The Chêneau Brace Concept

Manuel D. Rigo MD PhD
Institut Elena Salvá Barcelona
Disclosure:
- Medical director of ‘Institut Elena Salvá’. Private rehabilitation clinic
- Medical advisor of ‘Ortholutions’
Dr. Jacques Chêneau

In Bad Sobernheim
(Photo by Sanomed)
‘Trunk deformity reflects the spinal deformity’

- PROMINENT and FLAT regions

- No NEUTRAL Regions: PELVIS included

- All regions numbered: SCOLIOTIC ANATOMICAL MAP (A)

- Hemi-bodies show an INVERTED SAGITTAL PROFILE (B)

- LORDOTIZATION of the thoracic spine / KYPHOTIZATION of the lumbar spine

Original picture by J Chêneau
A corrected positive mould is created in order to provide highly selective PADS and EXPANSION ROOMS.
1) PADS (Located in the space, oriented and shaped to provide 3D correction)
2) EXPANSION ROOMS (For tissue’s migration, growth and breathing movements, converting a rigid brace into a dynamic rigid brace)
3) No NEUTRAL parts
3D Correction

- Three-points systems in the frontal plane. Alignment in the frontal plane
- Regional derotation and pair of forces in the transversal plane for local derotation
- Sagittal balance and physiological alignment
- Breathing mechanics against the morphological lordotization of the main thoracic spine
Regional Derotation
LUMBAR (RED)
Local Derotation
The pads for derotation, acting on the dorsal and ventral rib humps should be at the same level.
Mirror effect
Boston with upper thoracic extension
Principle supported by Perie D et al. Spine 2003
Fig. 78 et 79. — Dans le but d'une recherche de correction maxima, on peut provisoirement tolérer une légère surélévation de l'épaule. Vérifier cependant le comportement de la contre-courbure supérieure.
Classical Proximal Thoracic Pad
Breathing mechanics (Dynamic effect)
Breathing mechanics creating an internal pair-of-force for derotation and partial correction of the structural flat back
Breathing mechanics creating an internal pair-of-force for derotation and partial correction of the structural flat back
Frontal plane: Reduction of the Cobb angle
Transversal plane: Reduction of the axial rotation
Comparison 12/04 vs. 3/06
Limitations for Bracing
I Best case
II
III Worst case
‘A specific scoliosis classification correlating with brace treatment: description and reliability’
Rigo M, Gallo D, Villagrasa M
Scoliosis 2010 5:1

• **Clinical Criteria**: 4 general types based on clinical observations and exploration (modified from Ch Lehnert-Schroth)
• **Radiological Criteria**: To confirm and select brace specifications
Clinical Criteria. Four Categories
Modified from Lehnert-Schroth
Radiologic Criteria 1
Curve pattern compatibility

- Single Major \textit{High} Thoracic (upper or proximal)
- Single Major Thoracic
- Single Major Thoracolumbar
- Single Major Lumbar
- Major Thoracic and Minor Lumbar
- Double Major Thoracic and Lumbar
- Double Major Thoracic and Thoracolumbar
- Double Major Thoracic
- Multiple

Lonstein’s Revision of the Moe & Ketleson (1970)

Single \textit{Composite}

- Thoracic: T2-T11 (Disc T11-12)
- Proximal Thoracic: T3-4-5
- Main T = High: T6-7 Low T9-11
- Thoracolumbar: T12-L1
- Lumbar: L2-L4 (Disc L1-2)
- Lumbosacral: L5-S1 (Disc L4-5)

Major lumbar or TL / Minor Thoracic (Rigo)

Double major = 2 structural curves with a Cobb angle not $\neq 5^\circ$
Radiologic Criteria 2
Transitional Point and T1
CSL Offset
Radiologic Criteria 3
L5-L4 Counter-tilting

+ Counter-tilting

- Counter-tilting
Radiologic Criteria for Clinical 3 Curve Pattern (*Scoliosis* 2010, 5:1)
A1 type

Radiological Criteria 1

A1 = Long-Low thoracic
Apex = T9-11
L3 tilted to the convex thoracic side
L4 horizontal or tilted to the convex thoracic side

Radiological Criteria 2

Transitional Point offset to the convex thoracic side
(100% consistency)
T1 offset to the convex thoracic side
(Highly consistent, some times false negative)

= A1 type confirmed
Just with radiological criteria 1 + 2
(with or without proximal - D mod)
A1 Type (Radiological Criteria)
A1 Type design, Apex T11
A2 type

Radiological Criteria
1. Apex = T8 (9)
   L3-L4 + horizontal

   +

Radiological Criteria
2. Transitional Point offset to the convex thoracic side
   (100% consistency)
   T1 offset to the convex thoracic side
   (Highly consistent, some times false negative)

= A2 type confirmed
Just with radiological criteria 1 + 2
(with or without proximal - D mod)
A3 type

Radiological Criteria

1. Thoracic Apex = T8 (T9)
2. Lumbar Apex = L2-3
3. L4 tilted to the concave thoracic side

4. Transitional Point offset to the convex thoracic side
   (100% consistency)
5. T1 offset to the convex thoracic side
   (Highly consistent, some times false negative)

= A3 type confirmed
Just with radiological criteria 1 + 2
(with or without proximal - D mod)
A2 and A3 Types
Classic 3C design for Types A2 and A3 (Closed Pelvis)
A2/A3 Type Design
Radiologic Criteria for Clinical 4 Curve Pattern (Scoliosis 2010, 5:1)
### Classification and blueprints

#### B1 Type

**Radiologic Criteria 1**

- B1 = Double Major Thoracic/Lumbar or TL; or Combined Major Lumbar or TL/ minor Thoracic; or Combined Major Thoracic/ minor Lumbar or TL
- Thoracic Apex = T7-8-9
- Lumbar Apex = L2 (L3) or Low TL Apex = L1

**Radiologic Criteria 2**

- Transitional Point offset to the concave thoracic side
  - (100% consistency)
- T1 offset to the concave thoracic side
  - (100% consistency)

**Radiologic Criteria 3**

- Positive L4-L5 counter-tilting
  - (100% consistency)
- Sometimes L3-L4 counter-tilting

= B1 type confirmed

With radiological criteria 1 + 2 + 3
(with or without proximal - D mod)
Examples of B1 Type
Classic 4C Design for Type B1
‘Closed Pelvis’
Modified – already classic - 4C Design for Type B1 ‘Open Pelvis’.
B1 Type Design (open)
B2 Type

**Radiological Criteria 1**

B2 = Double Major Thoracic/High TL; or
Combined Major High TL/minor Thoracic; or
Combined Major Thoracic/minor High TL

Thoracic Apex = T7 (T8)
High TL Apex = T12

**Radiological Criteria 2**

Transitional Point offset to the concave thoracic side
(100 % consistency)
T1 offset to the concave thoracic side
(100 % consistency)

**Radiological Criteria 3**

Positive L4-L5 counter-tilting
(100 % consistency)
L3-L4 counter-tilting (Highly consistent). L2-3 possible

= B2 type confirmed
With radiological criteria 1 + 2 + 3
(No D modifier reported in this type)
Example of B2 Type

Border case B2-E2. Using clinical criteria to classify
4C Design for Type B2 type with TL pad. Pelvis closed or open.
B2 is very rare. First B2 type design (2000 or earlier)
Radiologic Criteria for Clinical N3N4 Curve Pattern (Scoliosis 2010, 5:1)
C1 Type

Radiological Criteria 1

C1 = Single Thoracic with no Lumbar curve
Thoracic Apex = T8 (T7-T9)

Radiological Criteria 2

Transitional Point + balanced or minimal offset to the convex thoracic side
T1 + balanced or minimal offset to the concave thoracic side (very often to the convex –D)

As far as there is no structural lumbar curve L4-L5 counter-tilting is negative

= C1 type confirmed
With radiological criteria 1 + 2 (without or with D)
C2 Type

Radiological Criteria 1

C2 = Combined Thoracic Major/Lumbar Minor (Both structural)
Double Major Thoracic/Lumbar
Thoracic Apex = T8 (T7-T9)
Lumbar apex L2 / TL = L1

Radiological Criteria 2

Transitional Point + balanced or minimal offset to the convex thoracic side
T1 + balanced or minimal offset to the concave thoracic side (very often to the convex –D)

Radiological Criteria 3

Negative L4-L5 Counter-tilting (False 4C)
(False positive due to real LLD on the convex thoracic side)

= C2 type confirmed
With radiological criteria 1 + 2 + 3 (without or with D)
Examples of C1 Type
Examples of C2 Type
Correction in Clinical 4 Curve Pattern
Radiological Subtypes B1 and B2

Correction in Clinical N3N4 Curve Pattern
Radiological Subtypes C1 and C2

TP = Transitional Point
CSL = Central Sacral Line
Classical design for C1
C2 Type Design – with D
C2 Type Like B1 (pelvis approach C2 *)

C2 Open, like 4

TP and CSL
Radiologic Criteria: Lumbar/Thoracolumbar Patterns

It is like B type but with NO structural curve
Examples of E1/E2 Types

Border case B2-E2. Using clinical criteria to classify
E1 type – Left convex

E1 Type Design
E1-E2 Border Type (T12-L1) – Right convex

The importance of the sagittal profile


Good results from a ‘Working Integrated Rehabilitation Team’ using right Biomechanical principles and ‘custom Cheneau brace’
Some studies showing good results in patients treated with ‘Custom Chêneau Type Brace’

1) The original Chêneau Brace, when performed with a proper design, provides the necessary 3D correction

2) The Chêneau type brace is not an orthopaedic product but a corrective concept. Knowledge and experience are necessary to produce the expected results