THE CHARLESTON BENDING BRACE

AN ORTHOTIST'S GUIDE

TO
SCOLIOSIS MANAGEMENT

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The History of Sidebending As A Scoliosis Treatment

Non-operative treatment of scoliosis has a long and diverse history. The method of sidebending as an orthotic treatment, while having such a lengthy past, has been a durable technique that remains in use today.

The Kalibis splint, also called the "spiral bandage", was one of the earliest reported orthosis for scoliosis treatment found in the medical literature. Several braces designed in the nineteenth century by German orthotists Heine, Hessing, and Hoffa bear remarkable similarities to later designs by Barr-Buschenfeldt. Probably the most successful and widely accepted sidebending device was the Risser turnbuckle cast, reported in the United States in 1931 by Hibbs, Risser and Ferguson. During the 1970s Lawrence Brown, M.D., of Greenville, South Carolina, utilized a bending brace in a full-time wear program. (*Fig. 1*)

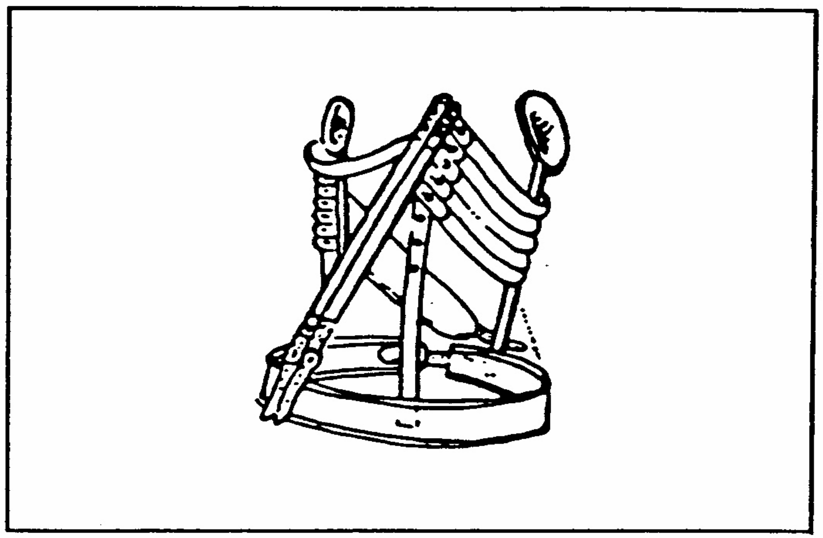


Figure 1

Sidebending orthosis are found throughout historical medical literature; bearing out the fact that, while subject to hardware development, the method of sidebending is an effective technique for scoliosis treatment…a technique with a past, as well as a future.

The Charleston Bending Brace

Early Development of the Charleston Bending Brace

Ralph Hooper, C.P.O. and Frederick Reed, M.D. of Charleston, South Carolina, collaborated on the early development of a new sidebending orthosis for nocturnal wear. This new brace was first fabricated in 1978 in Charleston for treatment of idiopathic adolescent scoliosis. Originally the new orthosis was used to treat patients in which other types of orthotic management had failed; patients who continued to show progressive curvatures, but whose skeletal maturity obviated full-time bracewear, and patients who had refused other treatment options. In these cases, time-modified bracewear seemed preferable to complete non-compliance, for obvious reasons.

In 1984 an investigational team was formed to study lateral bending time-modified bracewear. Team members included: Frederick Reed, M.D. of Charleston, South Carolina; Ralph Hooper, Jr. of Winter Park, Florida; Max F. Riddick, M.D. of Winter Park, Florida; and Charles T. Price, M.D. of Orlando, Florida.

Charleston Bending Brace Objectives

The goals of the Charleston Bending Brace program are to maintain the patient's scoliotic curvatures at, or near, pre-brace values throughout the growth period and on to skeletal maturity. Other goals are to promote better bracewear compliance through the nocturnal wear aspect. This component alone may reduce patient and family conflict, while helping to eliminate negative self-image problems associated with bracewear in adolescents.

The Advantages of the CBB Program

There are several distinct advantages to the Charleston Bending Brace program, nearly all of which are related to the nightwear component:

1. Allows full, unrestricted musculoskeletal development.
2. Allows opportunity for athletic participation, if desired.
3. Causes fewer and less severe complications.
4. Delayed complications are negligible, since brace is worn less time than not.
5. Results can be assessed without the customary long-term follow-up.
6. Decision-making regarding success or failure of the program can be made earlier.

Sidebending Theory

The factors contributing to the success of time-modified sidebending are unclear. Stretching the concavity and possibly a physiological contracture on the convexity of the curvature appears to play a role. Visuospatial impairment, EEG, and learning deficit disorders have all been identified in patients with scoliosis. Vestibular, cerebellar and posterior column function may be challenged by re-orientation of body position.

In theory, bending of the spinal column should add tensile and opposite compression forces to the vertebral epiphyses compared with forces at work in the upright posture. The benefits of uncompromised postural muscle tone during upright activities and the opportunity for the patient to remain athletically active during their brace course may enhance the phenomenon of spontaneous curve correction that occurs on a day-to-night basis.

All bracing systems depend on the nocturnal wear component as part of their programs. There are no harmful physiological, biomechanical, or clinical effects noted in the nocturnal wear program. With documented successful outcomes, the positive aspects of the Charleston Bending Brace system are evident even if the reasons for a success are not entirely clear.

Guidelines for Use

Single curves are the easiest curves to treat with sidebending because inadvertently increasing a secondary curve through bracing is not a concern. The single curve can be aggressively reduced in the CBB. Patients with single curves are considered the best candidates for treatment with the greatest likelihood of positive outcomes.

Treating double curves with the CBB is considered an advanced technique. Double curves respond well when treated correctly but a high level of expertise and care are required in the molding and fitting processes. It is important to designate the primary and secondary curves beforehand when bracing double curves in the CBB. The primary curve is always the curve that is "unbent".

Curvatures of 25 degrees to 40 degrees fall within standard orthotic treatment guidelines. There are no contraindications recognized for treating curves outside these parameters due to the high level of patient acceptance of the CBB program and many documented successful courses.

Concurrently, standard orthotic management of scoliosis calls for treatment of only skeletally immature curves. Some skeletally mature patients have benefited from CBB treatment. This is also reflected in the reporting.

Clinical Examination

A clinical examination is always conducted by the orthotist prior to the casting session. Patient flexibility can be assessed and a reasonable prediction of in-brace results may be determined from the clinical exam. This is also a good time to gauge the patient's tolerance level and take appropriate action to alleviate fears and anxieties in order to help the procedure go smoothly.

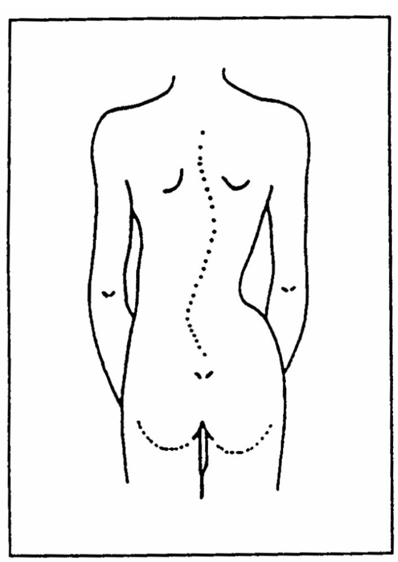


Figure 2a

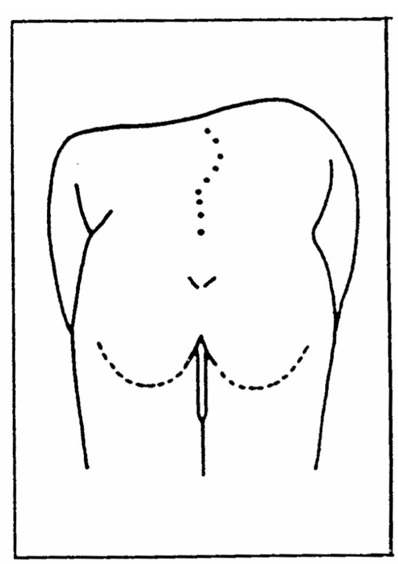


Figure 2b

Forward Bending – Have the patient stand facing away from you with weight equally distributed on both feet. *(Fig. 2a)* With arms extended and palms together, bend the patient forward to 90 degrees and stop. *(Fig. 2b)* Observe and note trunk rotation. Ask the patient to try and touch the floor to evaluate hamstring tightness.

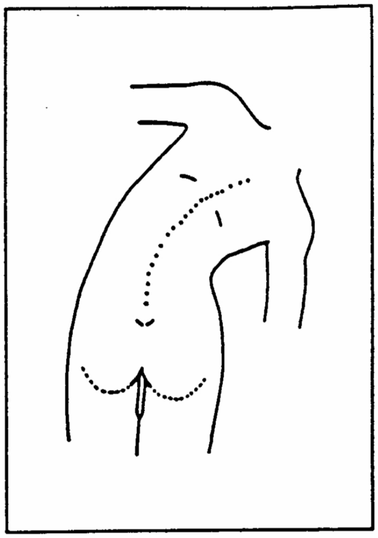


Figure 3a

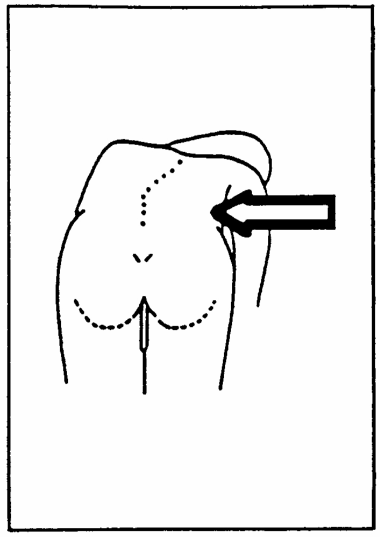


Figure 3b

Have the patient stand upright and then bend laterally at the waist. *(Fig. 3a)* Note how much range the patient has. Now place your hand at the apex of the curvature. Ask the patient to bend laterally a second time. Apply resistive force at the apex. *(Fig. 3b)* This is to determine relative flexibility or stiffness.

Radiography

Full-length standing PA X-rays are necessary for the patient evaluation and brace planning. Films should include the full spine and the iliac crests. Bending films are helpful for evaluation but are not necessary for brace "blueprinting". X-rays should be carefully marked "left" or "right", by the technician. All in-brace x-rays should be taken in the supine position.

If indicated, it should be explained to parents that modern X-ray techniques limit exposure through advanced equipment, special grids and high-speed film.

"Blueprint" the Brace

The "blueprint" is an essential resource for the orthotist during the CBB molding and fabrication processes. Several lines and angles are constructed on the X-ray to determine where the corrective forces should be applied both during the molding and at brace application. Center Line—the center line is a vertical drawn on the X-ray indicating where the patient's spine would be if it were straight and free from scoliosis.

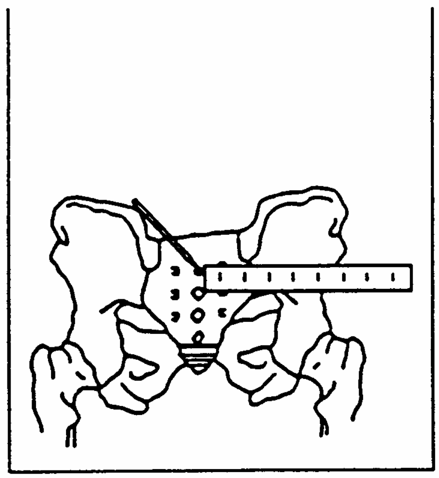


Figure 4

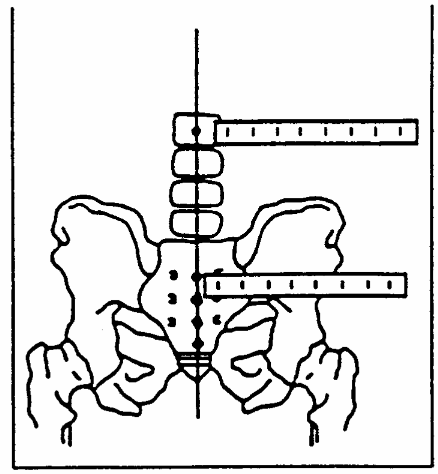


Figure 5

(Sacrum visible) Locate and mark a spot at the center of S-2. With a straight edge, measure the distance from the mark to the edge of the X-ray. *(Fig. 4)* At a point several inches above S-2, make a second mark that same distance from the edge of the X-ray as the first mark. Draw a vertical line through the marks. This line is the center line *(Fig. 5)*.

Vertebral Tilt Angle—The vertebral tilt angle *(Fig. 8a)* is formed by the intersection of a line perpendicular to the center line *(Fig. 8b)* and a line drawn across the inferior endplate of a selected vertebral body. *(Fig. 8c)* The vertebral tilt angle is useful in determining the limits of each scoliotic curve and to properly measure the Cobb Angle.

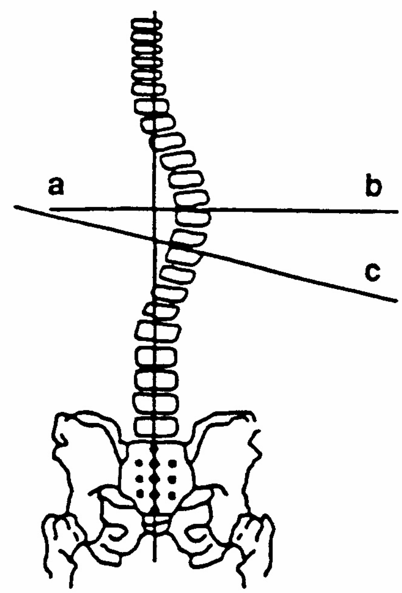


Figure 8
VERTEBRAL TILT ANGLE

Pelvic Tilt Angle—The pelvic tilt angle is formed by the intersection of a line drawn perpendicular to the center line *(Fig. 9a)* and a line across the superior edge of the iliac crests. *(Fig. 9b)* The angle formed by the intersection of the two lines is the pelvic tilt angle. *(fig. 9c)* The line perpendicular to the center line may be "lowered" until an angle is formed.

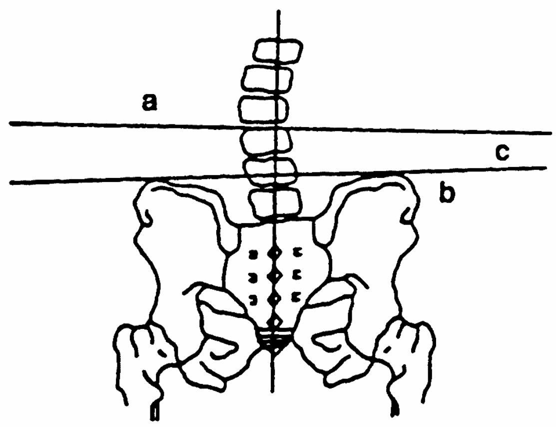


Figure 9
PELVIC TILT ANGLE

Lumbar/Pelvic Relationship Angle (LPR)—The LPR is the angle formed by the intersection of the pelvic tilt line *(a, Fig. 10)* and the vertebral tilt line of L-3, L-4, or L-5 individually *(b, Fig. 10)*. A maneuver aligning the lumbar/pelvic segment may be needed if the LPR is greater than 15 degrees.

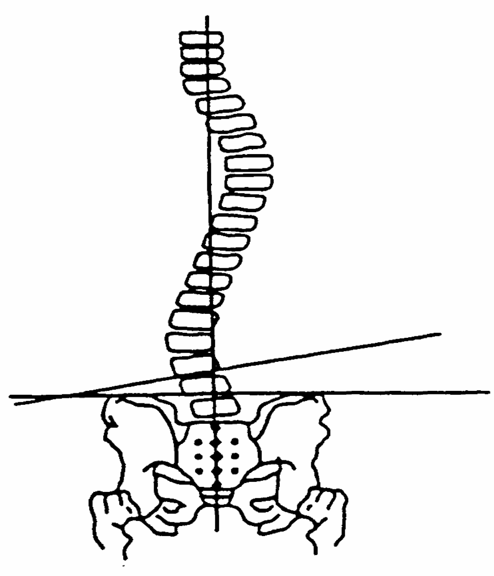


Figure 10
LPR ANGLE

The Cobb Angle—The first step in determining the Cobb angle is to locate the superior and inferior bodies in curvature.

1. Locate and draw a center line on the X-ray *(a, Fig. 11)*.
2. Draw a vertebral tilt line for each vertebra *(b, Fig 11).*
3. Find the null point by locating a vertebral tilt line, which is perpendicular to the center line. If no vertebral tilt lines are perpendicular to the center line, draw a line perpendicular to the center line, which lies equidistant between the two most nearly perpendicular lines. This line will represent the null point *(c, Fig. 11)*.

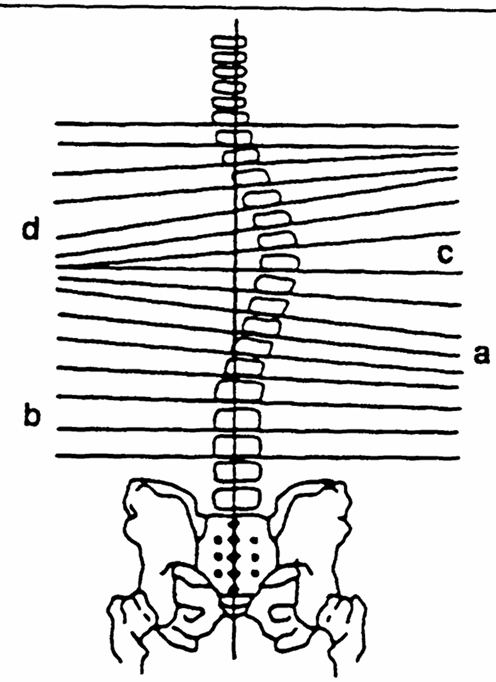


Figure 11
CURVE LIMITS

Begin at the null point and measure the vertebral tilt angles of each successive superior vertebra. As long as the angle increases, the vertebral body is included in the curve. The first vertebra with a lesser tilt angle is not included in the curve. To locate the most inferior vertebra in the curve, follow the same procedure and travel in the inferior mode. After locating the superior and inferior vertebral bodies in the curve, draw a line across the superior endplate of the superior vertebra and another line across the inferior endplate of the most inferior vertebra. *(d and e, Fig.11)*

Draw a perpendicular to each line and measure the angle *(Fig. 12a)* formed at the intersection. This angle represents the Cobb Angle.

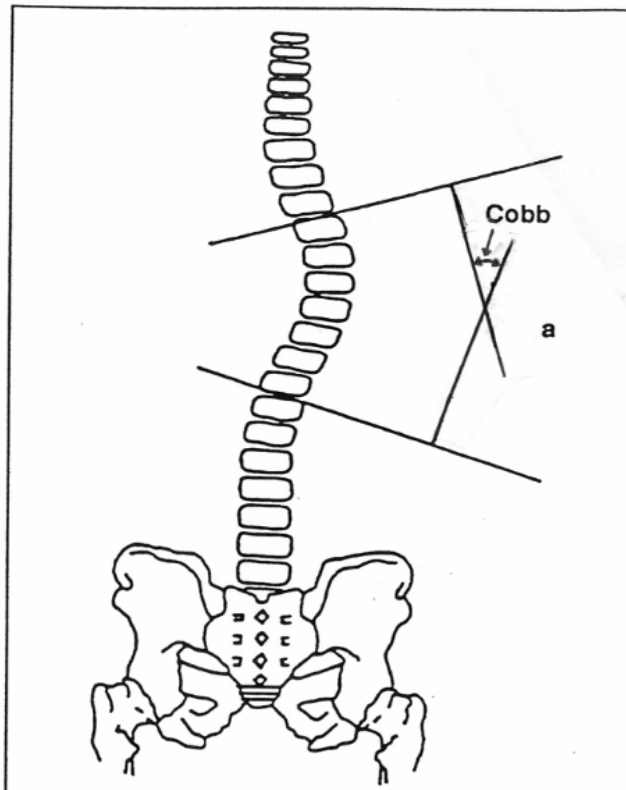


Figure 12
COBB ANGLE MEASUREMENT

Definitions of Terms

Lateral Shift Force: Laterally directed force with 10 degrees to 15 degrees of angulations from the perpendicular, applied to the apex of the primary curve. Lateral shift force must be sufficient to move the spine beyond the center line to a point which is equidistant to, and opposite, the original position and to maintain this position during unbending. This force is the single most important force in the curve correction process and should never be compromised. *(Fig. 13b)*

Stabilizing Force: Force applied opposite to the lateral shift force at the trochanter or the apex of a lumbar curve. The intensity of the stabilizing force is dictated by the strength of the lateral shift force. *(Fig. 13b)*

Unbending Force: The unbending force is the final force applied and is the main curve reducing force. Pressure is applied at the axillary region opposite the curve's apex. *(Fig. 13c)*

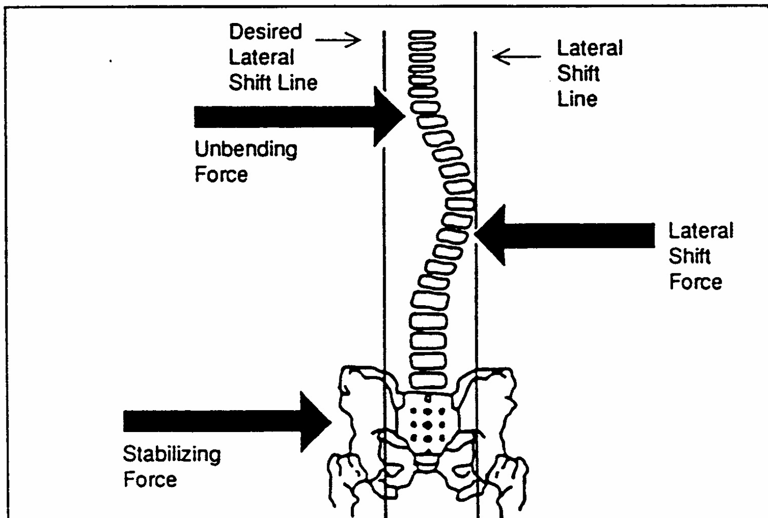


Figure 13
DEFINITION OF TERMS

Secondary Unbending Force: An advanced technique in which stabilizing force is applied at the apex of a lumbar curve, shift force is added at the apex of the thoracic curve, and unbending force is exerted at the axilla opposite the apex of the thoracic curve. The secondary unbend is made at the trochanteric region opposite the stabilizing force as an additional corrective measure. *(Fig. 13d)*

Maxims for Curve Correction Technique

Effective scoliosis management with the Charleston Bending Brace calls for careful, consistent curve reduction technique. Several keys to proper curve nomenclature and control should become part of the orthotist's basic knowledge. Confidence in, and use of, these maxims will enable the orthotist to produce an accurate mold with relative ease, thereby ensuring a satisfactory result.

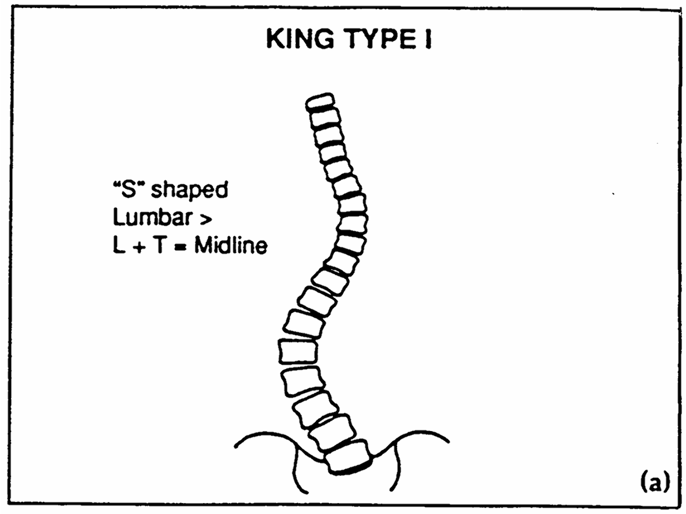
King's Classification of Scoliotic Curvature was originally developed as a pre-operative technique for selection of spinal fusion segments in scoliotic surgical patients. Now, King's Classification is an integral part of the Charleston Bending Brace system, but for a different purpose. The use of King's Classification allows practitioners a standard nomenclature for curve identification. With this common terminology, instruction and feedback are effectively passed between orthopedist and orthotist.

King's Classification refers to five categories of scoliotic curvatures, with each having a distinct appearance and form. The requisites for each category are easy to learn and use, even if the practitioner has been accustomed to another arrangement.

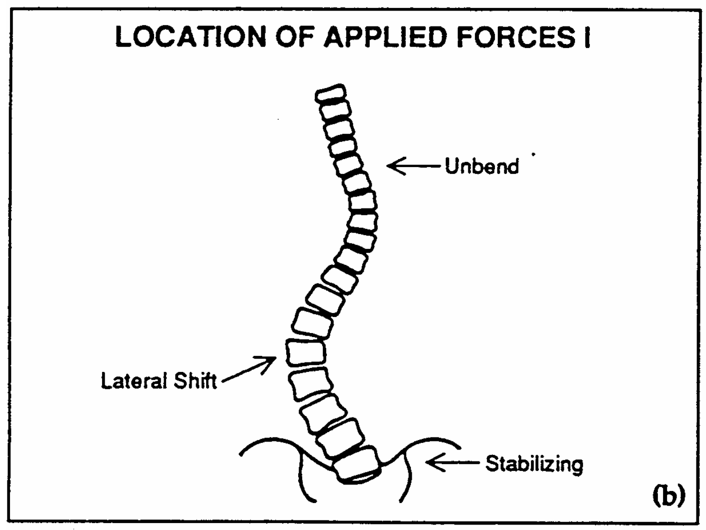
Curve Patterns

	Criteria
Type I	S-shaped curve in which both thoracic curve and lumbar curve cross midline Lumbar curve larger than thoracic curve on standing roentgenogram
Type II	S-shaped curve in which thoracic curve and lumbar curve cross midline Thoracic curve > lumbar curve
Type III	Thoracic curve is which lumbar curve does not cross midline (so-call overhang)
Type IV	Long thoracic curve in which L5 is centered over sacrum but L4 tilts into long thoracic curve
Type V	Double thoracic curve with T1 tilted into convexity of upper curve Upper curve structural on side-bending

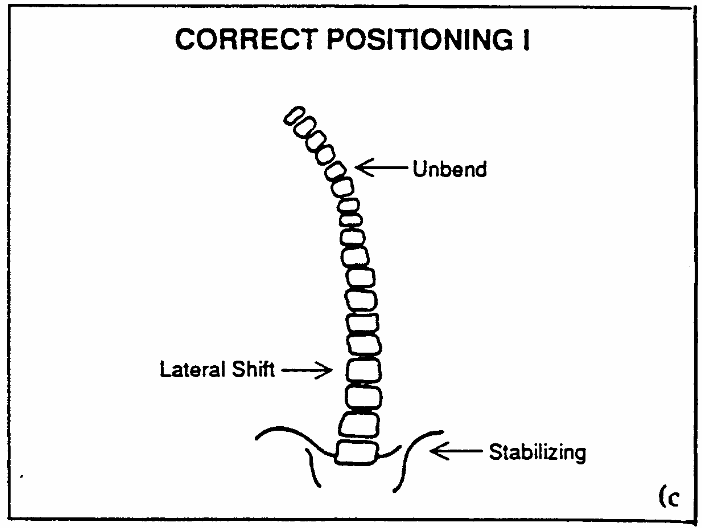
King Type 1 curvatures are "S"-shaped curves. Both the thoracic and lumbar components cross the midline. On standing X-ray, the lumbar curve is larger than the thoracic curve. Even though the lumbar curve is greater in magnitude, the thoracic curve is more flexible. These double curves are treated as lumbar curves. *(Fig. 14a)*



Measure the Lumbar/Pelvic Relationship Angle of L-3, L-4, and L-5. If any of these individually are greater than 15 degrees, elevate the pelvis on the concave side of the lumbar curve to align the lumbar column properly. *(Fig. 14b)* Apply stabilizing force to the trochanter opposite the apex of the lumbar curve.

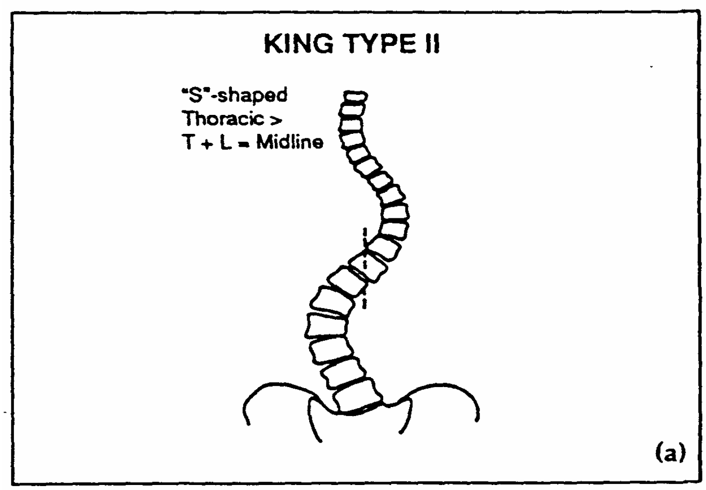


Add lateral shift force to the apex of the lumbar curve with sufficient force to move the spine beyond the midline to a point equidistar to, but opposite, the point of origin. Apply the unbending force to the axillaries region opposite the apex of the lumbar curve. Take care not to let the unbending force compromise the lateral shift force. At brace fitting, trim the brace to the apex of the thoracic compensatory curve or to a point slightly above it. *(Fig. 14c)*

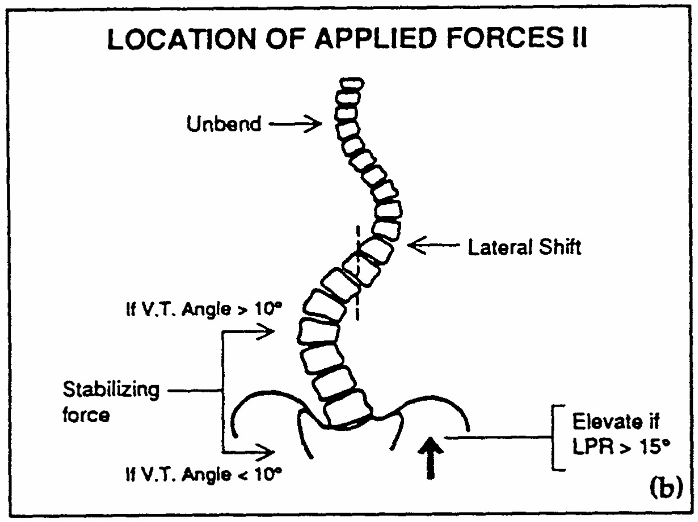


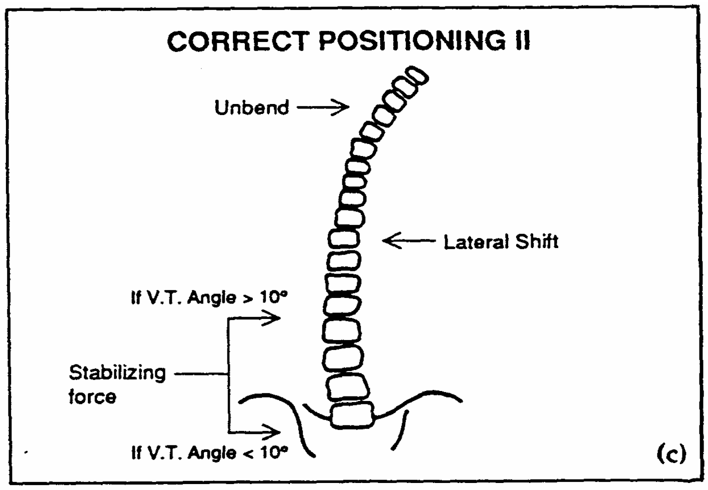
King Type II curvatures are also "S"-shaped. Again, both the thoracic and lumbar components cross the midline. The thoracic segment measures greater than or equal to the lumbar portion but the thoracic curve is more flexible. Stabilizing the lumbar curve and unbending the thoracic segment best treat these curves. (*Fig. 15a)*

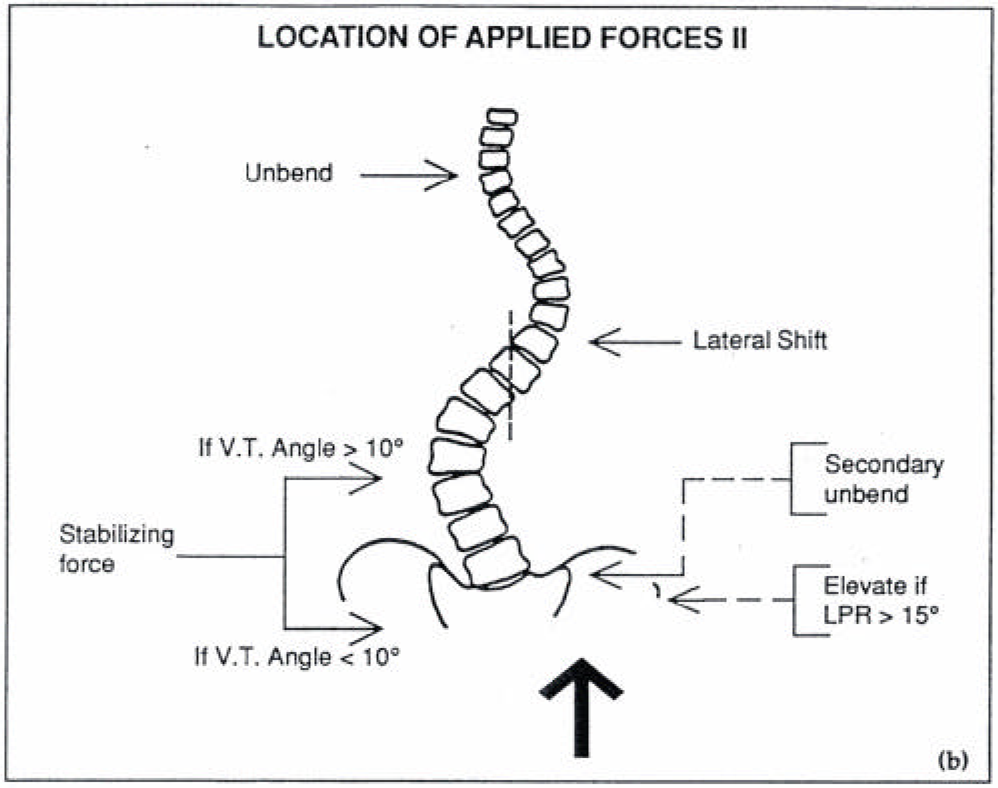
Measure the vertebral tilt angle of L-3, L-4, and L-5. If the VTA of any of these three, individually, is greater than 10 degrees, then apply the stabilizing force at the apex of the Lumbar curve. If the VTA of these entire vertebra measures less than 10 degrees, apply the stabilizing force at the trochanter. Measure the LPR angle of L-3, L-4, and L-5. If any of these angles individually measures greater than 15 degrees, elevate the pelvis on the concave side of the Lumbar Curve. Apply a lateral shift force at the apex of the Thoracic curve and shift beyond the midline as much as possible (applying substantial pressure).



Apply an unbending force in the axilla region but be careful not to compromise or overpower the lateral shift force. If the LPR angle of L-3, L-4, or L-5 is greater than 10 degrees, then apply a secondary unbending force at the trochanter opposite the stabilizing force. This secondary unbending force is the last force applied and is a laterally directed force. *(Fig. 15b)*


LOCATION OF APPLIED FORCES II
Unbend
Lateral Shift
If V.T. Angle > 10°
Stabilizing force
If V.T. Angle < 10°
Elevate if LPR > 15°
(b)


CORRECT POSITIONING II
Unbend
Lateral Shift
If V.T. Angle > 10°
Stabilizing force
If V.T. Angle < 10°
(c)

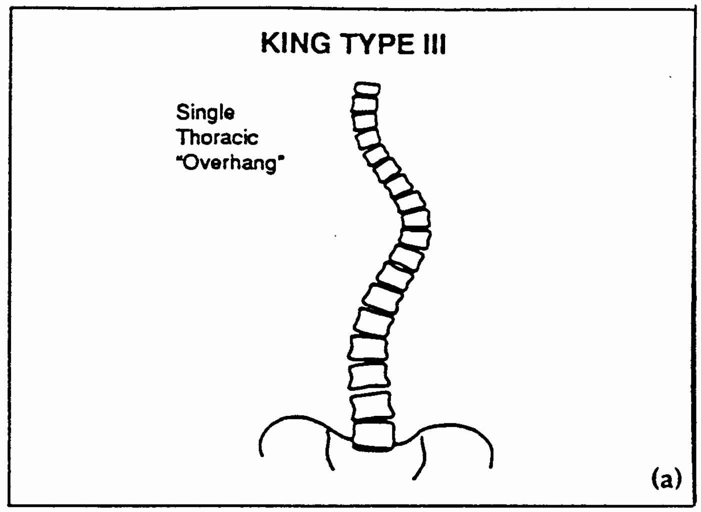


Location of applied forces when secondary unbend is used.

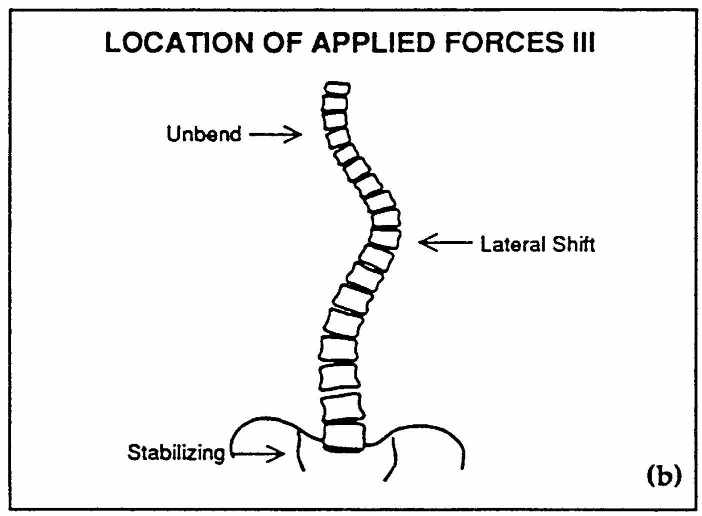
If the thoracic and lumbar curves are at 20 degrees or less and within 5 degrees of each other, treating a King I as a King II is appropriate. An in-brace thoracic curve should be corrected to 100% and the lumbar curve to 50%, in-brace x-ray. If the thoracic is 27 degrees or greater trim the unbend to the thoracic apex; under 27 degrees, leave the unbend high for maximum correction of the lumbar. If progression occurs, then trim to the thoracic apex. A lumbar curve of 35 degrees or greater should always be treated as a King I curve to control the lumbar curve. Always consider Risser age, curve degrees, menses, and family history in deciding treatment.

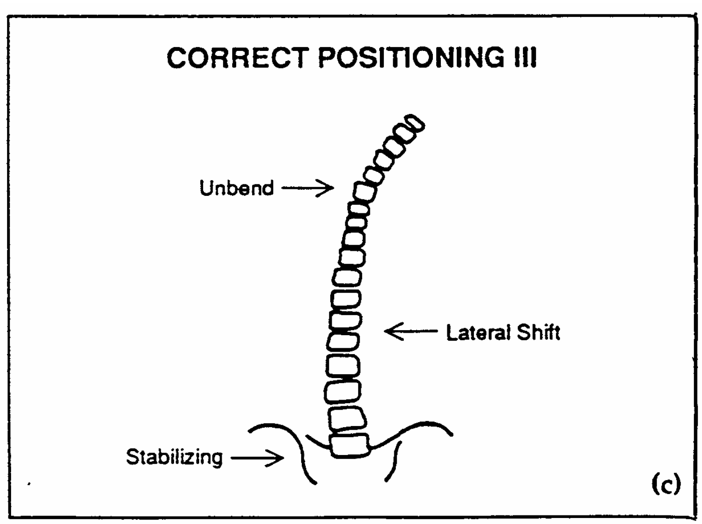
King Type III curvatures are essentially thoracic curves. The lumbar segment does not cross the midline in Type III. This pattern presents the so-called "Overhang: appearance. Type III curves generally present little difficulty in treatment. *(Fig. 16a)*

The correction method for Type III is less difficult than Type II because by definition the Lumbar vertebra will not cross the midline or tilt in the opposite direction of the curve or it will be a Type II curve. However, we still measure the LPR angle and the VT angle to confirm our diagnosis. In some instances the LPR angle may be greater than 15 degrees if the pelvic tilt angle is unusually large.



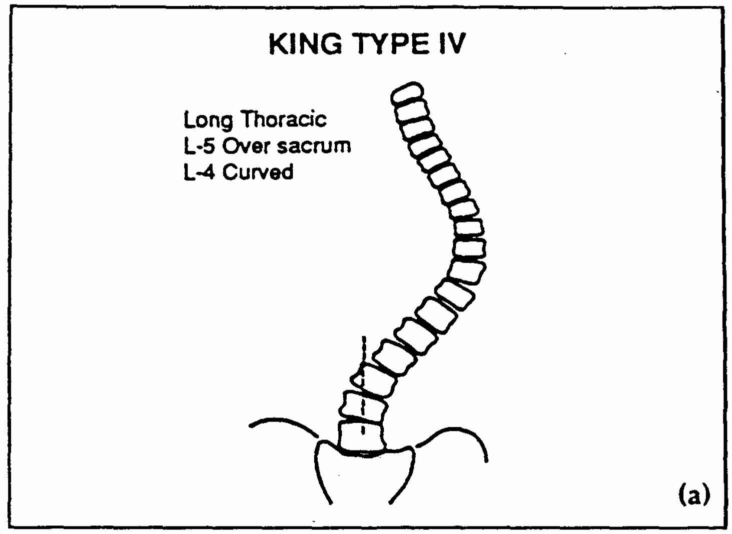
The location of forces applied is to apply the stabilizing force at the trochanter and then the lateral shift force at the apex of the thoracic curve, shifting beyond the midline as far as possible. Last apply the unbending force in the axilla region opposite the L.S. force being careful not to compromise or overpower the L.S. force.



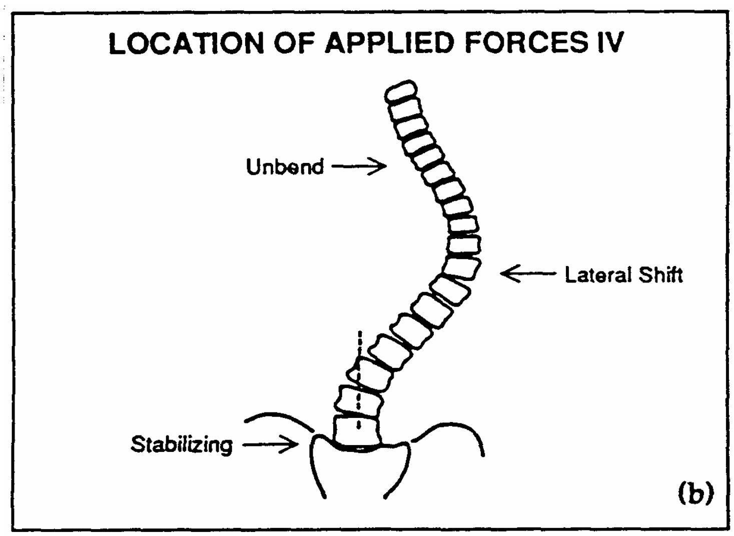


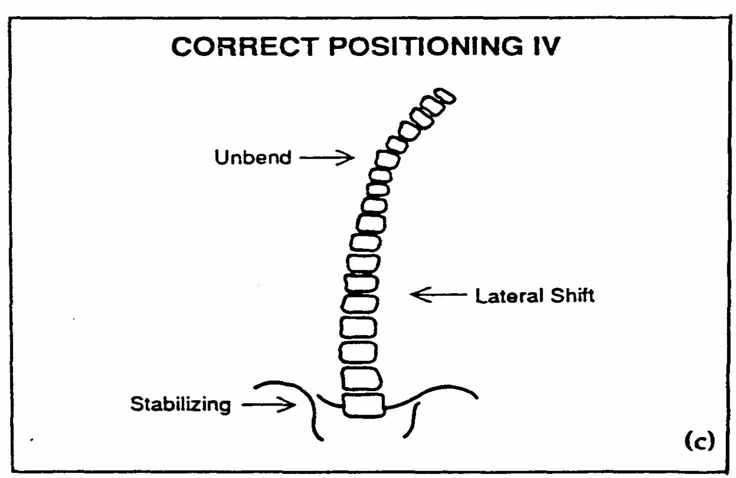
King Type IV scoliosis is characterized by long thoracic curves in which the body of L-5 is centered over the sacrum but the body of L-4 is tilted into the curved segment. These curves are best treated as thoracolumbax curves, but emphasis should be placed on shifting the spine to the midline then unbending. *(Fig. 17a)*

In a Type IV curve there is no need to measure or consider the LPR angle or the VT angle because, by definition of curve types, they will not be a factor. This type curve is a single curve with L-4 tilted into the curve.

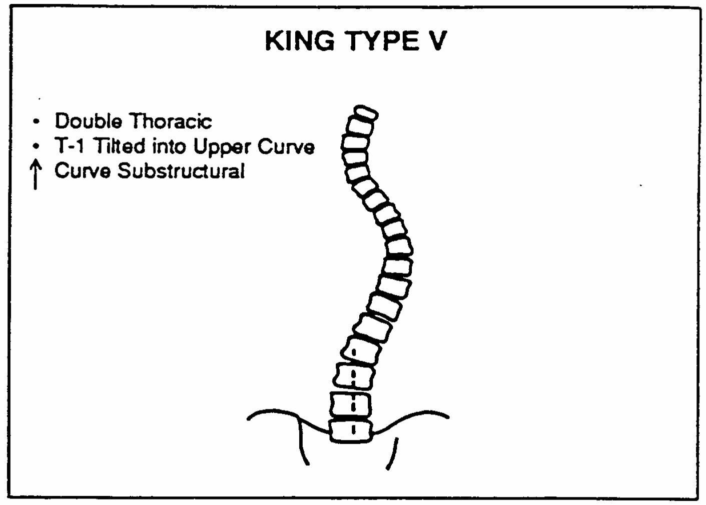


The location of forces for a Type IV curve is to apply the stabilizing force at the trochanter opposite the apex of the thoracic curve, apply the lateral shift force at the apex of the curve and shift laterally beyond the midline as great a distance as possible. Apply the unbending force in the axilla and unbend, being careful not to compromise or overpower the L.S. force. *(Fig. 17b)*

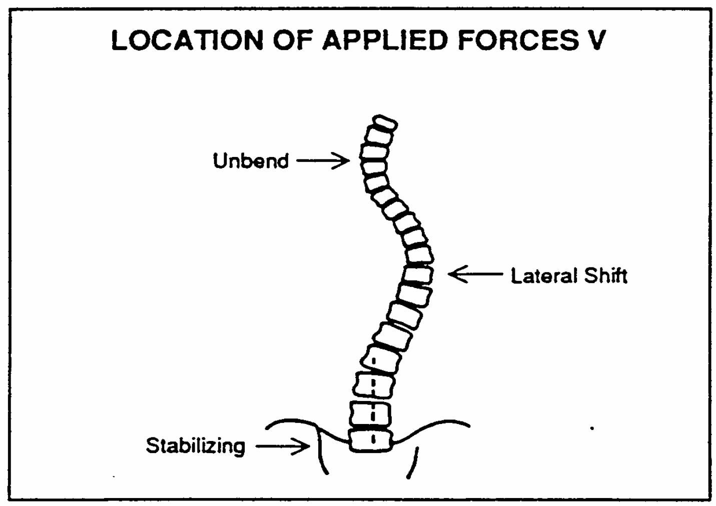


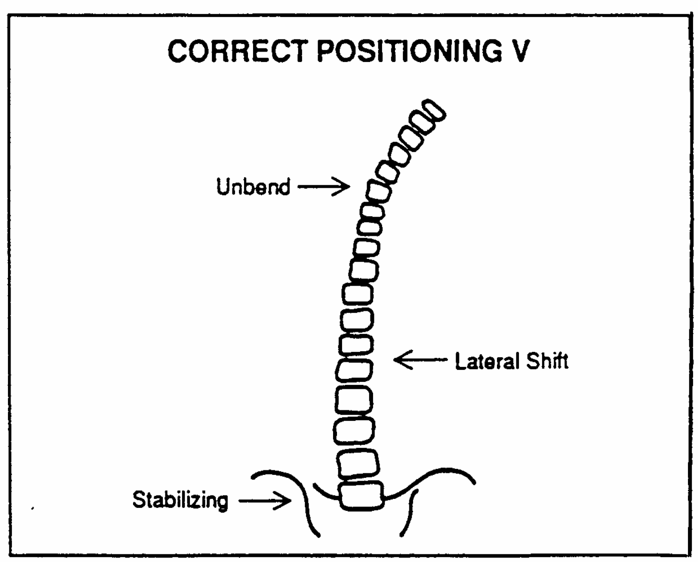


King Type V curvatures are double thoracic curves with the body of T-1 tilted into the concavity of the upper curve. The thoracic segment appears to be structural on X-ray. Type V curvatures are treated as thoracic curves. *(Fig. 18a)*



The curve correction technique is identical to that used in Type IV curvatures. *(Fig. 18b and 18c)* Start by applying stabilizing force at the trochanter opposite the apex of the thoracic curve. Then add lateral shift force to the apex of the thoracic curve, using sufficient force to move the spine beyond the midline to a point equidistant to, but opposite, the original starting position. Finally, add unbending force to the axilla opposite the apex of the thoracic curve.





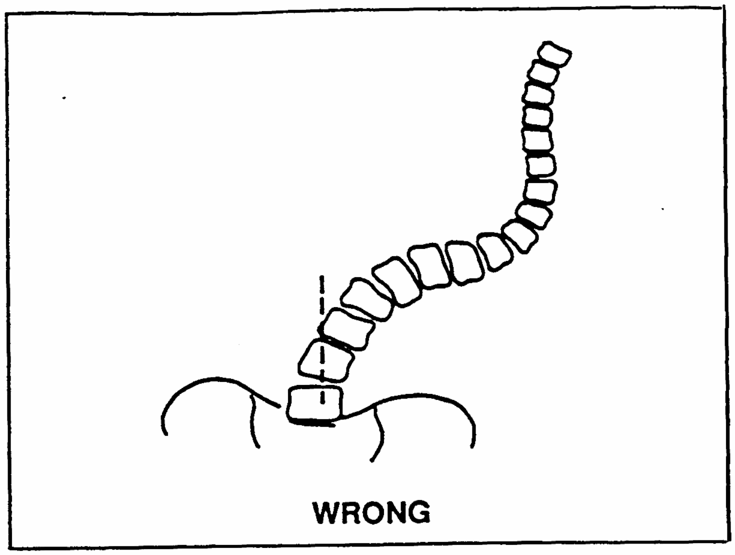


Figure 19

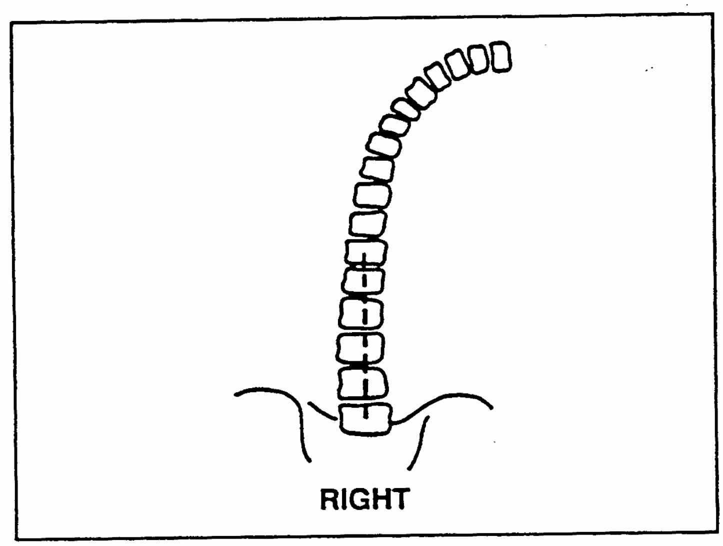


Figure 20

When applying stabilizing, shifting and unbending forces to the spinal column, it is paramount that the forces be balanced so that gross decompensation, with little or no curve correction, is avoided. Properly distributed forces are essential to successful curve reduction. Unbending forces should not be applied until the lumbar column has reached the midline. *(Fig. 19 and 20)*

Casting Procedures for the Charleston Bending Brace

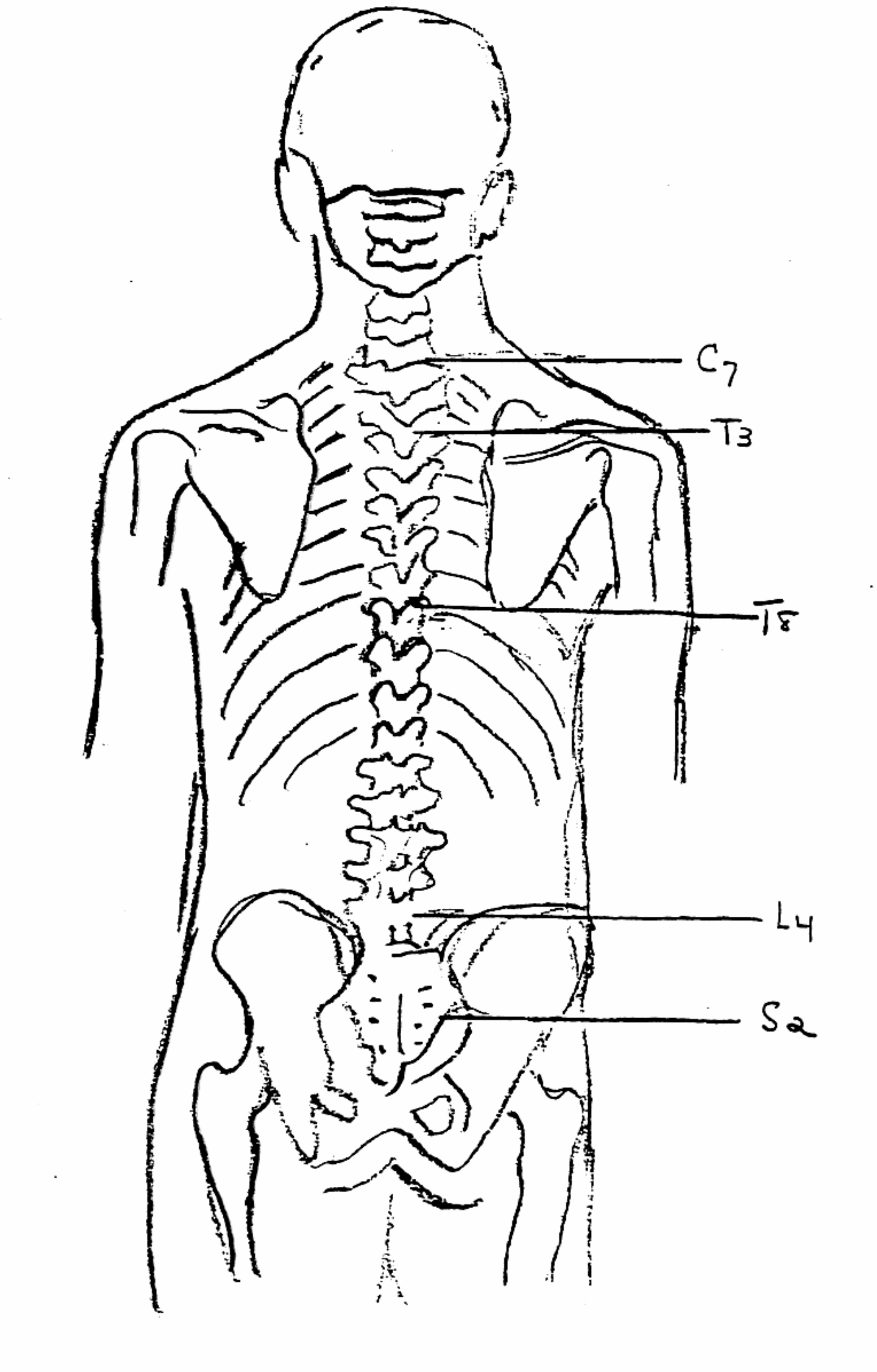
Casting Procedure

These instructions are an informational supplement for the orthotist who has received prior training in the Charleston Bending Brace system. This written instruction should not be used as a comprehensive guide for the practitioner who is unfamiliar with the CBB casting procedure. The Charleston Bending Brace casting procedure bears many similarities to other casting methods.

1. Place two (2) layers of smooth, well-fitted stockinettes on the patient's torso. If synthetic casting materials are to be used, cover the axillary area also.
2. Determine where the apex of the bend should be by studying the X-ray carefully.
3. Use information from the clinical exam to determine the patient's flexibility and readiness for the procedure.
4. Measure circumferences at the waist, ASIS, xyphoid and axilla.
5. While the patient is sidebending, measure the distance from the axilla to the trochanter on the convex side of the curve.
6. Have the patient stand close to the wall for balance and support. The feet should be one (1) foot from the wall, hip-width apart. Place the hands above the head on the wall at equal heights. The patient should be looking toward the wall. The practitioner should check for trunk rotation or excessive lumbar lordosis.
7. Place muslin straps over each iliac crest and have the patient stand on muslin ropes. Tighten the ropes until the patient's pelvis is well defined, noting that the pelvis is "square" with the footboard or floor.
8. If indicated, use foot blocks to induce pelvic tilt.
9. Mark the ASIS.
10. A. Cast with plaster or synthetic, use 6". Cast from top to bottom. Start high on the axillary with a snug wrap. Follow down overlapping ½ of the previous roll, ending inferior to the gluteal fold.
    B. Watch for roping of casting materials. Check for trunk rotation, knees straight or equally bent.
11. After the mold is completely set, loosen and unhook the iliac crest straps. Be careful not to distort the mold.
12. Remove the cast once it has set. Cut the outer stockinette. The cast must be thick enough to disallow distortion when removing.
13. Remove the stockinette from inside the plaster shells.
14. Carefully pack the mold for shipping. Ship it to Sea Fab with copies of the X-ray, Patient Data Form and Measurement Form with King Classifications.

Equipment/Materials Needed

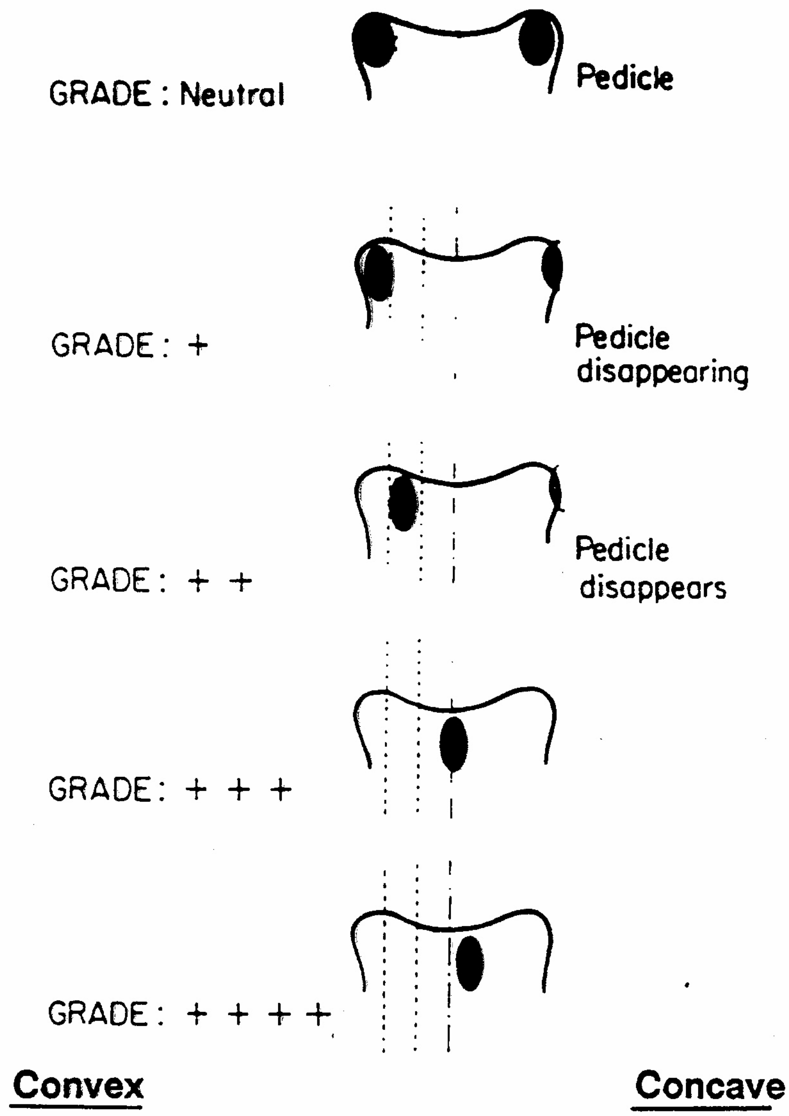
Stockinette to cover the body, twice, from shoulder to mid-thigh
6" plaster or flexible synthetic (Delta Lite)
Muslin strips for Iliac crest
Tape measure
Measurement form
Marking pencil



TCH:CFM

Figure 21

BONY LANDMARKS



Pedicle method of determining vertebral rotation

	Pedicle Convex	Concave
Grade: Neutral	No asymmetry.	No asymmetry.
Grade: +	Migrates within first segment. Early distortion.	May start disappearing. Early distortion.
Grade: ++	Migrates to second segment.	Gradually disappears.
Grade: +++	Migates to middle segment.	Not visible.
Grade: ++++	Migrates past mid-line to concave side of vertebral body.	Not visible.

Figure 22

PEDICLE ROTATION

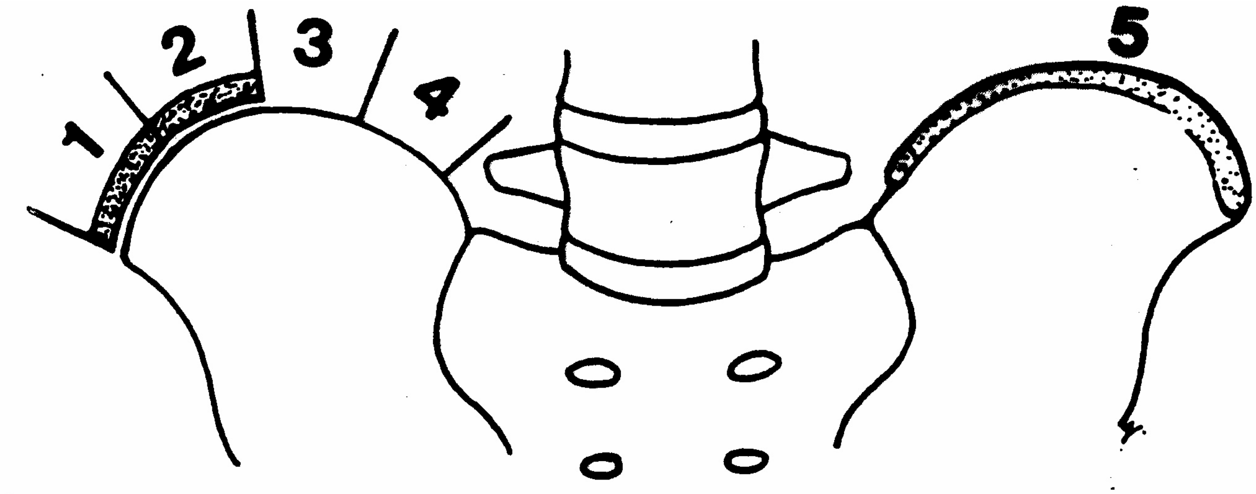


Figure 23

RISSER SIGN

Brace Fabrication and Quality Control

Because X-ray interpretation and cast modification are critical to the brace manufacturing process, a specialized and highly trained source is required for fabrication. The exclusive manufacturing and quality control responsibility for the Charleston Bending Brace has been assigned to SEA FAB, INC. SEA FAB, INC. also coordinates data accumulation and management in cooperation with Charleston Bending Brace Seminars.

Brace Fitting and Check-Out

When the new CBB is received, careful attention to trim and fit requirements are the responsibility of the attending orthotists.

1. Place the patient in the supine position.
2. Have patient roll into the brace while at the same time, bending to conform to the braces corrective shape.
3. Locate the waist indentation on the brace and position it between the patient's ribs and iliac crests.
4. Fasten the Velcro straps and evaluate the axillary trim. Trim for maximum axillary pressure. The patient should be able to lower the arm completely without discomfort.
5. On the conceive side of the brace, the proximal edge of the brace should lie at the apex of the curve. If the trim is too high, the patient will be allowed to bend over the apex of the curvature and the amount of curve correction will be compromised.
6. Trim the antero-proximal edge of the brace for breast relief.
7. The antero-distal trim line should be at or slightly proximal to the gluteral fold. If the trim is too high, the patient will experience discomfort.
8. The postero-distal trim line should be at or slightly proximal to the gluteral fold. If the trim is too high, the patient will experience discomfort.
9. The postero-proximal trim line should describe a smooth diagonal line transitioning form the high, convex side of the brace to the lower concave side.

Caveats Regarding the Initial In-Brace X-ray

The measurement of the soliotic curvature in-brace is a means of comparing the visible effects of treatment with the state of the anatomy before treatment. The measurement itself is a relative comparison with the original condition but is not an active component of the treatment itself.

The Cobb measurement has been the generally accepted standard of scoliosis measuring techniques. After application of the Charleston Bending Brace, the Cobb Measurement may be "O" degrees, though technically this is not a true Cobb reference. *(Fig. 24)* The endplates used, as reference points may arguably be invalid, after the shape of the curve has been completely changed.

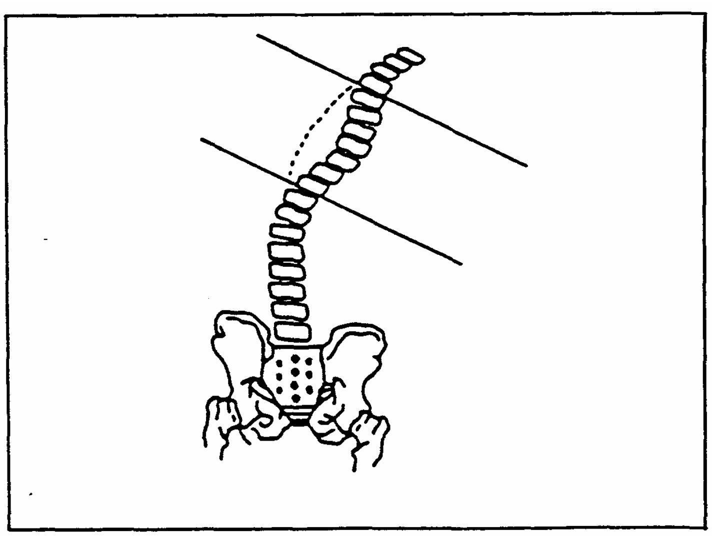


Figure 24

After CBB application, it is evident that the corrected spine has assumed an unorthodox appearance. Several points should be revisited to mitigate this. The patient is supine in-brace, negating concerns about load bearing on the spinal column and compensation versus decompensation as a desirable, or undesirable position. For immediate comparative purposes, the Cobb measure alone suffices, but ultimately a subjective visual evaluation by the orthopedist and the orthotic practitioner will probably be more valuable in determining the acceptability of the finished orthosis. *(Fig. 25)*

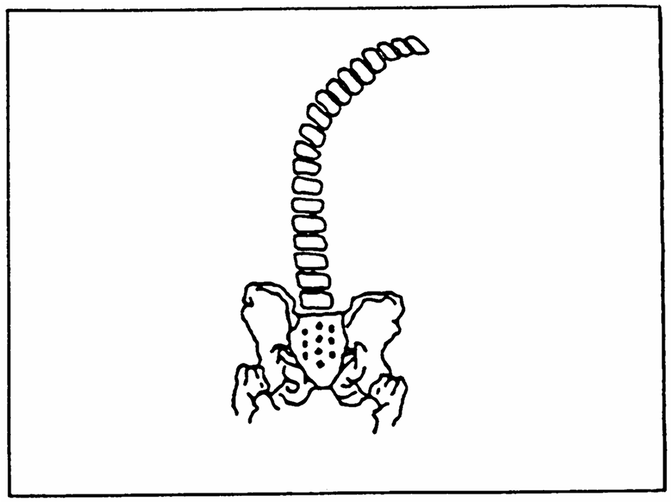


Figure 25

Just as the theory of sidebending scoliosis correction is not completely understood, yet successful treatment outcomes are reported. A departure from the traditional measuring system by subjective visual evaluation does not controvert the spine's improved appearance, nor does it negate any positive results.

Exercise Program

The use of a regimented exercise program as an adjunct to scoliosis brace treatment is a concept having many adherents, as well as detractors. Both camps have advocated either explicit programs producing measurable results, or "free play" exercise without regimentation.

The Charleston Bending Brace system is designed to obtain direct, as well as subtle, benefits from the practice of an exercise program supervised by a Registered Physical Therapist. The therapist is able to recognize the strengths and deficits of each individual patient, make recommendations, set up programs, and document results. The therapist may also serve as a patient's and familly's motivator by altering the program at intervals to freshen the routine.

The Registered Physical Therapist is able to conduct an individual needs assessment, measure the patient's strength and flexibility, and evaluate such aspects as body control, dexterity and proprioception. Special programs may be incorporated, including aerobic and recreational dance or other exercise routines, which are often in conjunction with organized sports.

The goals of supervised exercise programs are to:

1. Maintain or increase muscle strength and tone
2. Maintain or increase flexibility
3. Promote correct postural alignment
4. Increase awareness of body position

Components of the program may include:

1. Pelvic tilt-supine or upright
2. Abdominal, gluteal and shoulder girdle strengthening
3. Hamstring, hip flexor and pectoral strengthening
4. Diaphragmatic or other deep breathing exercises

ILLUSTRATIONS