



# SPINAL ORTHOSIS

DR Priyadarshini Smruti Prava  
HOD ,Dept of Physiotherapy  
IHS,BBSR

# HISTORY

**In the excavation of Nechian desert, the first direct evidence of fracture bracing was found. There, mummies of the 5th dynasty (2625-2750 B.C.) were found with splints still intact and wrapped with in the burial clothes. These splints appear to have been adequate and relatively effective by current standards.**

- ▶ **Galan (131-201 A.D.) may have been the first to use dynamic bracing for Scoliosis and Kyphosis. In addition to his braces, he attempted to treat these conditions by breathing exercises, loud singing and voluntary expansion of the concavity.**
- ▶ **The splints and the braces of the next 1000 years were probably heavy, clumsy and of marginal efficiency. Wood, Bamboo, Metals, Leather were used.**

- ▶ **Amborise Pare (1510-1590) was the Surgeon of the sixteenth century. He devoted an entire book on bracing, Prosthetic and other Assistive Devices.**

- ▶ **No brief history of bracing would be complete without a special mention of Nicholas Andery, Prof. of Medicine at the University of Paris in the mid 1700s. He was more concerned with deformities than fractures. He used braces for all types of deformities. He stated that if the spine be crooked in the form of S, the best method you can take to mend it. Wrote several books, introduced dynamic bracing and coined the word the Orthopaedia.**

# Orthosis

- ▶ An orthotic device (commonly just referred to as an orthotic) is an external device applied on the body to limit motion, correct deformity, reduce axial loading, or improve function in a certain segment of the body.

# Indications for recommending Orthotic devices

- ▶ Pain relief
- ▶ Mechanical unloading
- ▶ Scoliosis management
- ▶ Spinal immobilization after surgery
- ▶ Spinal immobilization after traumatic injury
- ▶ Compression fracture management
- ▶ Kinesthetic reminder to avoid certain movements

# Five mechanical principles of spinal orthosis

## 1. Balanced horizontal forces

- ▶ Horizontal forces are eminently suitable for providing efficient bending moments for the correction of lateral curvature, derotation of vertebrae, and immobilization of the spine. Most of the braces work on the three point systems. Three horizontal forces are applied at points along the length of the spine. Two are in one direction, and the one is in opposite direction, Since the system is in equilibrium, the some of the forces and the some of the bending moments they create must be equal to zero

## **2.Fluid compression**

- ▶ **It is possible to use soft tissues (muscles, fascia, and tendons) to support a compressive load. Nature has used the diaphragm and abdominal muscles to compress the contents of the trunk cavity. Thus, the turgor of fluid under pressure is employed to support or splint the spine e.g. TLSO, LS belt. This technique is especially effective in resting and unloading the lumbar spine.**

## **3.DISTRACTION**

- ▶ **By the application of tension through distraction. It is possible to achieve a certain amount of immobilization and stability of the spine.**

## 4.SLEEVE PRINCIPLE

- ▶ This involves the construction of a cage around the patient. There are basically two semicircular fixation points, one above the other. The between the two, there are various uprights the uprights may be at the sides of the patients, or they may be posterior and paraspinous. This upright serves as a sleeve, a splint, a distracter and as a point for attachments of various accessory devices such as localizer pads, axillary slings or abdominal pads

## 5.SKELETAL FIXATION

- ▶ These appliances provide the most effective methods of applying reliable control to the spine .e.g. Halo fixation or Halo pelvic fixation point

# Success of the orthosis

- ▶ Decreased pain
- ▶ Increased strength
- ▶ Improved function
- ▶ Improved posture
- ▶ Correction of spinal curve deformity
- ▶ Protection against spinal instability
- ▶ Minimized complications
- ▶ Healing of ligaments and bones

# Drawbacks of the Orthosis

- ▶ Discomfort
- ▶ Local pain
- ▶ Osteopenia
- ▶ Skin breakdown
- ▶ Nerve compression
- ▶ Muscle atrophy with prolonged use
- ▶ Decreased pulmonary capacity

- ▶ Increased energy expenditure with ambulation
- ▶ Difficulty donning and doffing orthosis
- ▶ Difficulty with transfers
- ▶ Psychological and physical dependency
- ▶ Increased segmental motion at ends of the orthosis
- ▶ Unsightly appearance
- ▶ Poor patient compliance

# Duration of Orthotic use

- ▶ *is determined by the individual situation.*
- ▶ In situations where spinal instability is not an issue, recommend use of an orthosis until the patient can tolerate discomfort without the brace.
- ▶ When used for stabilization after surgery or acute fractures, allow 6-12 weeks to permit ligaments and bones to heal.

# ***SELECTION AND PRESCRIPTION OF SPINAL ORTHOTICS IN SPINAL LESIONS***

- ▶ **TO AID IN SITTING STANDING AND WALKING BY SUPPORTING CERTAIN WEAKENED OR PARALYSED MUSCLES AND UNSTABLE JOINTS.**
- ▶ **TO RELIEVE PAIN AND SPEEDY RECOVERY OF DISEASED OR INJURED STRUCTURES BY PROTECTION AND IMMOBILIZATION IN THE OPTIMUM POSITION AND COMFORT.**
- ▶ **TO PREVENT PROGRESSIVE DEFORMITIES OF SPINE CAUSED BY ABNORMAL STRESSES AND STRAINS FROM SUCH DEFORMING FORCES AS MUSCLE IMBALANCE, GRAVITY OR TISSUE CONTRACTURE.**
- ▶ **TO CORRECT AN ALREADY EXISTING DEFORMITY BY MEANS OF SOME ACTIVE CORRECTIVE MECHANISAM INCORPORATED IN THE BRACE.**

***IN 1973 THE COMMITTEE ON PROSTHETIC AND ORTHOTIC RESEARCH AND DEVELOPMENT, THE NATIONAL RESEARCH COUNCIL, NATIONAL ACADEMY OF SCIENCE HAVE INTRODUCED A NEW TERMINOLOGY BASED ON THE JOINTS THEY INCLUDE. SUCH AS:-***

- ▶ **S O (SACRAL ORTHOSIS)**
- ▶ **S I O (SACRO-ILIAC ORTHOSIS)**
- ▶ **L S O (LUMBO-SACRAL ORTHOSIS)**
- ▶ **T L S O (THORACO LUMBO SACRAL ORTHOSIS)**
- ▶ **C T L S O (CERVICO THORACO LUMBO SACRAL ORTHOSIS)**
- ▶ **C O (CERVICAL ORTHOSIS)**

# ***TYPES OF SPINAL ORTHOSIS***

- ▶ **1. SUPPORTIVE**
- ▶ **2. IMMOBILIZATION/RIGID**
- ▶ **3. CORRECTIVE**

# SUPPORTIVE ORTHOSIS

- ▶ **INCLUDE FLEXIBLE AND SEMIRIGID CORSETS AND BELTS, LIGHT FLEXIBLE METAL BRACES. EXAMPLE:-**
- ▶ **TROCHANTERIC BELT**
- ▶ **SACRO-ILIAC BELT**
- ▶ **LUMBO-SACRAL BELT**
- ▶ **LUMBO-SACRAL CORSET**
- ▶ **ABDOMINAL CORSET**
- ▶ **HERNIA BELT**
- ▶ **THORACIC BINDER**
- ▶ **COLLERS etc.**



# INDICATIONS

- ▶ LOW BACK PAIN
- ▶ SPRAIN
- ▶ SPONDYLOSIS
- ▶ SPONDILOLYSTHESIS
- ▶ SCIATICA
- ▶ DISCETOMY
- ▶ POSTOPERATIVE
- ▶ PENDULOUS ABDOMEN
- ▶ HERNIA etc.
- ▶ Minor Fractures



# IMMOBILIZATION BRACES

- ▶ THOSE INCLUDE RIGID CORSET OF LEATHER
- ▶ PLASTER CORSETS, PLASTIC ORTHOSIS AND
- ▶ HEAVY RIGID METAL BRACES



# IMMOBILIZATION/HEAVY RIGID METAL ORTHOSIS

- ▶ **CHAIR BACK BRACE (L.S.A.P.CONTROL ORTHOSIS)**
- ▶ **-KNIGHT SPINAL BRACE (L.S.A.P. & L.CONTROL ORTHOSIS)**
- ▶ **-WILLIAM LORDOSIS BRACE (L.S.P & L.CONTROL ORTHOSIS)**
- ▶ **-TAYLORS BRACE (T.L.S.A.P.CONTROL ORTHOSIS)**
- ▶ **-KNIGHT-CUM-TAYLOR BRACE (T.L.S.A.P & L CONTROL ORTHOSIS)**
- ▶ **-ASH/JWETT BRACE (T.L.S.ANTERIOR CONTROL/HYPER EXTENSION ORTHOSIS)**
- ▶ **-COW HORN BRACE (T.L.S.A.L & ROTARY CONTROL ORTHOSIS)**
- ▶ **-POLYPROPYLENE MOLDED ORTHOSIS**



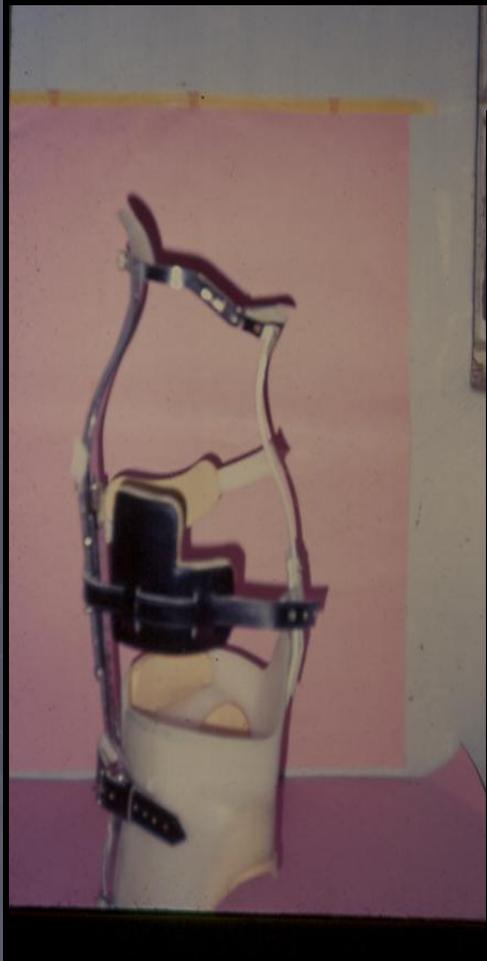
# INDICATIONS

- ▶ **TUBERCULOSIS**
- ▶ **ARTHRITIS (SPONDILOSIS)**
- ▶ **SPODILOLISTHESIS**
- ▶ **COMPRESSION FRACTURES**
- ▶ **DISC SURGERY**
- ▶ **ADOLSCENT KYPHOSIS**
- ▶ **SENILE OSTEOPOROSIS**
- ▶ **LORDOSIS**
- ▶ **PARAPLEGIA etc.**



# CORRECTIVE ORTHOSIS

- ▶ **INCLUDE THOSE WHICH PRODUCE AN ACTIVE CORRECTIVE MECHANISAM INCORPORATED IN THE ORTHOSIS**
- ▶ **MILWAUKEE BRACE (CTLSO)**
- ▶ **BOSTON BRACE - T8 Underarm**
- ▶ **MIAMI BRACE - T6 Orthosis**
- ▶ **NYOH BRACE - Higher level**
- ▶ **WILMINGTON BRACE- T8**
- ▶ **TORTICOLLIOS BRACE - Wry Neck**



# Miami brace



# ▶ The Cervical appliances are broadly classified into three groups.

- ▶ Basic Collars
- ▶ Poster appliances
- ▶ Custom made/Moulded Orthosis

## Basic Collars

1. Soft collars
2. Hard Collars
3. Adjustable collars
4. Magnetic Cervical collars
5. These are devices that wrap around the neck and are adjustable circumferentially.

## ▶ Poster appliances/Collars are:-

1. Two or four poster appliances
2. SOMI Orthosis (Sterno- Occipital- Mandibular-Immobilizer)
3. Halo Orthosis
4. Minerva Orthosis

### Functions

- ▶ Restricts flexion and extension of the head and cervical spine by forces applied under the mandible and occiput.
- ▶ Limit lateral flexion and rotation by forces at the mandibular and occipital support.
- ▶ Adjustment of lengths of uprights can relieve the cervical spine of some portions of the weight of the head.

## **Custom made/Moulded orthosis are:-**

1. Philadelphia Cervical Collar
2. Cuirass Cervical Orthosis
3. Moulded Cervical orthosis

## **Functions**

1. Similar to the soft cervical collar, in that it provides a reminder to limit neck motions and retains body heat.
2. Due to the reinforcement provided in the Orthosis greater restriction to cervical flexion, extension, rotations and lateral motion are achieved.

## Functions

- ▶ Provide some mechanical restrictions of forward flexion and extension and, to a lesser degree, lateral flexion and rotation.
- ▶ Through sensory feedback, remind the wearer to limit head and neck motions.
- ▶ Retain body heat, which may aid healing of soft tissue injuries and reduce muscle spasm.
- ▶ All cervical appliances remind the wearer to restrict head and neck motions. In addition, depending on its design and fit, a particular orthosis may impose forces to position the head, limit flexion, extension, rotation, and/or lateral motion of the head and cervical spine, and reduce load on the cervical spine by supporting a portion of the weight of the head.

# Cervical orthosis

- ▶ *cervical collars*
  1. soft cervical collar
  2. hard cervical collars

soft cervical collar is a common orthotic device made of lightweight material, polyurethane foam rubber, with a stockinette cover. It has Velcro closure strap for easy donning and doffing. Patients find the collar comfortable to wear, but it is soiled easily with long-term use.

# Indications

1. Warmth
  2. Psychological comfort
  3. Support to the head during acute neck pain
  4. Relief with minor muscle spasm associated with spondylolysis
  5. Relief in cervical strains
- ▶ **The soft collar provides some limitations of motion**
1. Limits full flexion and extension by 5-15%
  2. Limits full lateral bending by 5-10%
  3. Limits full rotation by 10-17%



► **Hard cervical collar**

The hard cervical collars are similar in shape to a soft collar but are made of Plastizote, a rigid polyethylene material shaped like a ring with padding. Height can be adjusted in certain designs to fit patients better. Velcro straps are used for easy donning and doffing. The hard collar is more durable than a soft collar with long-term use.



## ► Indications

1. Support to the head during acute neck pain
2. Relief of minor muscle spasm associated with spondylosis
3. Psychological comfort
4. Interim stability and protection during halo application

## ► Motion restrictions

1. Limits full flexion and extension by 20-25%
2. Less effective in restricting rotation and lateral bending
3. Better than a soft collar in motion restriction

# HEAD CERVICAL ORTHOTICS

## ► The Philadelphia collar

is a semi rigid HCO with a 2-piece system of Plastizote foam. Plastic struts on the anterior and posterior sides are used for support. The upper portion of the orthosis supports the lower jaw and occiput, while the lower portion covers the upper thoracic region.



- ▶ Motion restrictions for the Philadelphia collar
  1. Limits flexion and extension by 65-70%
  2. Limits rotation by 60-65%
  3. Limits lateral bending by 30-35%



► **Indicated:**

1. Anterior cervical fusion
2. Halo removal
3. Dens type I cervical fracture of C2
4. Anterior Discectomy
5. Suspected cervical trauma in unconscious patients
6. Tear-drop fracture of the vertebral body  
(Note: Some tear-drop fractures require anterior decompression and fusion.)
7. Cervical strain

# CERVICAL THORACIC ORTHOTICS

- ▶ Cervical thoracic orthotics (CTOs) provide greater motion restriction in the middle to lower cervical spine from the added pressure on the body. The upper cervical spine has less motion restriction. CTOs are used in minimally unstable fractures

# The Sternal-Occipital-Mandibular-Immobilizer (SOMI)

- ▶ Is a rigid three-poster CTO with anterior chest plate that extends to the xiphoid process and has metal or plastic bars that curve over the shoulder. Straps from the metal bars go over the shoulder and cross to the opposite side of the anterior plate for fixation. A removable chin piece attaches to the chest plate with an optional headpiece that can be used when the chin piece is removed for eating. The two-poster CTOs start from the chest plate and attach to the occipital component. The SOMI is ideal for bedridden patients since it has no posterior rods.



- ▶ The SOMI is less effective compared to other braces in controlling extension, but it is very effective in controlling flexion at the atlantoaxial and C2-C3 segments. The SOMI is better than the cervicothoracic brace in controlling flexion in the C1-C3 segments



## ▶ **HALO DEVICE**

- ▶ The halo device is the most common device for treatment of unstable cervical and upper thoracic fractures and dislocations as low as T3. The halo provides maximum motion restriction of all cervical orthotics. The halo ring is made of graphite or metal with pin fixation on the frontal and parietal-occipital areas of the skull. Development of lightweight composite material led to design of radiolucent rings compatible with magnetic resonance imaging (MRI). The halo ring attaches to the vest anteriorly and posteriorly via 4 posters.
- ▶ The halo vest has shoulder and underarm straps for tightening and usually is made of rigid polyethylene and extends down to the umbilicus



## *indications*

- ▶ Dens type I, II, and III fractures of C2 (Note: Dens type III fractures of C2 are treated more successfully with surgery.)
- ▶ C1 fractures with rupture of the transverse ligament
- ▶ Atlantoaxial instability from rheumatoid arthritis with ligamentous disruption and erosion of the dens
- ▶ C2 neural arch fracture and disc disruption between C2 and C3. (Note: Some patients may need surgery for stabilization.)
- ▶ Bony single column cervical fractures
- ▶ Following cervical arthrodesis
- ▶ Following cervical tumor resection in an unstable spine
- ▶ Following debridement and drainage of infection in an unstable spine
- ▶ Following spinal cord injury (SCI)

## ► **Contraindications**

1. Concomitant skull fracture with cervical injury
2. Damaged or infected skin over pin insertion sites

## **Relative contraindications**

1. Cervical instability with ligamentous disruption
2. Cervical instability with 2 or 3 column injury
3. Cervical instability with rotational injury involving facet joints



## ► **Motion restrictions**

1. Limits flexion and extension by 90-96%
2. Limits lateral bending by 92-96%
3. Limits rotation by 98-99%

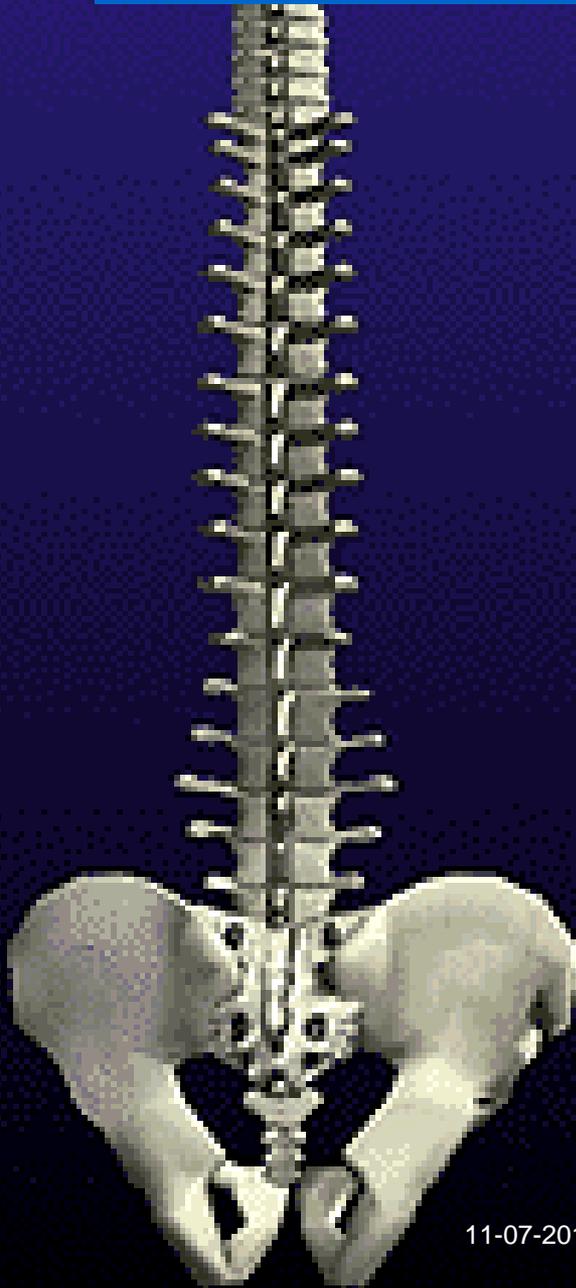
## **complications associated with halo placement**

1. Neck pain or stiffness 80%
2. Pin loosening 60%
3. Pin site infection 22%
4. Scars 30%
5. Pain at pin sites 18%
6. Pressure sores 11%

## **complications associated with halo placement**

1. Restricted ventilation 8%
2. Dysphagia 2%
3. Nerve injury 2%
4. Dural puncture 1%
5. Neurological deterioration 1%
6. Avascular necrosis of the dens
7. Ring migration
8. Inadequate bony healing
9. Inadequate ligamentous healing

# NORMAL AND SCOLIOTIC SPINES.



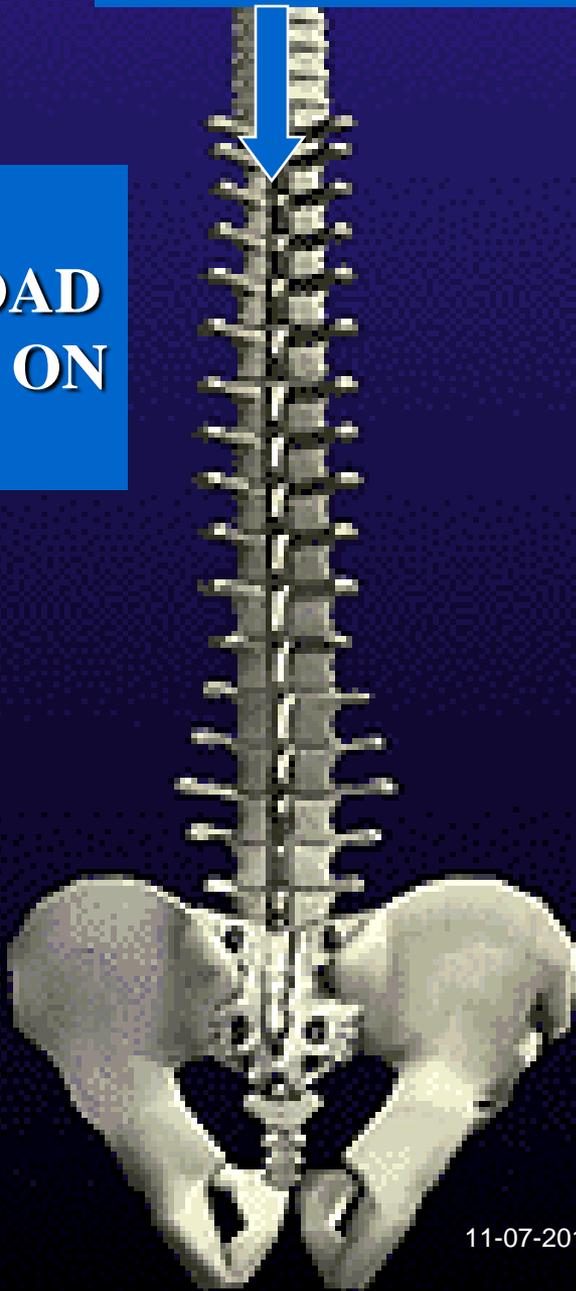
11-07-2016



BPT 8TH SEM

# NORMAL AND SCOLIOTIC SPINES.

**NORMAL  
AXIAL LOAD  
BEARING ON  
SPINE.**



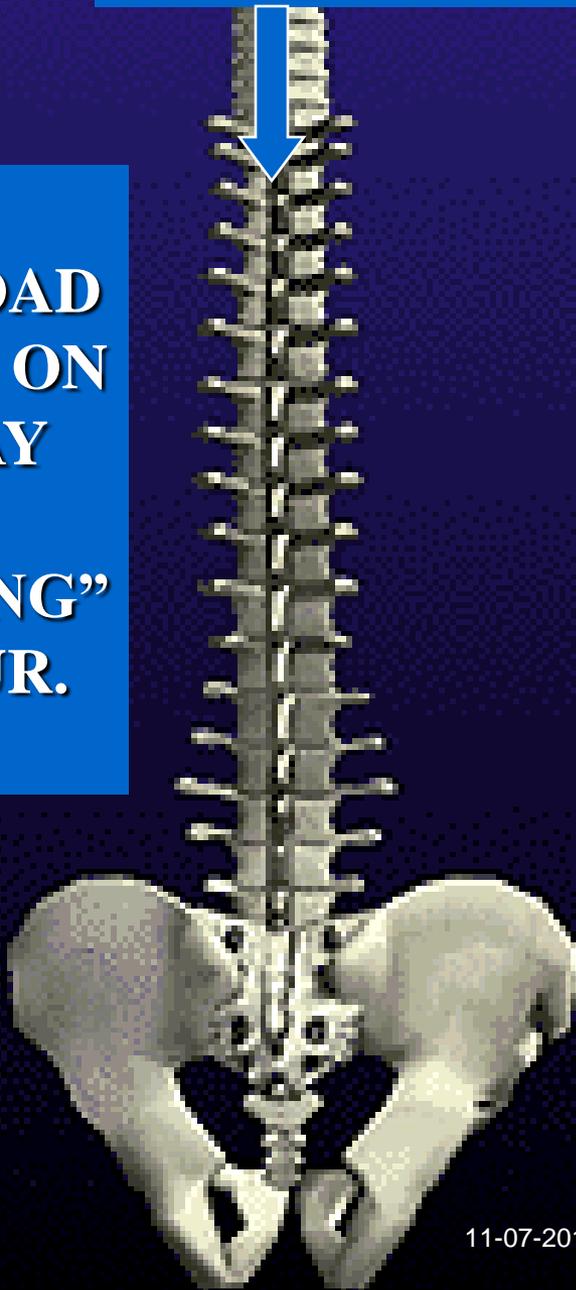
11-07-2016



BPT 8TH SEM

# NORMAL AND SCOLIOTIC SPINES.

**NORMAL  
AXIAL LOAD  
BEARING ON  
SPINE MAY  
CAUSE A  
“BUCKLING”  
TO OCCUR.**



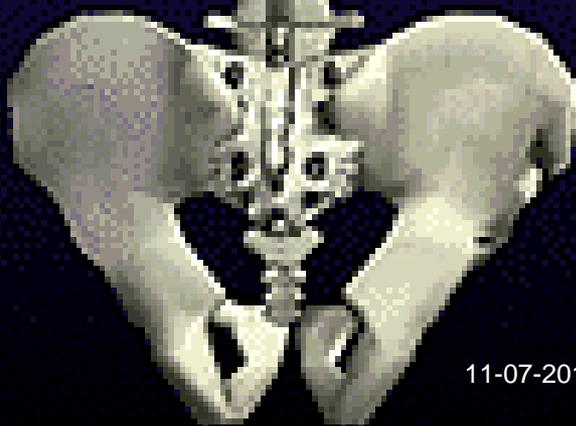
11-07-2016



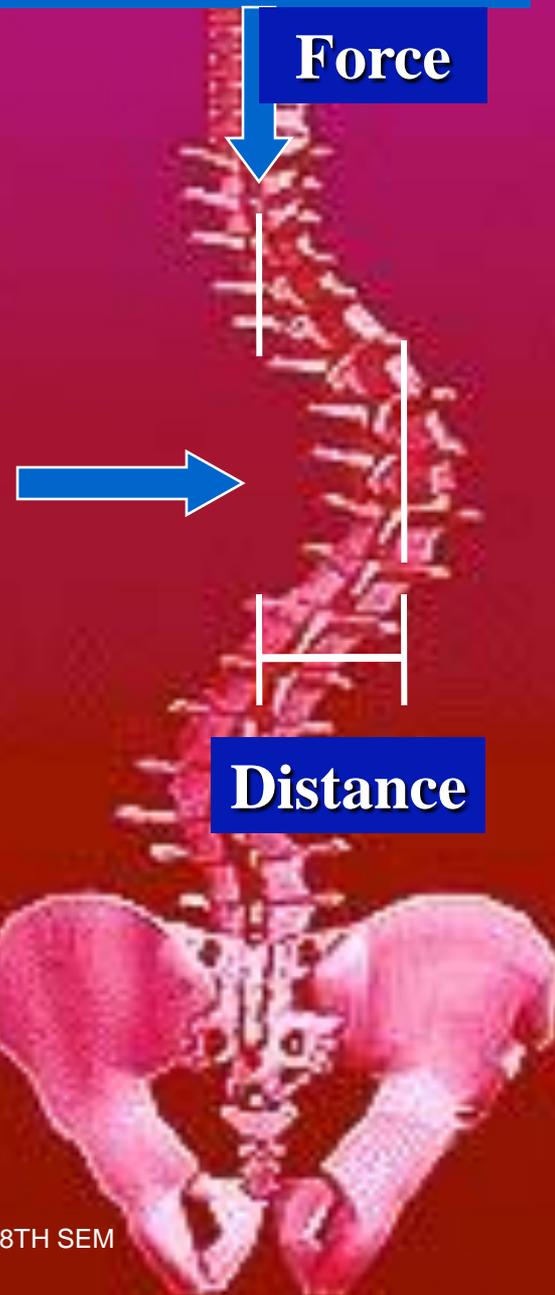
BPT 8TH SEM

# NORMAL AND SCOLIOTIC SPINES.

**NORMAL  
AXIAL LOAD  
BEARING ON  
SPINE MAY  
CAUSE A  
“BUCKLING”  
TO OCCUR.**



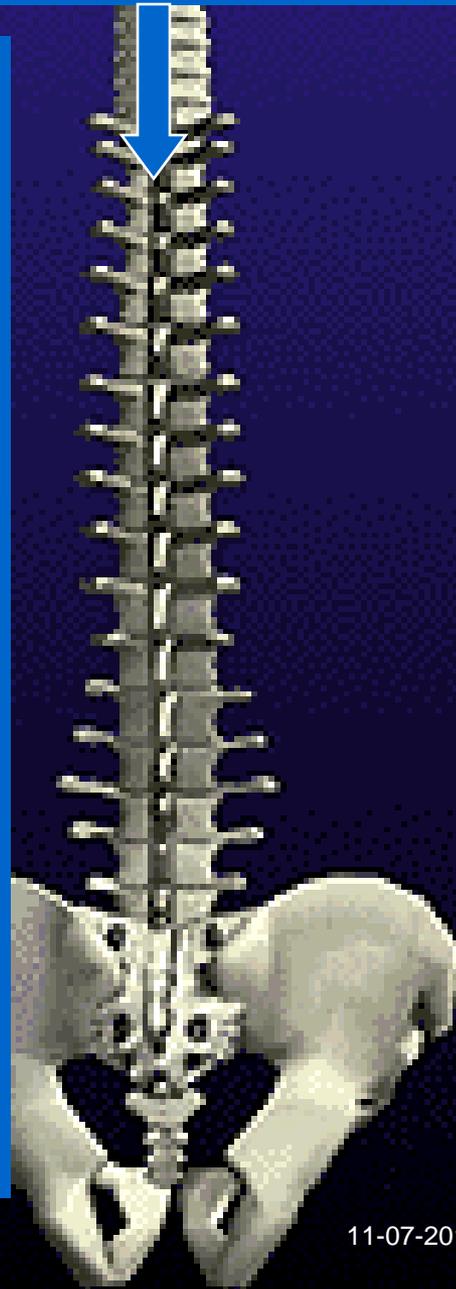
11-07-2016



BPT 8TH SEM

# NORMAL AND SCOLIOTIC SPINES.

**NORMAL  
AXIAL LOAD  
BEARING ON  
SPINE MAY  
CAUSE A  
“BUCKLING”  
TO OCCUR  
WHICH  
THEN  
ROTATES  
TOWARDS  
THE  
CONCAVE  
SIDE.**



11-07-2016



BPT 8TH SEM

# Evaluation and Mechanism of Action

- ▶ Orthoses must be designed and fitted to:
  - Reduce Any Decompensation
  - Reduce Curve Maximally
  - Keep Constant Force On Curves
  - Be Easily Adjusted
  - Be As Comfortable As Possible

# Type Of Orthosis is Insignificant

- ▶ All Orthoses Provide Force in Approximately the Same Manner
- ▶ Orthotists Usually Have Regional Preferences as to Device “Type”
- ▶ Any Orthosis May Function Well; Or Poorly (Outcome is Highly Clinician/Patient Dependent)

# How Do We Achieve the Best Results?

- ▶ AAOP consensus report (JPO supplement, October 2003) the best result is to consider balance first and correction secondarily.
- ▶ Balance of the curves is approximations of coronal vertebral displacements from the center vertebral sacral line.
- ▶ If left displacements are considered a negative integer and right displacements positive, the closer the average is to zero, the better balanced the spine is.

# Clinical Force Systems

- ▶ We achieve balance and correction by utilizing synergistic force systems that are specific to curve types.
- ▶ These forces are applied through the use of force pads.
- ▶ Some forces are used to shift the torso, others are synergistic constraints to resist the translational forces.

# Which Orthosis Should I Use?

- One that you are comfortable with.
- Must be effective.
- Basic rules followed.
- Type is insignificant.
- Easily adjusted?
- Cosmetic?
- Easy to don?
- Availability?

# Orthosis Selection

- **Two Categories; CTLSO (Milwaukee Brace, TLSO (Boston Brace, Wilmington Jacket, Rosenberger, Miami etc...))**
  - **Curves with apices superior to T8 = Milwaukee Brace**
  - **Curves with apices at or below T8 = TLSO**

# THORACOLUMBAR ORTHOTICS

- ▶ Thoracolumbar orthotics (TLOs) are used mainly to treat fractures from T10-L2 since their mobility is not restricted by the ribs, unlike fractures from T2-T9. Immobilization from T10-L2 helps prevent further collapse.
- ▶ The **Jewett hyperextension** brace uses a 3-point pressure system with 1 posterior and 2 anterior pads. The anterior pads place pressure over the sternum and pubic symphysis. The posterior pad places opposing pressure in the mid-thoracic region



## ▶ Indications Jewett hyperextension brace

1. Symptomatic relief of compression fractures not due to osteoporosis
2. Immobilization after surgical stabilization of thoracolumbar fractures

## ▶ Motion restrictions

1. Limits flexion and extension between T6-L1
2. Ineffective in limiting lateral bending and rotation of the upper lumbar spine

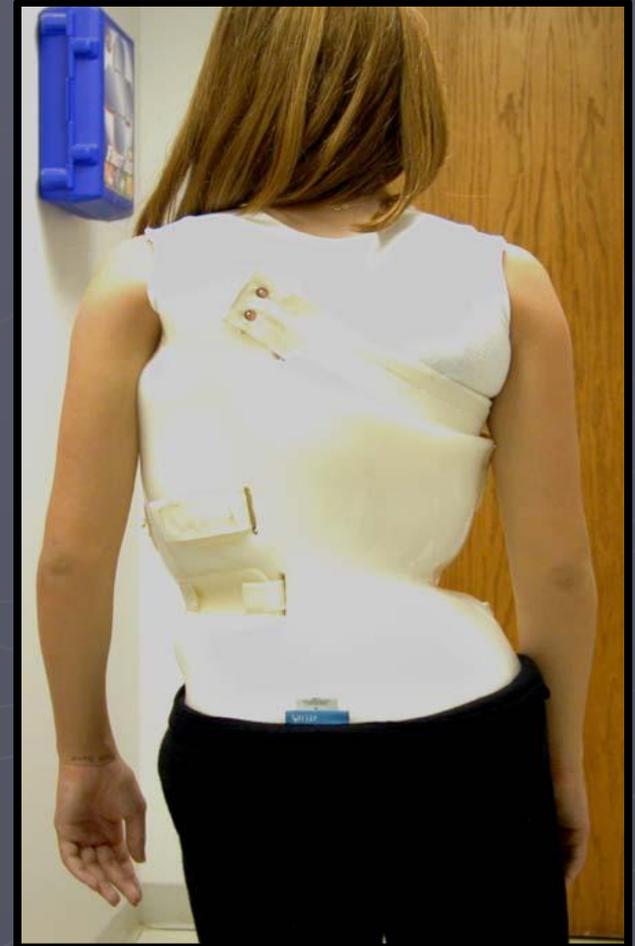
► **Contraindications to use the Jewett brace**

1. Three column spine fractures involving anterior, middle, and posterior spinal structures
2. Compression fractures above T6 since segmental motion increases above the sternal pad
3. Compression fractures due to osteoporosis



- ▶ Thoracolumbosacral orthosis (TLSO),
- ▶ is fabricated from polypropylene or plastic and offers best control in all planes of motion and increases intracavitary pressure. This orthosis has a lightweight design and is easy to don and doff. The TLSO provides efficient force transmission as pressure is distributed over wide surface area, which is ideal for use in patients with neurologic injuries

# Rosenberger TLSO



## ► Indications for the TLSO

1. Immobilization for compression fractures from osteoporosis
2. Immobilization after surgical stabilization for spinal fractures
3. Bracing for idiopathic scoliosis
4. Immobilization for unstable spinal disorders for T3 to L3

## ► Motion restrictions

1. Limits side bending
2. Limits flexion and extension
3. Limits rotation to some extent

## ► Clinical information on the custom-molded TLSO suggests that it is more effective in preventing idiopathic scoliosis curve progression

# LUMBO-SACRAL CORSETS

## MAIN FUNCTION OF THE FLEXIBLE LSO's

- ▶ ANTERIOR AND LATERAL TRUNK CONTAINMENT ELEVATES THE INTRA CAVITY PRESSURE, DECREASING THE LOADING ON THE VERTIBRAE AND DISC.
- ▶ DEPENDING ON THE NUMBER, PLACEMENTS AND RIGIDITY OF THE VERTICAL STAYS, THREE POINT PRESSURE IS APPLIED THAT TENDS TO RESTRICT SPINAL MOTION.

## ► **Indications**

1. Unloading of the intervertebral discs and transmit pressure to soft tissue areas
2. Relief for low back pain (LBP)
3. Immobilization after lumbar laminectomy
4. Kinesthetic reminder to patient following surgery

## **Motion restrictions**

1. Limits flexion and extension at the L1-L4 level
2. Limits rotation minimally
3. Limits lateral bending by 45% in the thoracolumbar spine

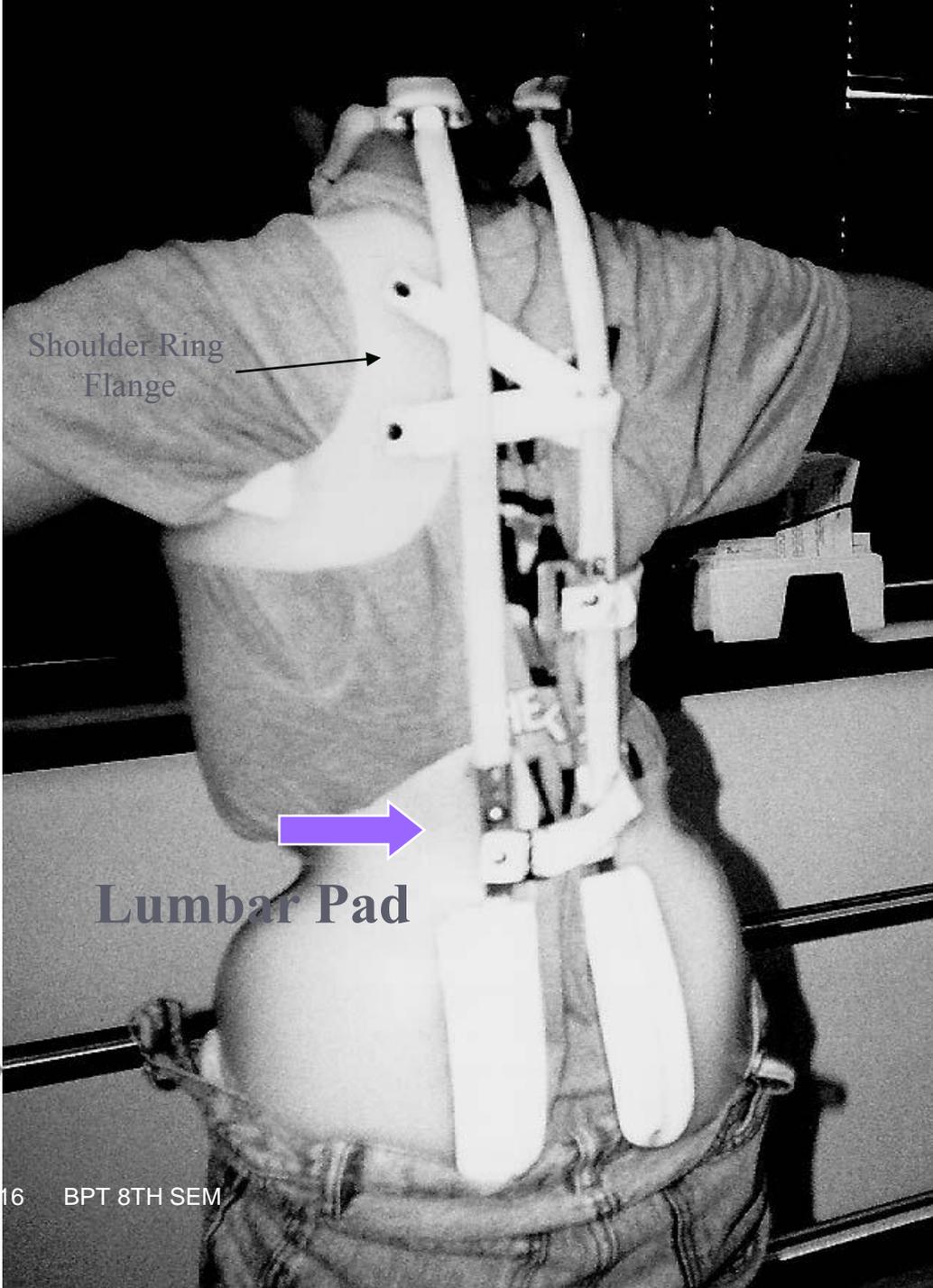
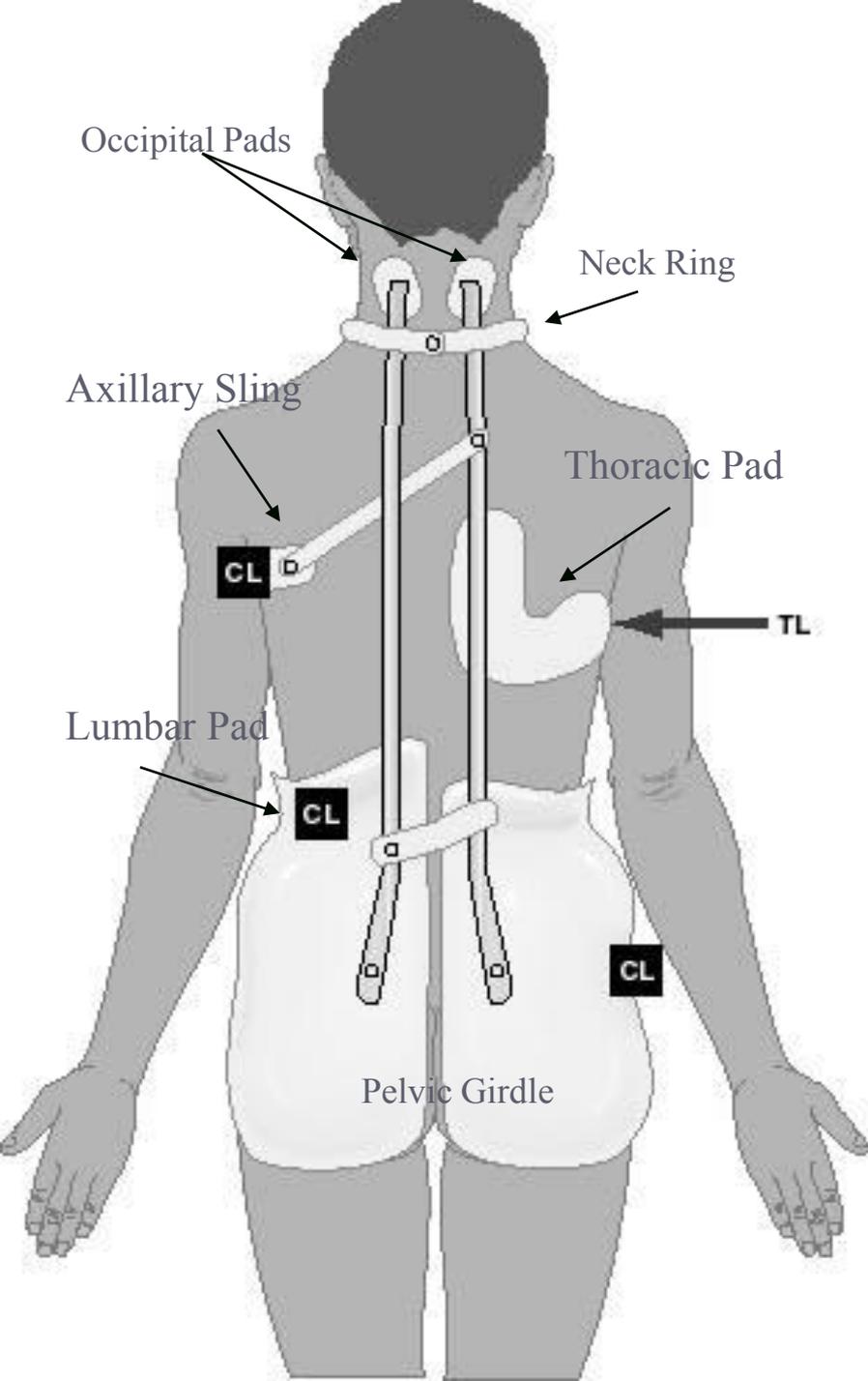


# THE MILWAUKEE BRACE

- ▶ The Milwaukee brace is a CTLSO originally designed by Blount and Schmidt to help maintain postoperative correction in patients with scoliosis secondary to polio. The brace is designed to stimulate corrective forces from the patient
- ▶ **Three factors are probably involved in its mode of action. These are:-**
  1. Passive support
  2. Dynamic correction &
  3. Control of the ends correction of the spinal column

- ▶ The brace has an open design with constant force provided by the plastic pelvic mold. The pelvic portion helps reduce lordosis, derotates the spine, and corrects frontal deformity.
- ▶ Uprights have localized pads to apply transverse force, which is effective for small curves. The main corrective force is the thoracic pad, which attaches to the 2 posterior uprights and 1 anterior upright. Discomfort from the thoracic pad creates a righting response to an upright posture. The lumbar pads play a passive role compared to the thoracic pads.





# Primary Milwaukee Brace Corrective Components

- **Thoracic Pad**
- **Axillary Sling**
- **Lumbar Pad**

# Thoracic Pad



- **“L” Shaped for CTLSO.**
- **Fitted on the Convex Side, Posterio-lateral Quadrant, at and Inferior to the Apex of The Curve (Two Horizontal Levels Below the Curve).**
- **Anterio-medial Directed Force.**
- **Translates Force Through Ribs.**
- **Anterior for Derotation-medial for Curve Correction.**



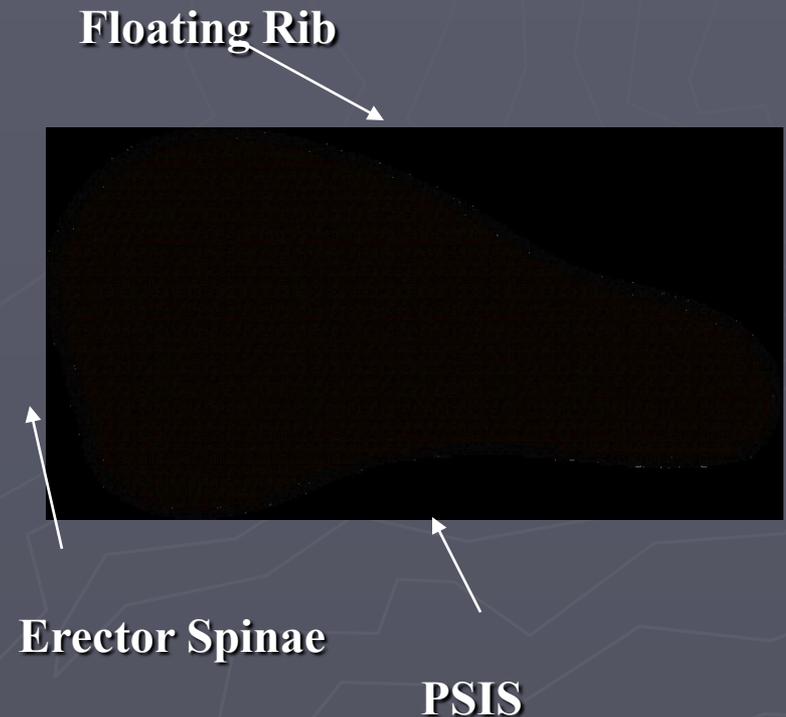
# Axillary Sling of CTLSO or Axillary Wall of TLSO.

- Fitted at Superior, Concave Side Endpoint of Thoracic Curve.
- May Only Be Fitted As High As T5-T6.
- Provides Force To Correct Curve.
- Third Point Of Thoracic Force Triangulation.
- **EXTREMELY IMPORTANT!**



# Lumbar Pad

- **“Kidney” Shaped Pad.**
- **Fitted On Apex Of the Convex Side Of Curve.**
- **Must Not Contact Ribs or Iliac Crest.**
- **Placed Over the Medial Border Of the Erector Spinae (Directly Above Transverse Processes).**
- **Must Compress Tissues to Translate Force to the Spine.**



# Indications for the Milwaukee brace

1. The major indication for the Milwaukee brace is idiopathic scoliosis that seen for evaluation when the curve is still mild or moderate in degrees. It is important that the curves have not become severely structural and that the patient is not skeletally mature. Results in this group of patients are good.
2. The assumption behind any corrective Orthosis in child hood is that skeletal growth is remaining to allow bone remodeling. This assumption also applies to the use of the Milwaukee brace.
3. For correction to occur the patient must be skeletally immature. Therefore the more growth remaining the better the anticipated results.

1. Patients with Risser score of I-II and curves greater than 20-30° that progress by 5° over 1 year need application of brace.
2. Curves between 30-40° need bracing, but not curves less than 20°.
3. Curves of 20-30°, with no year-over-year progression, require observation every 4-6 months. The Milwaukee brace is used for curves with apex above T7.

► **Duration of the Milwaukee brace use is determined by the following criteria**

1. Daily use ranges from 16-23 hours per day.
2. Treatment should continue until the patient is at Risser stage IV or V.
3. If curve is greater than 30°, consider continued use for 1-2 years after maturity since patients with curves of this magnitude are at risk for progression.

# Purpose of the Orthosis

1. Prevent progression of curves
2. Improve structural alignment
3. Reduce angulations and rotation
4. Restore compensation
5. Reduce pain
6. Improve appearance
7. Improve cardio pulmonary function

# ADVANTAGE OF MILWAUKEE BRACE

Because of its open design with uprights and pads, it minimally restricts respiration. However, with poor fabrication and too close contouring of the uprights, restriction can occur.

2. The open design allows good air circulation so wearing in hot climates is not a problem.
3. It can be lengthened as the child grows. Pad placement is altered with growth or when curve correction dictates such a change.
4. Controls of curves with an apex above T-7 is possible and high thoracic curves also can be treated.
5. Bio-mechanically the Orthosis work on the three or four point corrective system, which is generally a passive system. An active element is present due to the discomfort of the pads. The patient actively pulls away from the pad.
6. Most effective Orthosis in correcting the lateral curvature up to 40 - 45 degrees.

# DISADVANTAGE OF MILWAUKEE BRACE

1. The problem with the Milwaukee Brace today is psychological, with poor acceptance by teenage patients and some physicians.
2. It is heavy, cumbersome and uncomfortable.
3. Donning and doffing is not easy.
4. The neck ring is visible and thus trends to make the teenagers different in wearing.
5. Required a skilled Orthotist service
6. Circumferential adjustment of pelvic girdle not possible.

# BOSTON ORTHOSIS

- ▶ A prefabricated, posterior opening, plastic module which encompasses the pelvis and thorax to reduce and prevent progression of lumbar, Thoraco-lumbar, and thoracic curves with apices below T8.
- ▶ Design features of the module include: Symmetry, reaction points to affect considerable reduction of lumbar lordosis, concavity over of the abdomen to increase intra cavity pressure and assist in reducing lumbar lordosis, and soft foam rolls which fit over the iliac crests

# Boston brace



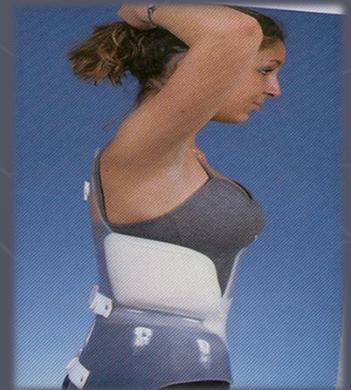
# Trimlines :

- ▶ Generally similar to those of Milwaukee brace pelvic girdle, with the following notable exceptions:
- ▶ Superior –posterior: Extends to the level of the 8th thoracic vertebra, thus providing a long lever arm for maintaining a flattened lumbar curve.
- ▶ Superior-lateral: Height depends on curve level. For a thoracic curve, the side opposite to the pad extends toward the axilla, while the side containing the pad is trimmed lower to allow for trunk shift.
- ▶ For a thoraco lumbar curve, the height on the convex side is determined by pad location, while the opposite side ends just above the iliac crest indentation.
- ▶ For lumbar curves, both side ends just above the crest indentation.

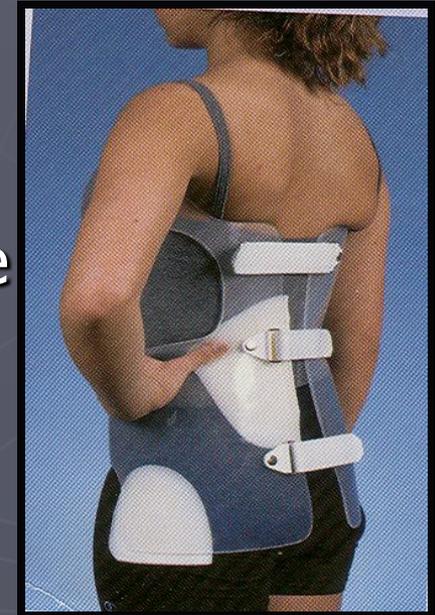


# MIAMI ORTHOSIS

- ▶ Custom molded, posterior opening, plastic shell which encompasses the pelvis and thorax and incorporates lumbar and / thoracic pads to reduce and prevent progression of lumbar, and thoracic curves with apices below T6.
- ▶ Minimal coverage of anterior and lateral aspects of the thorax so as to permit maximal spinal motion, reduce impairment of pulmonary function, and obviate possible interference with breast development.



- **A** minimum of firm shell to skin contact (except at points of force application) to allow the trunk shift away from pressure pads and to enhance ventilation.
  - A large window on the side opposite the thoracic pad.
  - Space created by addition of plaster to the positive model, opposite the lumbar pad.
  - Relatively thick pad which tends to hold the shell away from the skin.



# Trimlines



- ▶ The inferior aspects of the shell are similar to the design of the Milwaukee brace or Boston orthosis.
- ▶ Superiorly, however, there are significant differences.
- ▶ Superior lateral: on the concave side, shell extends to the axilla for thoracic and double curves, and to the rib emanating from the upper end vertebrae of the curve for thoraco-lumbar and lumbar curves.
- ▶ On the convex side, shell extends no higher than the controlling pressure pad, thus permitting lateral bend toward the concavity.
- ▶ Superior –Posterior: Trim lines cross the abdomen sufficiently below xiphoid level to keep the rib coverage minimal, thus permitting forward bend.
- ▶ Pads: Placement of lumbar and thoracic pads is essentially the same for the Boston Orthosis.

# Miami brace



# WILMINGTON ORTHOSIS

- ▶ **Custom molded, anterior opening, total contact, plastic body jacket which encompasses the pelvic and thorax.**
- ▶ **Used for curves with apices below T8.**
- ▶ **In the fitting and fabrication process, scoliotic curves are first reduced on a Riser or similar table by application of strong distraction and lateral corrective forces.**
  
- ▶ **A plaster wrap is applied while the patient is subjected to these forces so that the resulting positive plaster model represents the trunk with curves significantly reduced.**
- ▶ **The basic design goal of the plastic jacket molded over the model is to maintain the correction achieved while the corrective forces were being applied.**



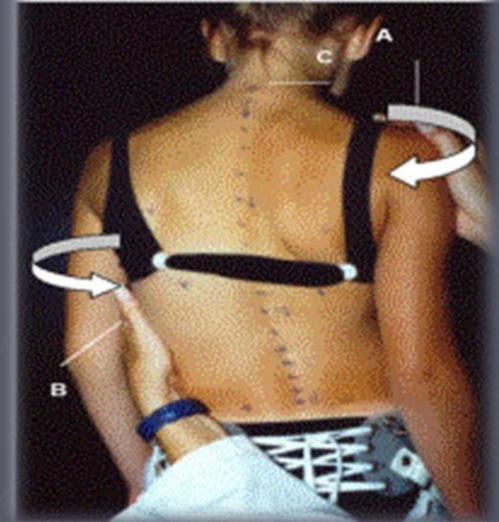
11-07-2016 BPT 8TH SEM

# Do Orthoses Really Help?

- Many studies support efficacy.
- Some refute efficacy.
- Negative articles all report technical errors (insufficient in-orthosis correction, late initiation of orthosis, premature weaning, poor compliance)
- Most articles are retrospective observational studies.
- Lacking valid comparisons to natural history.

# SpineCor Brace Overview

- ▶ SpineCor™ is a new breakthrough treatment for idiopathic scoliosis utilizing a dynamic corrective brace (DCB), clinical assistant diagnostic software (SAS) and postural measurement equipment (Free point). In worldwide clinical use, this new treatment has been shown to be effective in 89% of cases (either by stabilization or improvement in (Cobb) angle of the curve).



- ▶ **The SpineCor™ treatment approach is completely different to that of traditional 3-point pressure rigid orthosis; it is the first and only true dynamic bracing system for idiopathic scoliosis. SpineCor orthosis unique approach to treatment by global postural re-education has been shown to give progressive correction over time which, unlike any previous brace treatment, is extremely stable post brace weaning. Clinical experience to date also shows better compliance and cosmetic results.**

### **SpineCor™ :**

- ▶ **Allows patients four hours per day out of brace**
- ▶ **Allows total freedom of movement**
- ▶ **Offers better cosmesis under clothing, and**
- ▶ **Is cooler to wear.**

- ▶ No side effects. Rigid braces cause muscle atrophy and can be harmful to normal development in a growing child.
- ▶ Excellent treatment results, particularly when treatment is started early.
- ▶ Excellent stability of treatment results post bracing.
- ▶ Neuromuscular integration for maintenance of improved posture.
- ▶ Potential to reduce incidence of surgical intervention.
- ▶ SpineCor™ is a highly effective for the early treatment of idiopathic scoliosis

# ***SpineCor Treatment Procedure***

- ▶ **The first and only truly dynamic brace, which provides a progressive correction of Idiopathic Scoliosis from 15<sup>1</sup>/<sub>4</sub> Cobb angle and above.**
- ▶ **Preserves normal body movement and growth and allows normal activities of daily living.**
- ▶ **It is worn comfortably and easily under clothing.**
- ▶ **Increases patient's treatment acceptance leading to better compliance.**



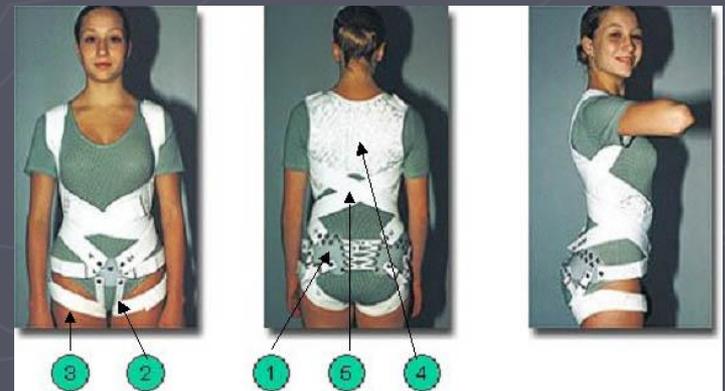
# *Indications*

- ▶ The SpineCor System was designed for the treatment of Idiopathic Scoliosis only . Its efficacy for treating neuromuscular, neurological or other types of scoliosis is unknown and generally non Idiopathic Scoliosis is contraindicated.



# The SpineCor Dynamic Corrective Brace is made up of two sections:

- ▶ The first section consists of the **pelvic base (1)**, the **crotch bands (2)** and the **thigh bands (3)**. Its role is to act as an anchoring point and support for the actions applied to the patient's trunk by the corrective elastic bands.
- ▶ The second section consists of **the bolero (4)** and **the corrective elastic bands (5)**. This is the part designed to make the correction of the scoliosis curve. The fitting of the corrective bands is specific for each patient and depends on the type of curve.



# **The use of a bodysuit under the brace is advised:**

- ▶ **For hygienic reasons; it will help to keep the brace cleaner for longer**
- ▶ **To add comfort; it will provide a barrier between the brace and your body, reducing the likelihood of the brace rubbing.**

**To facilitate going to the toilet; you only need to detach the snaps of the crotch bands and those of the bodysuit, avoiding removal of the brace**

# SpineCor Treatment

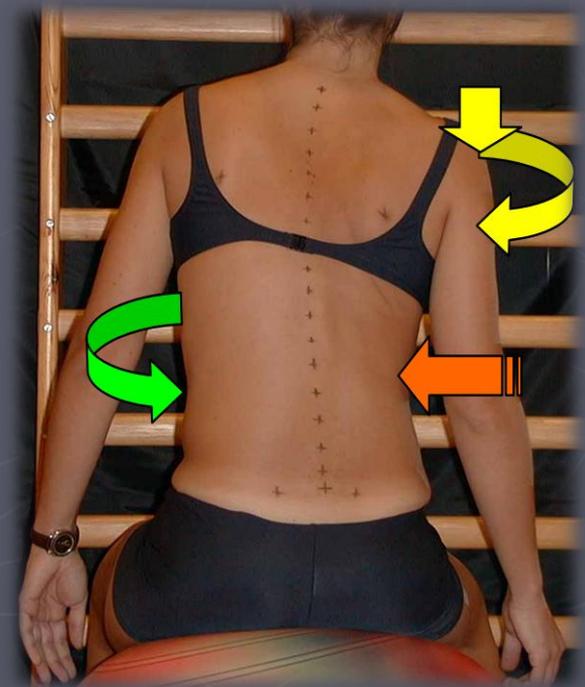
- ▶ The SpineCor™ brace is worn for 20 hours per day. The 4-hour out of the brace period should be taken in two or more intervals during the least active part of the day. The brace MUST be worn while sleeping.
- ▶ The length of treatment will depend on the severity of the curve, age at start of treatment and its evolution, but it is always a minimum of 18 months. (Average for adolescent scoliosis of 24 months, Juvenile cases require much longer treatment times.)
- ▶ To optimise the dynamic effect of the brace, patients are encouraged to perform any type of sport **WEARING** the brace (except for swimming).
- ▶ Patients may be suggested to undergo a specific SpineCor Physiotherapy Program in order to complement the action of the SpineCor brace.

# ***SpineCor Physiotherapy Program***

- ▶ The SpineCor Physiotherapy Program has been designed to complement the action of the brace and reinforce the principles of the treatment.
- ▶ Patients treated with the SpineCor™ brace must not carry out any other exercises program than the one designed to be performed in conjunction with the SpineCor™ brace treatment. (This does not include most athletics)
- ▶ Therefore, all physiotherapists working with patients treated with the SpineCor™ System must follow a specific SpineCor Physiotherapy Training Program.

# SpineCor Physiotherapy Treatment Principles

- ▶ **The SpineCor Physiotherapy Program exercises comply with and follow the Corrective Movement Principle, helping to integrate it, in order to:**
- ▶ **Obtain a faster consolidation of progressive curve reduction.**
- ▶ **Improve the neuro-muscular integration and postural reorganization.**
- ▶ **The SpineCor Physiotherapy Program mainly addresses:**
- ▶ **POSTURAL RE-EDUCATION EXERCISES: to encourage the integration of the Corrective Movement.**



- ▶ **MUSCULAR RE-BALANCE EXERCISES:** global muscular work, by eccentric contraction of shortened muscles and concentric contraction of extended counter lateral muscles at the same time, starting from Corrective Movement position, reinforcing this Corrective Movement and looking for postural over-correction.
- ▶ **RESPIRATORY EXERCISES:** done in combination with postural re-education and muscular re-balance exercises.
- ▶ Unlike a rigid brace, Spinecor uses a rotational 3D “Corrective Movement” which has been shown to be effective in reducing scoliosis curvatures. Spinecor is a dynamic system of elastic bands which uses gentle forces to change posture and movement over time. It can easily be worn under the clothes, during exercise and at work.

**Thank you for your attention!**



**THANK YOU**

# Weaning From The Orthosis

- **18 Months Post-menarche, Risser 4 and Slowed or Ceased Height Growth Are Indicators to Begin Weaning.**
- **4 Month Increments.**
- **Nights Only for 1 Year.**

Risser stages are defined as follows:

- ▶ Stage 0 = 0% excursion
- ▶ Stage I = 25% excursion
- ▶ Stage II = 50% excursion
- ▶ Stage III = 75% excursion
- ▶ Stage IV = 100% excursion and correlates with end of spinal growth
- ▶ Stage V = fusion to ilium, indicating cessation of vertical height growth