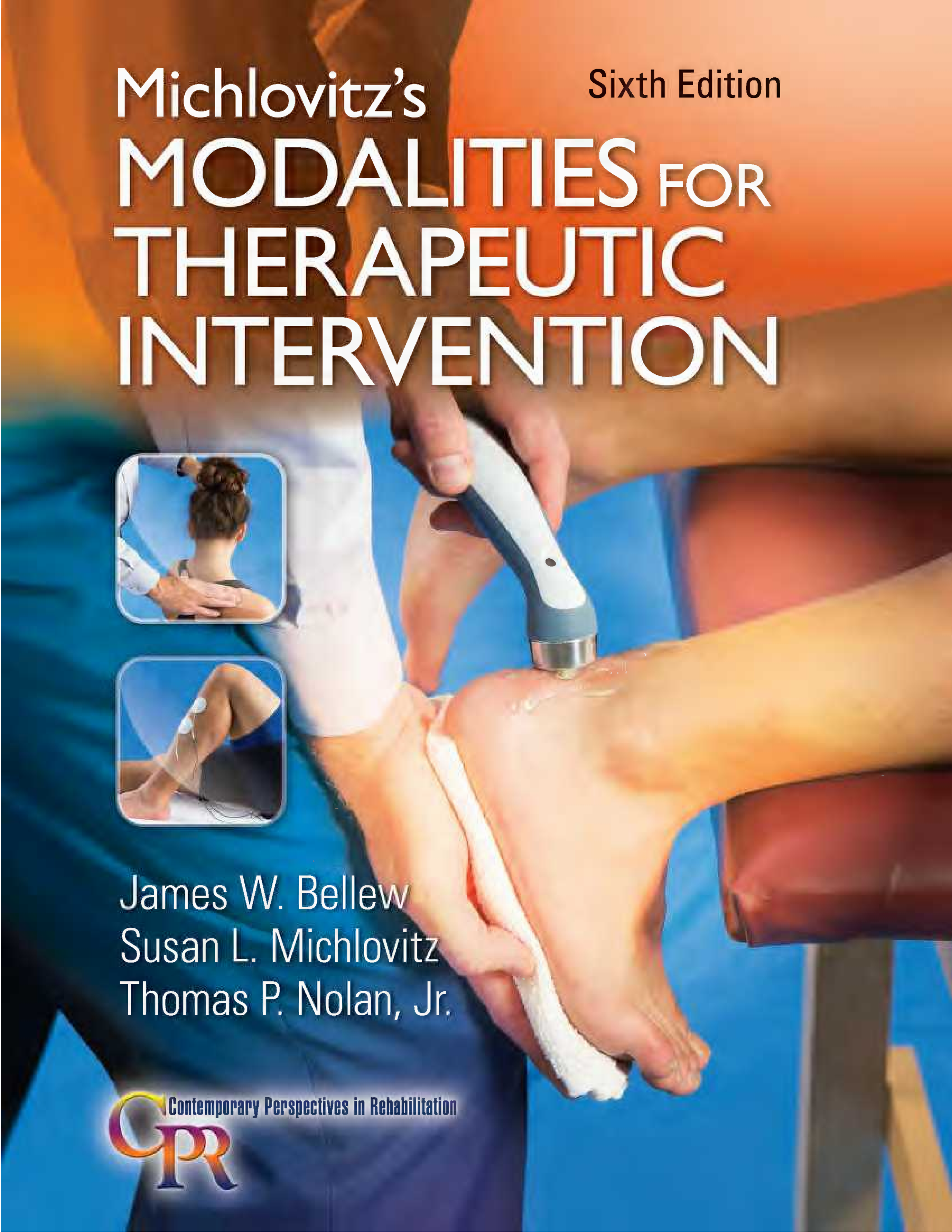
Michlovitz's MODALITIES FOR THERAPEUTIC INTERVENTION

Sixth Edition



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Contemporary Perspectives in Rehabilitation

CHAPTER 7

SPINAL TRACTION

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FOUNDATIONS OF TRACTION

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PATIENT OUTCOME EVIDENCE

FOUNDATIONS OF TRACTION

The practice of using traction—applying tensile forces to the long axis of the spine—to treat patients with spinal-mediated pain has been advocated for centuries. Modern support for traction stemmed largely from the British physician James Cyriax, who in the 1940s recommended using traction to treat patients with suspected disc lesions.[1] Practitioners from Cyriax's time to those who use more recent treatment approaches, including those developed by Australian physiotherapist Geoffrey Maitland, also proposed traction to be of value in treating patients with spinal disorders.[2,3] The rationale for this intervention in patient care may have evolved, but the fundamental concept of its usage has remained remarkably consistent over the years.

In the current evidence-guided era, the use of traction has been more closely examined for effectiveness in patient care. Many practitioners continue to cite traction as an essential clinical modality, often based on patterns observed in patient care experiences, although objective evidence of its value remains limited. In this chapter, the physiological and biomechanical effects of spinal traction will be described along with the clinical trials employing this modality. Additionally, the conventional traction methods often used by clinicians along with variations on traditional uses will be covered from a practical perspective.

BIOMECHANICAL AND PHYSIOLOGICAL EFFECTS OF TRACTION

Cervical Spine

Among the purported effects of traction is increasing the space between the vertebrae. The theorized value of intervertebral separation is for normalizing morphology—more specifically the disc's position and increasing the dimensions of the intervertebral foramen containing the spinal nerve root. Imaging studies in vivo and with cadaveric specimens have investigated the theoretical effects of traction on the cervical spine motion segment.

One study using fresh cadaveric human specimens[4] and another using live subjects[5] yielded nearly identical results. The dimensions of the intervertebral foramina were measured with computed tomography (CT) and radiography, respectively. In both studies, traction with the cervical spine in a neutral position significantly increased foraminal size. Combined cervical flexion and traction did not increase foraminal size greater than either flexion or traction alone. Other studies have documented a decrease in pressure within the intervertebral foramen[6] and an increase in the dimensions[7] of the intervertebral foramen with flexion of the cervical spine; these findings likely serve as the basis for including flexion when applying cervical traction.

In live humans, cervical intervertebral disc spaces were observed to increase with traction of almost 30 pounds while positioned in neutral and in flexion. Similar changes in the intervertebral disc spaces were not observed when traction was administered in extension of the cervical spine. Separation of the zygapophyseal joints was achieved only with traction in extension. In this study, however, the investigators reported that traction in this position was intolerable for many subjects, thereby limiting its clinical utility.[7]

The effect of traction on the disc has been of primary interest in other investigations. For example, CT was used to assess cervical disc herniations in 13 subjects before and immediately after 20 minutes of traction.[8] After traction, the mean area of the disc herniation was reduced and disc space was increased. Further, the spinal canal area and vertical dimension of the cervical spinal column were increased. Notably, the duration of these effects was not measured.

Multiple studies have examined the effect of traction on the musculature surrounding the cervical spine, with remarkably varied results. Interestingly, elevated,[9,10] diminished,[11,12] and no detectable changes[13] in muscle activity have all been observed as a result of cervical traction.

The effect of cervical traction on autonomic function has also been studied in two recent investigations. Significant changes were observed at higher magnitudes of traction (30% of body weight) but not at lower levels typically used in routine clinical practice. The changes in autonomic function noted in the subjects may have been associated with discomfort occurring from inordinately high tension levels of the experimental traction.[14,15]

In two studies employing animal models and, thus, not specific to a region of the human spine, histological changes subsequent to the application of traction were evaluated. Using a porcine model, traction was observed to encourage fluid exchange and nutrient transport through the anulus fibrosus. The investigators suggested that molecular convection and cell viability of the degraded discs increase with traction treatment.[16] In a rodent model, traction reportedly provided significant beneficial effect in maintaining disc height of degenerated discs, potentially retarding the process of degeneration.[17]

Lumbar Spine

The effects of traction on anatomic spatial relationships of the lumbar spine and the level of trunk muscle activity have also been evaluated by several investigators. In one study,[18] trunk muscle activity in 29 asymptomatic subjects increased initially with the application of traction but quickly subsided to prior levels. Whether traction was continuous or intermittent yielded no difference in the observations of muscle activity. In assessing for other potential responses, another investigation observed an increase in blood flow in the musculature commensurate with lessening pain associated with the use of traction.[19]

More than 60 years ago, Cyriax proposed that negative pressure created by traction draws in a protruding disc, reducing the extension of disc tissue beyond the vertebral body margin.[1] Intradiscal pressures have been observed to increase during active lumbar traction (distractive force by the subject's effort).[20] This is consistent with observations that intradiscal pressure increases with trunk muscle activation even with concurrent distractive force applied to the lumbar spine.[21]

Of relevance to possibly decreasing nerve root compression in radicular disorders arising from disc herniations, a reduction of disc material beyond the borders of the vertebral bodies was noted in 21 of 30 subjects as assessed by CT. The reduction effect was greatest in patients with median herniations and lowest among those with lateral herniations.[22] These measurements were completed before and during the application of lumbar traction. The investigators did not attempt to measure the persistence of these changes after traction.

In another trial,[23] the disc dimensions of 24 subjects with confirmed lumbar disc herniations who received traction for treatment were compared by CT with a control group of 22 subjects who had disc herniations but did not receive traction. Otherwise, both groups received the same treatment with physical therapy modalities and medications over a course of 15 sessions. Those subjects who received traction demonstrated a substantially greater reduction of the total area of herniated disc material as measured by CT.

In another study using young asymptomatic adults, the effects of lumbar traction on stature and postural alignment were assessed. At 50% of body weight, changes were noted immediately after the conclusion of traction, but the observed effect was short-term and absent within a few minutes.[24]

Although initially noteworthy, the lasting effect of the changed anatomical relationships caused by traction remains in question. Prior to use of these sophisticated imaging analyses, a cadaveric study of traction[25] determined the elongation induced during traction did not continue beyond 30 minutes after traction removal. Similarly, another study[26] demonstrated that a return to pretraction relationships occurred only 10 minutes after the release of traction.

Pain occurring distal to the knee with straight leg raising was measured before and after traction in a group of subjects with positive straight leg raising below 45° of hip flexion.[27] An increase in the angle of hip flexion prior to lower-extremity pain provocation during straight leg raising was observed immediately after lumbar traction at magnitudes of 30% and 60% of body weight. The straight leg raise angle in these subjects was compared to subjects receiving no traction and to subjects receiving traction at 10% of body weight. Duration of these changes was not measured (Box 7-1).

Box 7 ▪ 1 Biomechanical and Physiological Effects of Traction: Synopsis of Literature

Cervical Spine

- Fluid exchange and nutrient transport within the disc may be enhanced. The duration of any such effect is unknown.
- There is evidence that intervertebral foramina dimensions increase during traction application. Whether this can be further influenced by positioning in flexion or lateral flexion has not been established.
- Limited evidence suggests that disc herniation extension tends to be reduced when measured immediately after traction.
- Evidence is conflicting as to the effects of traction on the activity of cervical spine musculature.
- The duration of any observed biomechanical or physiological effect is not known.

Lumbar Spine

- Fluid exchange and nutrient transport within the disc may be enhanced. The duration of any such effect is unknown.
- During passive traction, intradiscal pressures can be reduced or become negative. Traction from patient-generated forces may increase intradiscal pressures. These pressures are thought to rapidly return to their prior state when traction ceases.
- The expanse of herniated disc material is suggested to reduce in some subjects during traction. Most single-observation studies suggest the effect is temporary. A cumulative effect with repeated traction sessions may occur, but evidence of such is very limited.

BASIC APPLICATIONS OF CLINICAL TRACTION

Several methods of traction have been used to treat patients with mechanical neck and back pain; the method used was often based on tradition rather than evidence of specific clinical value. Individual practitioner and patient care experiences often serve as the stimulus for the development of these general practices, which are subsequently propagated by convention. The lack of substantial data to support particular utilization guidelines has allowed for numerous permutations in the elemental practice of applying tension to the spine for symptom relief. To adequately understand traction and its uses, this chapter provides details on the basic features routinely available on modern traction devices. A comprehensive description is not possible due to the many uses of this modality.

Components of the Traction Table

Traction tables allow patients to receive treatment of the cervical and lumbar spine regions in relative comfort (Fig. 7-1). The table is adjustable in height by a hand or foot control switch. At one end of the table is the mechanical traction device, consisting of an electric motor and a control panel. The traction unit usually produces the tensile force via a cable that extends from the electric motor. The cable is attachable to the traction harnesses, which directly contact the patient. With the evolution of computer technology, the control panels of traction units have become increasingly sophisticated. Many modern models have touchscreen features and the

Fig 7 ■ 1 Traction table.

capacity to adjust numerous variables in the delivery of traction (Fig. 7-2). Treatment duration, cycle times, tension levels, and progressive or regressive steps in tension can be programmed into a treatment session with these controls.

Most traction tables also have a split top. The table surface, with its multiple segments, can be separated to minimize the friction from the patient's body on the table surface when applying traction to the lumbar spine. The section of the table nearest the motor can be unlocked so it glides within tracks that are set on rollers on the table's frame (Fig. 7-3). This allows the patient's pelvis and lower extremities to be moved while the remainder of the trunk is stabilized on the nongliding sections of the table. Thus, traction can be more accurately administered to the lumbar spine by significantly reducing the friction provided by the patient's superincumbent body weight. The nongliding segments of the

Fig 7 ■ 2 Traction control panel.

Fig 7 ■ 3 Separable traction table surface.

table often have adjustable tilting features to create more options for traction or to facilitate patient comfort with positioning.

Most commercially available traction tables now routinely have a removable harness unit that allows traction to be applied to the cervical spine (Fig. 7-4). These

Fig 7 ■ 4 Occipital harness for cervical traction.

harnesses usually snap-fit or pressure-fit into a latch mechanism on the motorized portion of the table. The occipital harnesses have mobile and stationary segments. Adjustable padded wedges on the harness directly contact the patient's head and neck along with a flat padded area for the occiput. The wedges fit snugly against the posterolateral aspects of the patient's cranium and are often capable of being approximated toward the patient's midline with a screw knob adjustment to prevent slipping during traction. The padded wedges are affixed to the movable segment of the harness, and the harness slides along the stationary portion via the tension produced by the traction motor. Occipital harnesses usually have a strap that can be tightened over the patient's forehead to secure the head in the harness (Fig. 7-5). The need to secure the patient's head firmly is greater with higher amounts of tension because the potential for the harness to slip increases. At lower levels of tension, practitioners often avoid using the strap for patient comfort.

Another standard feature of traction tables is a patient-controlled safety switch (Fig. 7-6). Patients receiving traction usually have intervals of indirect supervision. Thus, their safety is enhanced with a manually activated switch that allows them to immediately release the traction while sounding an alarm for assistance. Patients who experience anxiety with an unfamiliar intervention are often comforted by knowing that they are in control of the traction unit. Similarly, if patients experience discomfort while receiving traction, the switch allows them to release the tension and notify the clinician.

Traction tables represent significant capital equipment investments for most clinical settings and are often

Fig 7 ■ 5 Securing strap of cervical harness.

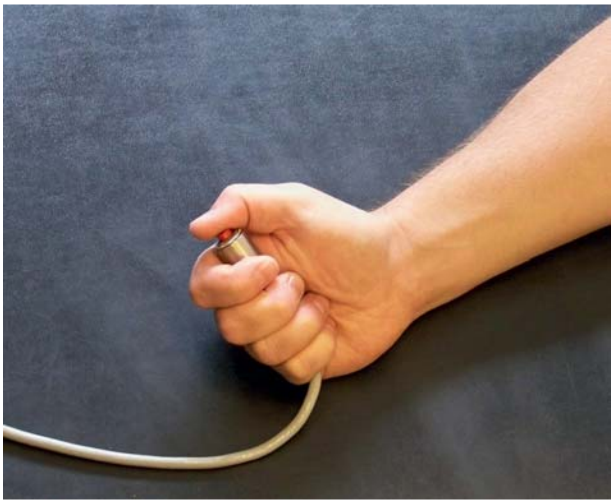

Fig 7 ■ 6 Patient-controlled safety switch.

used for many years. At the time of this publication, the price for traction tables with the accompanying motor unit ranges from approximately $4,000 to $19,000, depending on the features and options included.

Cervical Spine Traction: Procedures and Practice

Essential Elements

When describing the physical arrangement of cervical traction, *harness* may not be an ideal descriptor because current clinical apparatuses are considerably different from older devices. Before 1990, the portion of the equipment directly contacting the patient usually consisted of straps that encircled the patient's occiput and chin in order to deliver a superiorly oriented force. Practitioners grew concerned, however, about the force being applied to the mandible and through the temporomandibular joints with these harnesses. As a result, occipital-contact-only harnesses were developed and have now become universally adopted. These devices are generally accepted as more comfortable for all patients in addition to avoiding compressive force through the temporomandibular joints.

The typical preparatory steps for a cervical traction treatment session include the following:

- Step 1: The immobile portion of the cervical harness is first attached to the motorized unit housing or frame to provide for a stable base on which the mobile portion will operate (Fig. 7-7).

Fig 7 ■ 7 Step 1: Attachment of cervical harness to motor.

- Step 2: The cable is slackened from the motor, usually by a release lever or an electronic switch, and then linked to the mobile portion of the harness (Fig. 7-8).
- Step 3: Any slack in the cable is then removed without changing the position of the mobile portion of the harness (Fig.7-9).
- Patient comfort and relaxation during cervical traction are promoted as much as possible. For this reason, practitioners will often place small, well-insulated hydrocollator packs against the inferior edge of the harness upon which the patient will lie (Fig. 7-10).

Fig 7 ■ 8 Step 2: Slackening of cable to allow attachment of mobile portion of harness.

Fig 7 ■ 9 Step 3: Removal of cable slack.

Fig 7 ■ 10 Placement of optional small hydrocollator pack.

Most patients find the warming sensation from the hydrocollator packs across the upper thoracic and scapular regions relaxing, although the packs probably have negligible therapeutic value. Caution must be taken to prevent the hydrocollator packs from overheating the patient's upper back. This is particularly a concern in older patients who perhaps have less ability to dissipate heat.

- Step 4: The harness is opened and the patient is asked to lie supine on the table with the head placed on the flat padded area of the harness (Fig. 7-11).
- Step 5: Proper positioning of the patient in the harness is important for comfort (Fig. 7-12).
- Step 6: If the padded wedges are positioned too high relative to the patient's mastoid processes, slippage may occur during the traction session. In addition, patients

Fig 7 ▪ 11 Step 4: Opening of the harness to accommodate the patient.

Fig 7 ▪ 12 Step 5: Positioning of the patient in the cervical harness.

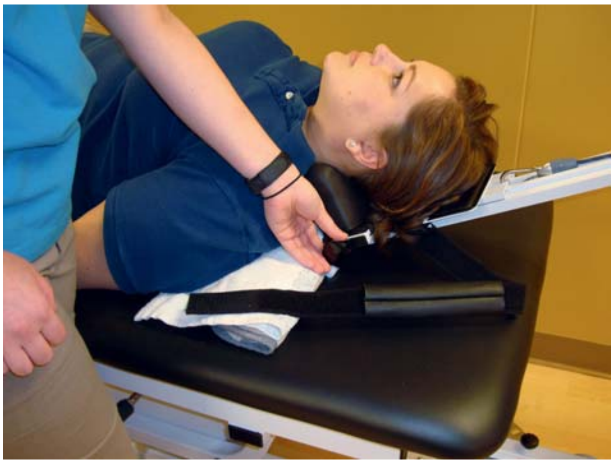

Fig 7 ▪ 13 Step 6: Adjustment of harness and padded wedges to patient.

Fig 7 ▪ 14 Step 7: Angle of cervical traction.

often report discomfort if the wedges are positioned too high, compressing the posterior cranium. Careful positioning of the harness and padded wedges usually allows the wedges to contact more along the inferior aspect of the cranium. The adjustable wedges are then approximated toward the midline to securely fit the harness to the patient's occiput (Fig. 7-13). Caution must be used to not overtighten this adjustment, which would cause an uncomfortable compressive sensation on the patient's neck.

- Step 7: The angle of the traction harness is adjusted, if necessary, for the relative amount of cervical flexion and any desired lateral flexion. Sagittal plane positioning is usually accomplished by adjusting the table height relative to the fixed height motor and control unit, whereas any lateral flexion occurs from relocation of the mechanized traction unit to either side (Fig. 7-14).
- Step 8: Positioning with one to two pillows or perhaps a bolster placed under the patient's knees can help promote comfort. Some practitioners place support under the arms proximally with small rolled towels. In one study, patient subjects preferred support under the upper extremities.[28] Such positioning and support enhances patient relaxation and may be particularly important in those with excessive thoracic kyphoses or remarkably protracted scapulae (Fig. 7-15). Practitioners will discuss with the patient the sensory experiences and responses they should expect while receiving traction. The patient should be instructed to notify the clinician immediately if pain increases or if the patient becomes uncomfortable in any way during the session. To ensure a mutual understanding of this communication, ask patients to verbalize their comprehension of these instructions.

Fig 7 ■ 15 Step 8: Positioning the patient's upper and lower extremities for comfort in cervical traction.

- Step 9: The patient is provided with an aid to call for assistance or is shown the safety switch (Fig. 7-16).
- The chosen settings for the duration and dosage of the traction unit are programmed into the control panel and traction is initiated.
- The prudent clinician will directly observe the traction unit mechanics and the patient response when the session begins. A minimum of 2 to 3 minutes of observation is recommended. This provides further opportunity to ensure the patient's comfort, assess an immediate response, and reinforce expected and unintended responses during the treatment session.

Mechanical Preparation

In addition to patient comfort, the actual arrangements of the table and harness angle are also variables that affect cervical traction, particularly in reference to the angle of cervical spine flexion as measured by the harness relative to the horizontal table surface (see Fig.7-14). Many practitioners, however, have methods of choosing the angle of application or the line of pull for the cervical traction harness, such as selecting the angle depending on the level of the cervical spine that is most symptomatic. For example, the lower cervical spine levels are often treated with greater amounts of flexion while the middle and upper levels may be treated with considerably less flexion. As described earlier, the selection of traction angle based on presumed changes of anatomic relationships during traction has not been validated.

Other practitioners choose a more simplistic approach of asking the patient to report the angle of greatest comfort and adjust the table height accordingly. In addition to the sagittal plane angle, some practitioners will use a lateral flexion angle, presumably to have greater distractive effect on the side of the cervical spine with greater involvement, in the presence of asymmetrical or unilateral symptoms (Fig. 7-17). Most traction tables now have the option of setting the motor and control unit at angles in the patient's coronal plane to achieve traction in cervical lateral flexion. Whether a particular arrangement of the cervical harness results in

Fig 7 ■ 16 Step 9: Providing the patient with the safety switch or another aid to call for assistance.

Fig 7 ■ 17 Positioning of cervical traction with right-side bias.

better patient outcomes than other harness setups has not been validated and remains a convention. Decision-making in individual patient care situations based on examination findings and positions of relief may suggest a particular method; however, generalizations about this aspect of traction decision-making must be made with reservation because of a lack of evidentiary support.

Traction Dosage and Decision-Making

In addition to the angle of traction, several other variables are at the discretion of the practitioner, such as the amount of tension, the duration of treatment, and the timing of the cycle with intermittent traction. These variables may collectively be considered traction dosage. Again, the use of accepted, if not substantiated, practices are generally seen in reference to these parameters. Practitioners often view traction dosage as analogous to the grading of manually applied passive movements to the spine (Box 7-2).

Comfort is a foremost consideration with patients receiving traction. As a rule, the amount of tension applied to the cervical spine should not cause or increase symptoms. In the presence of peripheral symptoms, possibly of nerve-root origin, practitioners generally agree that distal symptoms warrant particular observation for changes during and immediately after traction. If the patient reports any worsening of upper-extremity symptoms during a treatment session, whether pain or paresthesia, traction should immediately cease. Similarly, if symptoms worsen after traction, the practitioner should reconsider the traction dosage or determine if traction is an appropriate treatment option at that time.

Box 7 ▪ 2 Variables at Practitioner's Discretion in Delivery of Cervical Traction

- Static or intermittent
- Angle of application
- Dosage
  - Amount of tension
  - Duration of traction
  - Cycle
    - Total cycle duration
    - Proportion of time of maximum vs. minimum tension
    - Inclusion of ascending or descending steps at initiation or conclusion

The practitioner's assessment of the acuity and irritability of the patient's condition is part of this reasoning process. Mechanical pain syndromes characterized by pain that is quickly and easily increased with minimal movement or provocation generally suggest conservative traction dosages initially. Symptoms not highly irritable or acute may allow tolerance of greater dosages. Thus, the practitioner is challenged to find a threshold that has a beneficial effect without applying excessive force or provoking symptoms.

> ***Key Point!*** After deciding to use traction for an individual patient, most practitioners choose a conservative traction dosage for the initial application. This will establish a favorable, or at least neutral, patient response to the trial treatment.

Within the context of the patient having been recently evaluated, perhaps with provocative maneuvers, assessing the patient's response during and subsequent to the first traction session requires caution. A common occurrence is for the patient to report a modest pulling or stretching sensation within or immediately adjacent to the spine during treatment. This is not an indication to stop or alter the traction. Indeed, frequently, patients will describe this stretching or pulling sensation favorably, with the sensation often diminishing over the course of the traction session. Practitioners often hypothesize that this sensation may indicate an improvement of soft tissue extensibility. Thus, such a response is generally viewed as favorable.

Tension amounts typically range between 10 and 25 pounds for the upper limit of intermittent cervical traction.[29–32] Although continuous and intermittent traction are possible on most tables, the majority of practitioners will use intermittent traction, cycling between two levels of tension for the duration of the session. For the lower level of tension, practitioners often use approximately one-half the level of tension as the upper level for intermittent traction. If continuous traction is chosen, less tension and total duration than the upper level of intermittent traction are usually selected.

With cervical traction applied in the supine position, as opposed to the older practice of seated traction with a vertical pull, the weight of the head is less of a factor in the net amount of tension applied to the cervical spine. The angle of the traction harness, however, may be a factor in the net tension applied. A greater angle of cervical flexion will increase the vertical force component of the head's weight, whereas the vertical component will be negligible with a low flexion angle. Thus, to achieve a comparable net traction on the cervical spine, the amount of tension programmed into the traction unit may need to be relatively larger to compensate for a greater flexion angle. The practitioner may elect to increase the tension setting by an increment of 2 or 3 pounds at the greater flexion angle and then reassess the patient's response for comfort and symptom reduction.

The treatment session usually lasts 10 to 20 minutes, as determined by the overall dosage and the acuity and irritability of the patient's condition. In the absence of well-established criteria, this is arbitrary, as is the timing of the cycles with intermittent traction. A cycle proportion of 30 seconds at the greater tension to 10 seconds at the lower tension of intermittent traction is common, but wide variation of this occurs due to therapist preference. With this cycle proportion and total time being substantial variables at the practitioner's discretion, caution should be used when selecting these amounts based on the individual patient characteristics.

Patients receiving traction will also occasionally experience a rebound effect, characterized by a reduction of symptoms during traction followed by an increase and persistence of symptoms for minutes or hours after the session ends. When a rebound effect occurs, detailed communication between the practitioner and patient is required for accurate interpretation. A brief, transient increase of centrally perceived symptoms after traction may be a one-time localized tissue response or may be an indication for a lower traction dosage while continuing with the original plan of care. Conversely, an increase of symptoms lasting several hours, particularly those including distal symptoms, demands that the practitioner reconsider using traction. When interpreting this feedback from the patient, the practitioner must also consider concurrent interventions being administered, along with the patient's activities and behaviors after the first traction session. Thus, practitioner–patient communication is paramount in appropriate decision-making for traction, particularly after the initial trial or significant changes in the dosage.

After a traction session ends, common practice is to release the tension from the harness, loosen the harness from the neck, and allow the patient to rest for approximately 5 minutes before rising. The patient should also be allowed to rest briefly in a sitting position after arising from supine to minimize any positional hypotension. A patient reporting dizziness or feeling faint during or immediately after traction or upon returning to sitting demands close observation and a check of vital signs. The patient should not rise from the table until such a response subsides. A prolonged response may warrant a medical consultation for underlying conditions, and the practitioner should reconsider using traction with this patient.

Before deciding to use traction in subsequent sessions, the practitioner should carefully interpret the patient's response to the prior session. If the patient reports temporary or lasting symptom relief (particularly with peripheral pain or paresthesia) and greater function, this suggests a possible benefit. Other objective evidence indicating favorable responses to cervical traction can include an increase in cervical range of motion (ROM), increased ability to complete specific daily activities (especially involving the upper extremities), improved upper-extremity reflexes, increased upper-extremity strength (e.g., grip), or normalization of previously observed sensory losses.

Key Point! Among those practitioners who use cervical traction, there is consensus that it cannot be a sole intervention for patients with cervical spine mechanical pain syndromes. Use of therapeutic exercise, manual therapy techniques, and neural mobilizations are clearly supported by evidence[33] for patients with cervical spine dysfunction and are often used in concert with cervical traction.

Lumbar Spine Traction: Procedures and Practice

Essential Elements

Traction has a longer historical use to treat patients with mechanical dysfunction of the lumbar spine than it has for those with cervical spine syndromes. There is a similar, if not greater, lack of substantive evidence as to its value and for the methodology of optimal application, but lumbar traction remains a common intervention employed by many clinicians.

After the decision to use traction, the first variable at the practitioner's discretion is whether to apply it while the patient is prone or supine. No well-developed criteria exist to guide this decision. Some practitioners prefer to use one position exclusively, unless patient comfort or poor response suggests an alternative. Other practitioners will place their patients in the position of greatest comfort as the starting point. For example, if the patient's symptoms are less severe when lying prone, then the practitioner may use prone positioning for traction. Alternately, supine traction may be chosen if the patient achieves greatest relief from lying supine with hips and knees flexed. Yet another factor may be patient age. Older patients, perhaps more likely to have mechanical pain associated with degenerative changes of the posterior elements of the lumbar spine, are thought to typically respond more favorably to a flexed, supine position.

Mechanical Preparation

After the patient's position is determined, the traction table and harnesses can be set with these considerations:

- During supine positioning, well-insulated hydrocollator packs are often used under the patient's back (Fig. 7-18). There is no known direct clinical benefit from the heat application; however, such a measure can promote patient comfort and usually encourages relaxation during the treatment. Because of the superincumbent body weight and limited flexibility for modification after traction has begun, particular caution must be employed to avoid burning or overheating the patient. Older individuals with less ability to dissipate heat may require additional layers of insulation and more frequent monitoring during treatment.
- Step 1: After the hydrocollator packs are placed on the table surface, the pelvic and thoracic harnesses are positioned with consideration for the location of the separation of the table segments and subsequent patient positioning (Fig. 7-19).
- Step 2: As the patient assumes position on the table, the patient's lumbosacral junction or targeted area of the lumbar spine is positioned over the separation between mobile and stationary segments of the table (Fig. 7-20). This allows the distraction to be more

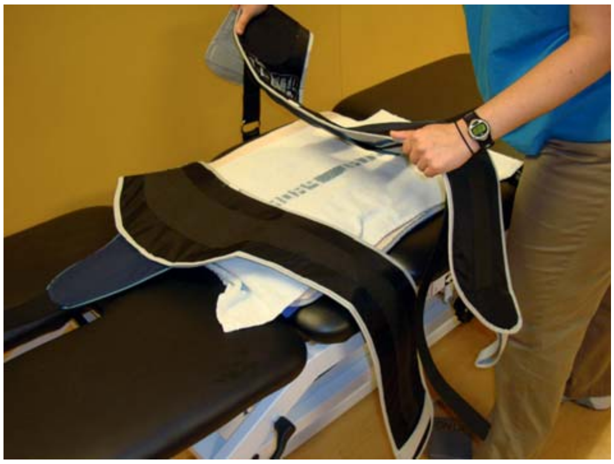

Fig 7 ▪ 19 Step 1: Placement of the pelvic and thoracic harnesses for lumbar traction.

Fig 7 ▪ 18 Placement of optional large hydrocollator pack.

Fig 7 ▪ 20 Step 2: Positioning of the target area of traction over the table separation.

localized to the spinal segments of interest when the gliding portion of the table is released.

- Step 3: After the patient is asked to lie supine on the harnesses and the lower extremities are positioned for comfort with the hips and knees partially flexed, support is placed under the knees. Many practitioners prefer a "90-90 position" in which a stool is placed under the calves of the supine patient, resulting in the hips and knees each being positioned at approximately 90 degrees of flexion (Fig. 7-21).
- Step 3 alternative: Other options include use of a bolster under the flexed knees to achieve a comfortable position for the patient (Fig. 7-22).
- Step 4: Precise placement of the harnesses is important for patient comfort and to achieve greatest traction effect. The traditional pelvic harness with two securing straps requires the upper of the two straps securing the harness to be placed superior to the patient's iliac crests. The lower strap will ideally be inferior to the iliac crests but superior to the greater trochanters. Thus, each strap on the pelvic harness will be seated against a bony prominence when traction is applied, minimizing the likelihood of slipping (Fig. 7-23). The thoracic harness is best placed inferior to the widest lateral dimension of the rib cage. Thus, when traction is applied, the thoracic harness will also seat against the bony prominences at the flare of the rib cage. Some newer lumbar traction harnesses have only one securing strap, which may require more attention to detail with fitting the harness (Fig. 7-24).

Fig 7 ▪ 21 Step 3: Positioning for "90-90" lumbar traction.

Fig 7 ▪ 22 Step 3, alternative: Positioning for traction in supine with a bolster under the knees.

Fig 7 ▪ 23 Step 4: Overlap of thoracic and pelvic harnesses with both seating against bony prominences.

Fig 7 ▪ 24 Traction harness with a single strap.

The straps on both harnesses are clasped and tightened (Fig. 7-25). The extent of tightening is dependent on the amount of traction tension to be used. Larger amounts of tension require the straps to be firmly secured, whereas more modest traction tension does not require the straps to be as tight. The goal is patient comfort while preventing the harnesses from slipping from their optimal placements on the patient's body. For female patients, a rolled towel placed vertically between the breasts before closing the thoracic harness may help prevent discomfort. Clothing can occasionally interfere with the function of the thoracic harness. Multiple layers of clothing, particularly with synthetic materials offering minimal friction or bulky garments, can compromise the thoracic harness's position when tension is applied. If the patient can maintain modesty and remove excess layers of upper-body clothing, a more secure and sustained positioning with the thoracic harness is often achieved.

- Steps 5 and 6: After the harnesses are secured on the patient, slack in the straps anchoring the thoracic harness to the fixed portion of the table is removed to minimize any upper-body movement when tension is applied. The cable is released from the motorized unit (Fig. 7-26) and attached to the pelvic harness (Fig. 7-27). The sequence of some steps may vary, depending on the traction unit and harnesses being used. In all cases, the harnesses are secured first around the patient before slack is removed from the other harness attachments.

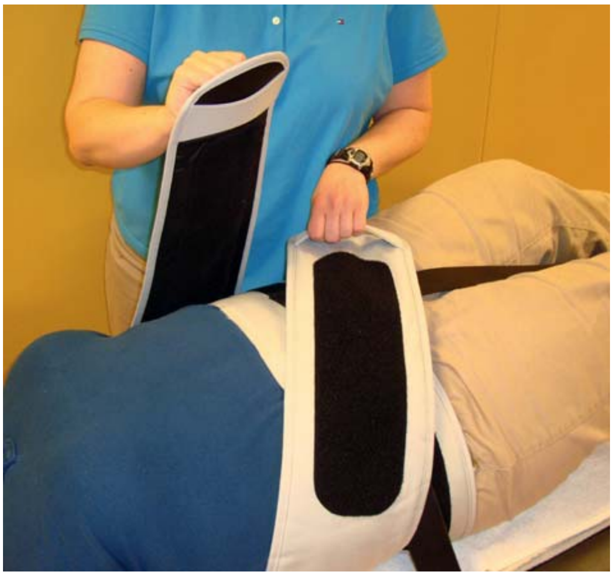
Fig 7 ▪ 25 Tightening of harness in preparation for lumbar traction.


Fig 7 ▪ 26 Step 5: Slackening of cable to allow attachment to the harness.


Fig 7 ▪ 27 Step 6: Attachment of cable to pelvic harness.

- Step 7: After the patient is positioned and the harnesses are secured, the slack in the cable between the harness and motor is removed (Fig. 7-28).
- Step 8: Next, the table surface lock is released, allowing the table segments underlying the lumbar spine and pelvis to separate when the traction tension increases (Fig. 7-29).
- The traction parameters are programmed into the control panel and traction is initiated.
- The prudent practitioner will closely observe the patient and apparatus over a minimum of two to three cycles of intermittent traction, ensuring that the harnesses are secured and do not slip. Particular attention is warranted to avoid allowing the thoracic

Fig 7 ■ 28 Step 7: Removal of cable slack.

Fig 7 ■ 29 Step 8: Release of table lock.

harness to slip superiorly on the patient and into the axillae. Some patients may have body types that make it challenging to adequately secure the harnesses to avoid slippage during traction.

With prone positioning, the harnesses are similarly placed on the table such that the lower lumbar segments or the lumbosacral junction align with the splits of the tabletop's segments (Fig. 7-30). Usually, this allows the patient's face to fit comfortably in the opening of the table's head segment. The tilt of this segment is often adjusted slightly down for greater patient comfort. The inability to communicate face-to-face with the patient during prone traction requires diligence on the practitioner's part to ensure the patient is not having an unfavorable response.

Some practitioners prefer to apply manual mobilizations immediately to the lumbar spine or encourage the

Fig 7 ■ 30 Positioning for prone lumbar traction.

patient to complete extension exercises immediately after traction and before weight-bearing through the spine. This may be accomplished more easily with prone traction because only the belts being loosened and the table surfaces being secured are necessary to proceed. If those interventions are chosen to follow supine traction, a nearby table can be brought next to the traction table, allowing the patient to roll prone onto the second table. As described in the section on cervical traction, a rest period after the release of traction is usually warranted before proceeding.

With prone or supine positioning, the table height and the angle of the traction unit relative to the table can be adjusted, but these adjustments may not exert the same effect as in traction of the cervical spine. Without the stationary arm of the cervical traction harness providing for greater angulation of the tension, only minor variation of the traction tension toward lateral flexion are possible with lumbar traction arrangements.

Traction Dosage and Decision-Making

The variables in lumbar traction tension are similar to those described previously for the cervical spine. Additionally, the practitioner must determine whether supine or prone positioning is preferable. Positioning of the lower extremities may also be a consideration because this influences the alignment of the lumbar spine during traction. Collectively, total duration, cycle time, and amount of tension comprise the traction dosage. Values are usually set conservatively to establish patient tolerance, particularly with conditions that are highly irritable or acute. Use of tension up to approximately one-half of the patient's body weight is common practice, although this may not be selected for the initial treatment session. Similar to cervical traction, a cycle of approximately 30 seconds at the maximum tension to 10 seconds at the lower tension is typical, although this is subject to practitioner preference. Manipulation of these variables can significantly increase or decrease total traction dosage (Box 7-3).

Communication between the practitioner and patient before the traction session and immediately afterward about expectations and responses is a necessity. Further communication during the next visit is essential to assess the patient's response before doing another treatment. A reduction in pain, particularly with lower-extremity symptoms, along with increased ambulatory or sitting tolerances indicate a positive response to lumbar traction. More objective evidence such as increasing the angle of hip flexion during straight leg raising before symptom provocation along with improvement in deficits in reflexes or sensation also suggest benefit. Assessment of the patient's response to traction must always be made within the context of concurrent interventions and the patient's other activities or behaviors.

Patient Safety

Generally, patients will not be supervised during the entire treatment period. Therefore, patients must have a call system they can use if they need assistance during the traction session. Even though the patient safety switch is available, some practitioners prefer a bell or similar audible call method that patients can use if they merely need to make minor adjustments or if they have a question and do not need to immediately terminate the traction treatment.

Key Point! The patient and practitioner must communicate about expectations and anticipated responses from traction to ensure that no harm is done and that the experience for the patient is favorable.

Patients must understand that they should alert the practitioner if they experience any undesirable responses during treatment. Questions should be asked and answered before a patient's first traction experience. The practitioner must ensure that the patient understands that traction should be a comfortable experience, rather than one to be endured for later benefit. If the patient's symptoms worsen, particularly if they are referred or radicular in nature, the patient should notify the practitioner or other clinical staff immediately. Similarly, the practitioner or other clinical staff must frequently assess the patient's comfort and response during the traction session. Patients with highly acute or irritable conditions require meticulous observation to ensure that they are not having an adverse response to the traction.

Safety check: With lumbar traction, a mandatory procedure is to secure the lock for the tabletop segments immediately after releasing the tension at the end of the session. Failure to do so may result in a sudden shift of the mobile portion of the table while the patient is on it or when rising from it, resulting in injury or irritation of symptoms, essentially negating the benefit of the traction or worsening the patient's condition.

Little scientific rationale exists to support the use of heat concurrently with traction, but if done, caution should be taken to avoid overheating or burning a patient lying on the hydrocollator packs. Older patients or those with other thermoregulatory issues require special care with heat application. Frequent communication with the patient as to the comfort level with the heat is advisable. The practitioner must bear in mind that the heat is to promote patient relaxation rather than to bring about a specific therapeutic value. Thus, its use is not essential.

Adverse effects have been reported from the use of traction, albeit infrequently. The majority of clinical trials fail to mention adverse events. Existing reports are often lacking in detail but typically consist of symptom exacerbation, either localized to the neck or back or including

Box 7 ▪ 3 Variables at Practitioner's Discretion in Delivery of Lumbar Traction

- Supine or prone position
- Positioning of lower extremities to influence lumbar spine alignment and comfort
- Static or intermittent
- Angle of application
- Dosage
  - Amount of tension
  - Duration of traction
  - Cycle
    - Total cycle duration
    - Proportion of time of maximum vs. minimum tension
    - Inclusion of ascending or descending steps at initiation or conclusion

peripheral or radicular symptoms. Headaches, nausea, and fainting have also been reported.[34,35] Although apparently rare, these occurrences establish the need for cautious decision-making before using traction, regular monitoring of patients while receiving traction, and communication with patients as to their responses to the intervention.

Indications for Traction

Clearly established indications for using traction to treat the cervical or lumbar spine for mechanical pain syndromes remain elusive. Historically, the trend has been to use traction more prominently in the overall treatment plan when patients present with signs and symptoms consistent with radicular symptoms or other clinical criteria suggestive of radiculopathies. As classification schemes for patients with cervical or lumbar spine syndromes have evolved, some have included a subgroup of patients for whom traction is a preferred or optional intervention. Validation of these subgroups has not yet been accomplished.

The initial proposal of a treatment-based classification for low back pain contained a subgroup of patients for whom traction was suggested as the preferred intervention.[36] This categorization was largely based on patients experiencing distal symptoms when they performed trunk movement in any direction. Subsequent descriptions of the Treatment-Based Classification System[37,38] did not as clearly delineate a traction subgroup. The presence of symptoms distal to the knee, particularly when worsened with extension movements along with a crossed straight-leg raise and neurological deficits, were cited in one study as possible indicators for traction improving the probability of a favorable patient outcome.[39] Many clinicians will consider traction for patients with lumbar spine syndromes when peripheral symptoms or overt radicular signs are not reduced by movement or position testing in a manner similar to that initially proposed by Delitto et al.[36] The more recently published and contextually different Impairment-Based Classification System for Low Back Pain presents traction as a complementary intervention and does not specifically identify a patient subgroup best matched for mechanical traction treatment.[40] More simplistically, the reduction of symptoms with manually applied traction may be another criterion used in decision-making, although this has also yet to be validated (Fig. 7-31).

Fig 7 ■ 31 Application of manual lumbar traction during examination.

The Impairment-Based Classification for Neck Pain and accompanying clinical practice guideline[33] cites traction as a preferred intervention for those patients presenting with radiating upper-extremity symptoms. Evidence for this designation includes provocation of upper-extremity symptoms with foraminal compression testing, such as Spurling's maneuver (Fig. 7-32); reduction of those symptoms with manually applied traction (Fig. 7-33); and possible accompaniment of neurological involvement with upper-extremity sensory, motor, and reflex deficits. Notably, a clinical prediction rule for identifying patients most likely to benefit from cervical traction has been proposed.[41] The predictive variables

Fig 7 ■ 32 Spurling's maneuver during examination.

Fig 7 ▪ 33 Application of manual cervical traction during examination.

included peripheralization of pain with lower cervical mobility testing, a positive shoulder abduction test, age of 55 or older, reduction of symptoms with manual distraction, and a positive upper-limb tension test. The reported statistical support for the derivation of this clinical prediction rule was robust; however, the study has been criticized for its methodology,[42] and validation of the clinical prediction rule has yet to be completed. Similarly, other investigators have proposed a clinical prediction rule for identifying those patients who might specifically benefit from home cervical traction.[43] The predictor variables in this study were pain at a level of 7 out of 10 or greater, a score on the Fear Avoidance Beliefs Questionnaire Work Subscale of less than 13, relief with manually applied traction, and pain perceived distal to the shoulder. Validation of this clinical prediction rule also has yet to occur.

Key Point! Clearly and definitively delineating the criteria for which patients might respond most favorably to traction has yet to occur. In the absence of clear practice guidelines, practitioner discretion is the greatest variable in traction usage. The evolution of evidence supporting manual therapy and exercise suggests these interventions be considered as a concurrent first option rather than traction for many patients with cervical and lumbar spine clinical syndromes.[33,40,44,45] For patients who have success with these interventions, traction should be considered a second-line or complementary intervention.

Contraindications for Traction

Before using traction on the spine, practitioners must screen patients for conditions that may cause adverse responses or for which definitive contraindications exist (Box 7-4). Cervical traction is contraindicated in patients with acute cervical spine trauma, particularly recent whiplash-associated disorders. Connective tissue diseases or rheumatologic disorders that can result in tissue laxity or joint hypermobility/instability are specific contraindications for the cervical spine. Foremost among these is rheumatoid arthritis, which is often characterized by asymptomatic subluxations of the upper cervical spine.[46–50] Ankylosing spondylitis, although characterized by rigidity and ossification in the lumbar and thoracic spine regions, may lead to upper cervical instability and is also a specific contraindication.[46,47,51–53]

Other diseases and disorders known to affect bone integrity, such as osteoporosis and osteopenia, are also contraindications for traction. Similarly, traction is contraindicated in patients with histories of steroid use or those who use medications that weaken or demineralize bone. Localized hypermobility or instability in the region of interest is also a contraindication.

Traction is contraindicated in patients who have received surgical stabilization or decompression of the spine or in patients with spine implants or prosthetic discs. The structural integrity of these devices or the bone-implant material interface may be compromised by the traction force.

Patients who have undergone cervical spine discectomies often will have also received interbody fusions at

Text continues on page 230

Box 7 ▪ 4 Contraindications for Mechanical Traction

- Acute cervical trauma, including whiplash-associated disorders
- Osteoporosis or osteopenia
- Use of steroids or other medications that tend to compromise bone integrity
- Rheumatologic disorders affecting connective tissue, including rheumatoid arthritis and ankylosing spondylitis
- Joint hypermobility/instability
- Pregnancy
- Prior surgical stabilization or decompression
- Spinal implants/prosthetic discs
- Nonmechanical pain

CASE STUDY 7-1 Cervical Traction

A 38-year-old male presents for physical therapy with primary complaints of left neck, periscapular, and arm pain. He also describes paresthesia distal to the left elbow, extending into the first and second digits. He is unable to identify a specific event precipitating these symptoms but noted them gradually increasing the day after moving a household appliance 1 week ago. Upon questioning, he specifically denies any trauma to his cervical spine. His occupation is manager of several multiunit apartment buildings. He reports an inability to complete both the more physically demanding aspects of his job and the desk and computer-based responsibilities because of his symptoms.

Upon clinical examination, cervical active ROM is observed to be severely pain-limited in all planes, particularly with extension, left rotation, and left lateral flexion. His upper extremity reflexes are at 2+, except for the left biceps brachii, which is at 1+. Muscle testing across the upper extremities yields grades of 5/5 on the right. Left upper-extremity muscle tests are all pain-limited to 4+/5, except for the left biceps brachii at 4/5. Grip strength on his dominant right side is at 105 pounds and the left is at 27 pounds. Light touch sensory ability is diminished at the pad of the left second digit. Spurling's maneuver on the right is negative but on the left elicits an increase of distal paresthesia. Manually applied traction reduces the left periscapular and proximal arm pain. Left upper-limb tension testing is highly provocative of symptoms in the arm and forearm, with full positioning limited to 30° deficient of full elbow extension during the test.

CLINICAL DECISION-MAKING

1. Does the patient have a problem that can be improved with the use of traction?
   ANSWER: Although specific indications for traction remain unclear, the examination findings are noteworthy. Given that manual traction reduced his symptoms, adding traction to his treatment regimen may be warranted, particularly since no other position or measure has offered pain relief over the past week.

2. Is the patient appropriate for application of traction? Do any of the general precautions or contraindications to traction apply, or are there any specific considerations regarding application of traction to this patient?
   ANSWER: The patient denies any medical history that would contraindicate the use of traction. The examination findings and his history since the onset suggest his condition to be highly acute and irritable. The presence of multiple suggestions of peripheral neurological deficit requires close observation and careful decision-making, as further deterioration would suggest worsening of his condition.

3. What are the specific goals to be achieved with the use of traction?
   ANSWER: The immediate goal for this patient would be to reduce the pain, which is theorized to be of nerve-root origin. Pain relief will allow the patient to resume restorative sleep and perhaps return to a portion of his job duties. A reduction of pain will also enhance his ability to complete the therapeutic exercise and other active interventions planned for home and in subsequent clinical visits.

4. What specific type of traction is appropriate for the patient?
   ANSWER: The evidence is limited, but intermittent traction at the angle of cervical flexion offering the lowest level of peripheral symptoms is a reasonable starting point from which to begin a trial of traction. This may be adjusted during the course of traction and after the first treatment based on his responses.

5. What specific parameters of traction would be appropriate for the patient?
   ANSWER: The apparent level of acuity and irritability of his condition demands caution with the initial trial of mechanical traction. Traction dosage on the first day should be modest. As such, a reasonable trial with intermittent traction may be cycling between 12 and 6 pounds for 30 and 10 seconds, respectively. The initial total treatment time may be as little as 10 minutes. These variables, however, are subject to adjustment during the course of the traction session. Given his level of pain and inability to participate in daily demands, a follow-up visit the next day may be warranted.

6. What are the effective and safe application procedures for traction related to this patient?
   ANSWER: A dramatic improvement with one session of traction is an unrealistic expectation. Perhaps the first objective is to establish his tolerance to the chosen intervention. Assessing the patient's status during and immediately after the first session of traction is imperative. Any increase of symptoms peripherally is to be specifically avoided. If this occurs during the traction, the treatment should stop immediately. His response for the next several hours after traction will be, in part, the basis for determining the direction of his care at his next visit. A cumulative effect of pain reduction with subsequent applications is expected. Failure for this to occur indicates the need for medical consultation and diagnostic imaging, particularly if the neurological deficits persist or worsen.

CASE STUDY 7-2 Lumbar Traction

A 46-year-old male arrives at physical therapy with primary complaints of right low back, buttock, thigh, and calf pain of 2 weeks' duration. He describes the onset of these symptoms subsequent to lifting a spool of wire into a truck at his construction job. He reports difficulty maintaining any body position for more than 30 minutes, with sitting being the most provocative of his symptoms. He denies any change in bowel or bladder function since the onset of these symptoms.

Upon examination, pain grossly limited lumbar ranges of motion in all planes, and provocation of distal symptoms at the end of the available range in each direction is observed. Passive side-gliding of his lumbar spine is severely limited with distal symptoms in the left and a firm barrier to the right. He is intolerant of testing the S1 motor distribution when standing on the right because of pain. In supine, muscle testing across the lower extremities is particularly remarkable for ankle eversion on the right at 4/5 with no other deficits observed. Muscle stretch reflexes are at 2+, except for the right ankle at 1+. Straight leg raising on the right causes an increase of distal symptoms at 30° and is negative on the left. Decreased light touch sensation is noted at the great toe of his right foot. Attempts at repeated movement testing of the lumbar spine for centralization and eliminating the block to right side-gliding result only in an increase of the lower-extremity symptoms. Upon the application of manual lumbar traction during the examination, he reports a modest reduction of his back and lower-extremity symptoms.

CLINICAL DECISION-MAKING

1. Does the patient have a problem that can be improved with the use of traction?

   ANSWER: At the time of this examination, manually applied traction is the only procedure that reduces the patient's symptoms, particularly those in his lower extremity. All of the other attempts to centralize or reduce his pain worsen his symptoms. His outcome is difficult to project given the acuity and apparent irritability of his condition and the accompanying neurological deficits that suggest radiculopathy. Based on the examination findings, however, a trial of traction to assess his response is the best option to start his recovery process.

2. Is the patient appropriate for traction? Do any of the general precautions or contraindications to traction apply, or are there any specific considerations regarding application of traction to this patient?

   ANSWER: Upon review of his history and overall health status, there are no indications that traction is inappropriate to use in his treatment. Given the severity of his condition and apparent nerve-root involvement, caution is required. The specific traction dosage on the first attempt will be modest to assess his tolerance, and he will require close supervision during traction. Additionally, he will require close observation in the period immediately after traction and before he leaves the clinic to assess his response for future treatments.

3. What are the specific goals to be achieved with the use of traction?

   ANSWER: With conditions suggesting radicular pain, a reduction of peripheral symptoms is usually an early objective. If these symptoms can be decreased, he will become a candidate for other interventions not currently tolerated, which may accelerate his progress. These would include manual therapy, self-mobilization, motor control exercise, and higher-demand exercise consistent with his functional demands at work.

4. What specific type of traction is appropriate for the patient?

   ANSWER: With his most comfortable position being supine with his hips and knees flexed, the initial trial would logically incorporate this positioning. He gained relief with the manually applied traction during the examination as his hips and knees were flexed while his feet were resting on the table. Thus, replicating that position for the first attempt would be logical and could be accomplished with a bolster under his knees. There is no evidence to support either static or intermittent traction being superior overall or with subgroups of particular clinical presentations. With any sustained mechanical stresses apparently being poorly tolerated, the preferred initial arrangement is intermittent traction.

5. What specific parameters of traction would be appropriate for the patient?

   ANSWER: Given the acuity and apparent irritability of his condition, the initial trial of traction will require caution. The initial treatment to assess his response and attempt to establish a tolerance level will be at

Continued

CASE STUDY 7-2 Lumbar Traction—cont'd

25% of his body weight and for a shorter than usual period of 10 minutes. With his body weight at 200 pounds, the traction unit will be set at 50 pounds at the maximum tension and 25 pounds for the minimum tension. The time settings will be programmed for 10 total minutes with 30 seconds at maximum tension and 10 seconds at the minimum tension. Because of his condition's acuity and apparent irritability, two progressive and two regressive steps are also being programmed into the traction control unit.

6. What are the effective and safe application procedures for traction related to this case example?
ANSWER: Using traction with this patient is only the first step in what will evolve into a multimodal treatment approach. Provided he responds favorably to the traction on the first visit, the traction parameters will be progressed at the time of his second visit and perhaps subsequent visits to greater amounts of tension and longer duration. If symptoms are reduced, his response to repeated movements will be reassessed with the objective of advancing his self-treatment regimen to include self-mobilization procedures, most likely in a lumbar extension orientation. Exercises to activate the musculature supporting the lumbopelvic complex will also be incorporated early in his rehabilitation and progressed according to his tolerance and the quality of his recruitment patterns. He may also become a candidate to receive manual therapy at some point in his treatment. As his distal symptoms diminish, traction will likely be discontinued. The overarching concept is that traction in this patient's care is an early treatment option to reduce pain and facilitate an increased tolerance to other interventions established to be effective.

the involved segment and thus should not receive traction. This modality may not be strictly contraindicated in a patient with a remote history of a simple lumbar discectomy on a single level, but the practitioner should be careful when deciding which treatment option is most appropriate and the intended effect. Given the altered anatomy following discectomy, the practitioner must contemplate the proposed benefit from traction as opposed to other therapeutic options.

Because of multiple unknowns and the potential risks, lumbar traction during pregnancy is to be avoided. Use of cervical traction during pregnancy may not be absolutely contraindicated, but consideration must be given to hormonal influences potentially affecting tissue laxity.

If the patient reports pain in or around the spine that cannot be determined in the initial examination to be of mechanical origin, the practitioner should suspect potentially serious pathology. The inability to find movements or positions to relieve pain may be indicative of a serious health condition beyond the scope of physical therapy. As such, further medical consultation or diagnostic testing may be warranted rather than defaulting to traction as a mechanical treatment. Similarly, patients who report histories of cancer should have a thorough diagnostic evaluation, including imaging, before receiving traction because of the potential for disease recurrence or metastases.

Precautions

Individuals with claustrophobia may not be well suited to receive mechanical traction, particularly for the lumbar spine. The perception of being enclosed in the harnesses and confined on the table may precipitate anxiety that will preclude the patient from participating in traction. Similarly, if the traction table is located in a small room in the clinical setting, the effect may be magnified. For this reason, many practitioners prefer to place their traction tables in a curtained area within a more spacious area of the clinic. With some patients, the curtain partition, perhaps even partly opened, allows enough relaxation for the treatment to be well tolerated.

Patients with chronic obstructive pulmonary disease or other respiratory disorders may also find the harnesses required for lumbar traction uncomfortable and may be compromised by the supine position. Being able to secure the harnesses adequately while permitting the patient to relax and breathe comfortably may be difficult to achieve. If patients are distressed by the mechanical traction positioning and apparatus, treatment options other than traction may be better.

HOME TRACTION

An outgrowth of the benefit and sometimes transient symptom relief of clinical traction is the availability of a variety of home traction units. These units are often available over the counter or from some retail outlets. Other more sophisticated traction devices are available only through health-care providers or by prescription from a physician.

Cervical Spine

Recently, portable equipment closely replicating clinical models has become available for home use (Fig. 7-34). These usually consist of an occipital harness capable of gliding on a small, stable frame. Traction is provided by a manually operated pneumatic pump that includes a gauge for quantifying tension. The patient lies supine and is positioned in the harness similar to the larger clinical models. Some home models have adjustable harnesses, allowing the patient to adjust the pads by simply turning a knob. Other models have self-adjusting pads that seat against the occiput when traction is initiated. The patient achieves the traction effect by activating the manual pump, causing the harness to glide along the frame away from the base. An intermittent mechanical traction effect can be achieved by cycling the pressure up to a designated amount (usually replicating the amount found beneficial during clinical treatment), sustaining that pressure for a time interval (e.g., 1 minute), then releasing the pressure by a valve on the pump. Multiple cycles of this sequence can be completed. Manipulating the variables for home traction on one of these models can closely simulate that achieved on clinical traction tables.

Perhaps the simplest and least expensive apparatus, improvised many decades ago, is still available for cervical spine traction. A water-weighted bag attached to a cord coursing over a pulley that provides tension to a harness worn on the head can provide a modest traction effect for the cervical spine. These devices, used while sitting, must first overcome the weight of the head in order to traction the neck. Additionally, there is the risk that pressure through the mandible can cause or exacerbate temporomandibular joint dysfunction. Achieving intermittent traction with one of these models is not easily accomplished, and static traction may be more pragmatically completed, particularly if the patient is unassisted during the home traction session.

Lumbar Spine

Home lumbar traction units have been largely impractical and of questionable value until recently, when the design features of successful in-home cervical spine traction units were incorporated into lumbar spine units. A similar pneumatic pumping device is used to separate two surfaces on which the patient can lie (Fig. 7-35). The traction tension is usually considerably less than that produced by clinical models, but a sufficient approximation to that achieved clinically may have a modest effect or complement clinical traction. These units are usually compact and are self-contained in a carrying case. Patients with high levels of pain may have difficulty administering home lumbar traction without assistance. Positioning on the floor is required; thus, the associated mobility demands and the need to self-tighten the harnesses may prove difficult for someone with significant pain-limiting impairments. Lifting and carrying the

Fig 7 ■ 34 Home cervical traction unit.

Fig 7 ■ 35 Home lumbar traction unit.

home lumbar traction unit may present a similar challenge. Most of the pneumatic traction units, whether for the cervical or lumbar spine, have safety valves to prevent potentially injurious tension levels.

The usual intent of providing patients with home traction units is to enhance the effect achieved clinically and empower patients in their recovery. After a beneficial dosage is identified in the clinical setting, tension amounts and durations for home treatment may be replicated with home equipment. Alternately, individuals may attempt self-treatment at their own discretion or possibly by their physician's choice without clinical supervision.

The practitioner should guide the patient carefully through the process of home traction, completing the steps with the home unit while still under clinical supervision. Patient education to avoid causing injury with a home unit is important. Printed or written instructions detailing traction dosage and recommended frequency should be provided to the patient. In addition, patients are to be cautioned to take particular safety measures such as using a timer with an alarm to avoid falling asleep in the traction unit. Prolonged single-session use from patients falling asleep during home traction has been known to significantly exacerbate pain. To minimize the risk of pain worsening from home traction unit use, practitioners must require patients to verbalize their understanding and demonstrate appropriate use of home traction before they initiate self-treatment. Similarly, specific questioning of the response to home traction and any related necessary problem-solving are essential in subsequent clinical visits.

Home units are usually purchased, although some medical equipment providers will allow rental. The simple water bag home cervical traction units are available for as little as $20. Currently, the more sophisticated pneumatic versions emulating clinical models are approximately $400 to $500. The pneumatic lumbar home traction models are approximately $450 to $600. Because of this cost, home traction should not be recommended for patients unless clear benefit is demonstrated from clinical use and several sessions are anticipated for maximum benefit.

In part related to home devices, the effects of traction in water in patients with low back pain and signs of nerve-root compression have also been studied. Subjects accomplished low-magnitude lumbar traction by buoyant devices under the axillae while strap weights were attached to their ankles. Outcomes were also measured in a comparison group using only land-based interventions. The hydrotraction group reportedly had greater pain relief and centralization of symptoms compared to the land-based group. Obviously, great caution is warranted with any attempt of achieving similar traction results using ankle weights in water.[54]

PATIENT OUTCOME EVIDENCE

Despite traction having been a widely used intervention for neck and back pain for decades, strong evidentiary support for its use is lacking. Many studies evaluating traction are methodologically deficient and may not offer meaningful results. Additionally, many of the studies possessing better research designs do not correlate well to routine clinical practice. Thus, the ability to generalize the results in patient care scenarios may be limited.

Multiple studies have used simulated traction or traction at presumably ineffective levels of tension for comparisons against traction at greater and theoretically therapeutic levels of tension.[30,55–59] Although such methods allow allocation concealment to a greater degree, the actual differences in interventions between the groups may be minimized.

Other studies have used traction as the sole intervention,[31] which does not replicate the generally accepted standard of care. In routine clinical practice, patients receiving traction will frequently have complementary interventions such as manual therapy, exercises for key muscle recruitment and strengthening, postural correction, and neural mobilization.[29,33,60–62] Using multiple interventions, however, complicates or precludes isolating any treatment benefit as a result of a single intervention, including traction. The conflict between ideal clinical research and offering best clinical care according to professional judgment may not be easily reconciled in trials. To achieve strong evidentiary support in a study, the preferred study design is to isolate the independent variable of interest. The interaction between interventions or synergistic effects of various treatments, however, may not be appreciated in the results of such study designs.

One of the most frequent methodological issues is the heterogeneity of groups receiving traction in clinical studies. Practitioners have long sought to delineate particular patient characteristics that would predict those responding best to traction. Despite robust design otherwise, multiple studies combine patients with various clinical presentations in the groups being compared.[30,55–58,63–65] Thus, potential benefit in subsets of patients with neck or back pain syndromes who are receiving traction may not be easily recognized. As described earlier, limited evidence remains toward identifying patient characteristics that predict improved responses with traction. Efforts to identify those patients who are most likely to benefit from traction continue in recent and ongoing research.[39,66]

Auto-traction or patient-powered traction was equated to passive traction and has been used as the variable of interest.[56,65] Given the well-documented activation of spinal-supporting musculature with simple limb movements and more complex motor patterns,[67–75] self-traction may be completely ineffective in achieving distraction of spinal structures. In a previously mentioned study,[20] activation of the patient's musculature when performing self-traction easily precluded any distractive effects on the spine. Further, intradiscal pressures have increased during self-traction attempts.[20,21] Thus, considering auto-traction to be equivalent to passively administered traction also gives rise to methodological concerns of whether the interventions are comparable.

A small number of clinical trials, representative of clinical practice, yield conflicting results.[58,76] Case series have been published suggesting value in traction, particularly in patients presenting with signs and symptoms consistent with radiculopathies.[29,60,61] The absence of control or comparison groups, however, limit the ability to assess the effect of traction as the key variable. Additionally, the outcomes of patients receiving traction cannot be easily differentiated from those patients receiving alternative interventions or from the natural history of the disorders.

Recently, two studies have evaluated what the investigators described as traction for the lumbar spine; however, analysis of their mechanical apparatus and forces imparted on the patients reveals a nontraditional delivery of traction. Rather than longitudinal forces applied to the lumbar spine, these investigators applied external forces that lifted the trunk in supine so as to increase the lordotic curve, sometimes with a modest concurrent longitudinal force. The design and outcomes of these studies to date preclude any meaningful interpretation of the results.[77,78]

A noteworthy randomized trial assessed the value for cervical traction by comparing three patient groups of 13 subjects each. All had signs and symptoms of cervical radiculopathy with corresponding imaging results. All three groups received multimodal intervention approaches, including biophysical agents, exercises, and manual therapy. One group additionally received manually applied traction, and another group received mechanical traction. Both traction groups had superior outcomes with less severe neck and peripheral symptoms and less analgesic consumption compared to the non-traction group. The outcome differences were sustained across all assessment points, including at a 6-month follow-up.[79]

Similarly, in a relatively large, recent clinical trial of patients presenting with cervical radiculopathy, the addition of clinical mechanical traction was found to improve outcomes over those completing exercise only or exercise plus simple over-door home traction. The group receiving mechanical traction sustained better outcomes at multiple time points, including 12 months after enrollment.[80]

Recently published systematic reviews and suggested medical practice guidelines[34,35,81,82] have concluded there is minimal evidence for the use of traction to treat patients with neck and back pain. The majority of studies included in the systematic reviews had small numbers of subjects and contained moderate to high risk of bias, limiting their value. However, the conclusions regarding the absence of substantive evidence must be considered within the context of the inadequacy of the research and are generalized for populations, not particular individuals who may respond favorably to traction. Physical therapy clinical practice guidelines describe a modest but limited role for traction in treatment of patients with neck and back pain as part of multimodal intervention approaches.[33,40]

Key Point! Sound clinical reasoning and problem-solving based on individual patient factors remain incumbent on the practitioner in the application and assessment of mechanical traction in a multimodal treatment approach of spinal pain syndromes.

The cumulative evidence for benefit from cervical spine traction in mechanical neck pain syndromes is modestly greater than that for the lumbar spine. Although evidence-based practice and clinical guidelines can assist practitioners in the clinical reasoning processes of patient care, such information does not exclude or minimize the importance of making decisions of care based on the individual patient.

Documentation Tips

For documentation of traction treatment, describing the variables listed in Boxes 7-2 and 7-3 is appropriate. Additionally, describing the patient's responses to traction during the treatment session and immediately afterward while still under observation is recommended.

Clinical Controversy: Spinal Decompression

Fig 7 ■ 36 Lumbar spinal decompression unit.

Spinal decompression has been marketed intensely in recent years as a new method of addressing back and neck pain while yielding remarkable results. Popular media advertising through the radio, newspapers, and the Internet has often been used to promote decompression as a "breakthrough" in the treatment of spinal disorders. Spinal decompression equipment usually imparts cyclical longitudinal force on the spine with the patient lying supine on a tablelike device with a motorized unit (Fig. 7-36). According to the U.S. Food and Drug Administration (FDA), spinal decompression is described differently from traction largely because of a technicality. In the application process for equipment approval, manufacturers must label the equipment according to its presumed effects. Spinal decompression is labeled separately from traction on 510(k) applications to the FDA for marketing medical devices. Also, decompression has been granted a Current Procedural Terminology code apart from traction. These technical differences enhance the ability for marketers to distinguish decompression from traction in media campaigns.

Advocates of decompression claim physiological and biomechanical effects greater than traction, particularly on the intervertebral disc. Decreased or negative levels of intradiscal pressure have been measured in vivo during decompression.[83] Three case series suggested noteworthy improvement levels in patients receiving decompression and are frequently the sources of statistics used in marketing campaigns.[84–86] A systematic review of the clinical trials using decompression reveals that six of the seven studies report no difference in outcomes with spinal decompression; one investigation reported less pain but no change in disability of the subjects.[87] Additionally, the preponderance of the studies evaluating spinal decompression has been of relatively poor methodological quality. This is exemplified in a recently published retrospective case series with no long-term follow-up.[88]

Manufacturers and some professional groups openly promote decompression services as a means of increasing practice revenue at minimal effort. Assistant staff members, typically without substantive training in treating spinal disorders, are often used to administer the decompression to patients over a course of approximately 20 visits without requiring the time and effort of the supervising practitioner. As discussed among some practitioners, decompression's primary benefit to the practitioner is the increase in cash-paying patients. Strategies emphasizing the aesthetic qualities of decompression devices are often used in marketing to the public without regard to evidence of efficacy.[89] The lack of evidence in the current literature has led to the conclusion that spinal decompression has not been validated to be a superior intervention to traction.[82,90]

Inversion

One method of providing a distractive effect on the low back that does not require a clinical setting is the use of inversion devices, which allow gravity-facilitated traction. Home inversion equipment is available without prescription or assignment by practitioners. With many of these devices, the individual sits in a frame and then secures the lower extremities and pelvis with straps. The device can be unlocked and the person can invert body position such that the upper trunk weight is distracted from the secured pelvis and lower extremities. Inversion is remarkably simple and documented to increase lumbar intervertebral space immediately after the procedure.[91]

The inverted position, however, can have other unintended effects. Major increases in intraocular pressure leading to optic nerve dysfunction have been observed.[92,93] In addition, significant alterations in blood pressure has also been observed.[94–96] Anxiety while inverted is also common.[97] Inversion would not be an ideal choice for persons with histories of dizziness or vertigo. The physical demands to safely invert one's own body and then carefully return to an upright position are also a necessity for this process and may not be easily accomplished by some persons, particularly those in significant pain. Thus, safety and adverse effects are an issue, particularly when these devices are used without assistance or supervision.

A recent pilot study compared two groups of patients with single-level lumbar disc herniations. One group received physical therapy and the experimental group received physical therapy in addition to using a home inversion unit. A noteworthy reduction in surgeries was reportedly achieved in the inversion group compared to the physical-therapy-only group. On detailed review of the study results, however, none of the pain scales, functional outcome measures, or imaging results differed in the two groups. Thus, the implication of clearly superior outcomes in the inversion group (as stated in some promotional materials) must be interpreted cautiously.[98]

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