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ISTITUTO SCIENTIFICO ITALIANO
COLONNA VERTEBRALE

**RACHIDE: LE PROBLEMATICHE SUL
PIANO SAGITTALE**

Spine-Center Bologna, 10 ottobre 2015

**APPROCCIO
DIAGNOSTICO-TERAPEUTICO
ALLE DEFORMITA' DEL PIANO
SAGITTALE**



isico
ISTITUTO SCIENTIFICO ITALIANO
COLONNA VERTEBRALE

Dott. Minnella Salvatore





INTRODUZIONE



“The majority of degenerative disease occurs in spines that are well aligned in the coronal plane but exhibit highly variable morphology in the sagittal plane”



INTRODUZIONE



“ Recently interest has focused on the possibility that certain states of sagittal alignment may be related to the risk of symptomatic disc disease, spinal stenosis, progression of deformity or failed surgical intervention”



INTRODUZIONE



***“ When evaluating and treating patients
with spinal disorders, significant knowledge
of the normal spinopelvic balance
Is of primary importance”***



INTRODUZIONE



***“ Sagittal imbalance is a significant factor
in determining clinical treatment outcomes
in patients with deformity”***



EQUILIBRIO SAGITTALE GLOBALE



C'ERA UNA VOLTA.....

VISIONE "STATICA" del PIANO SAGITTALE

1. CURVA SACRALE

a concavità anteriore

2. LORDOSI LOMBARE

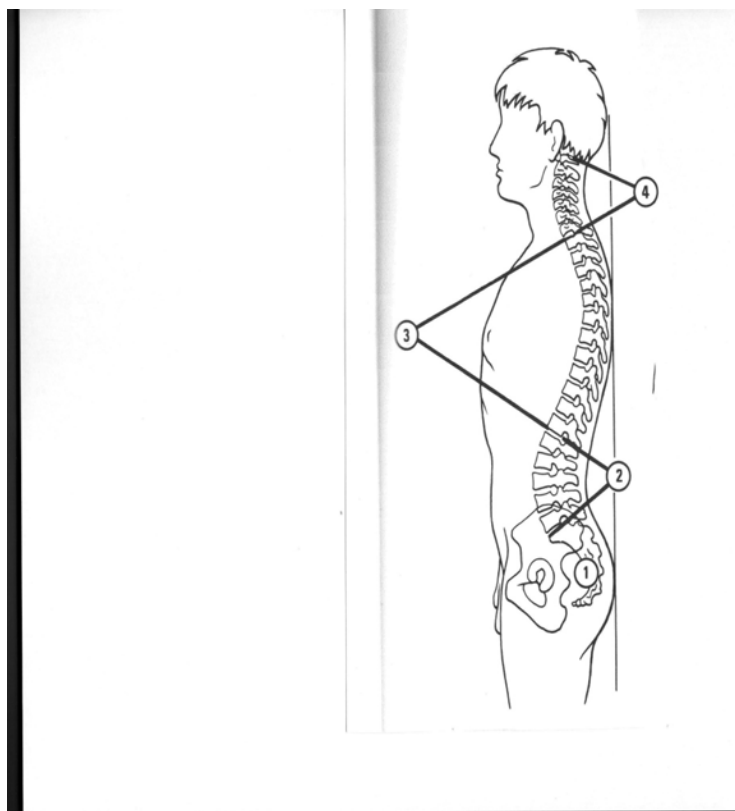
a concavità posteriore

3. CIFOSI DORSALE

a convessità posteriore

4. LORDOSI CERVICALE

a concavità posteriore

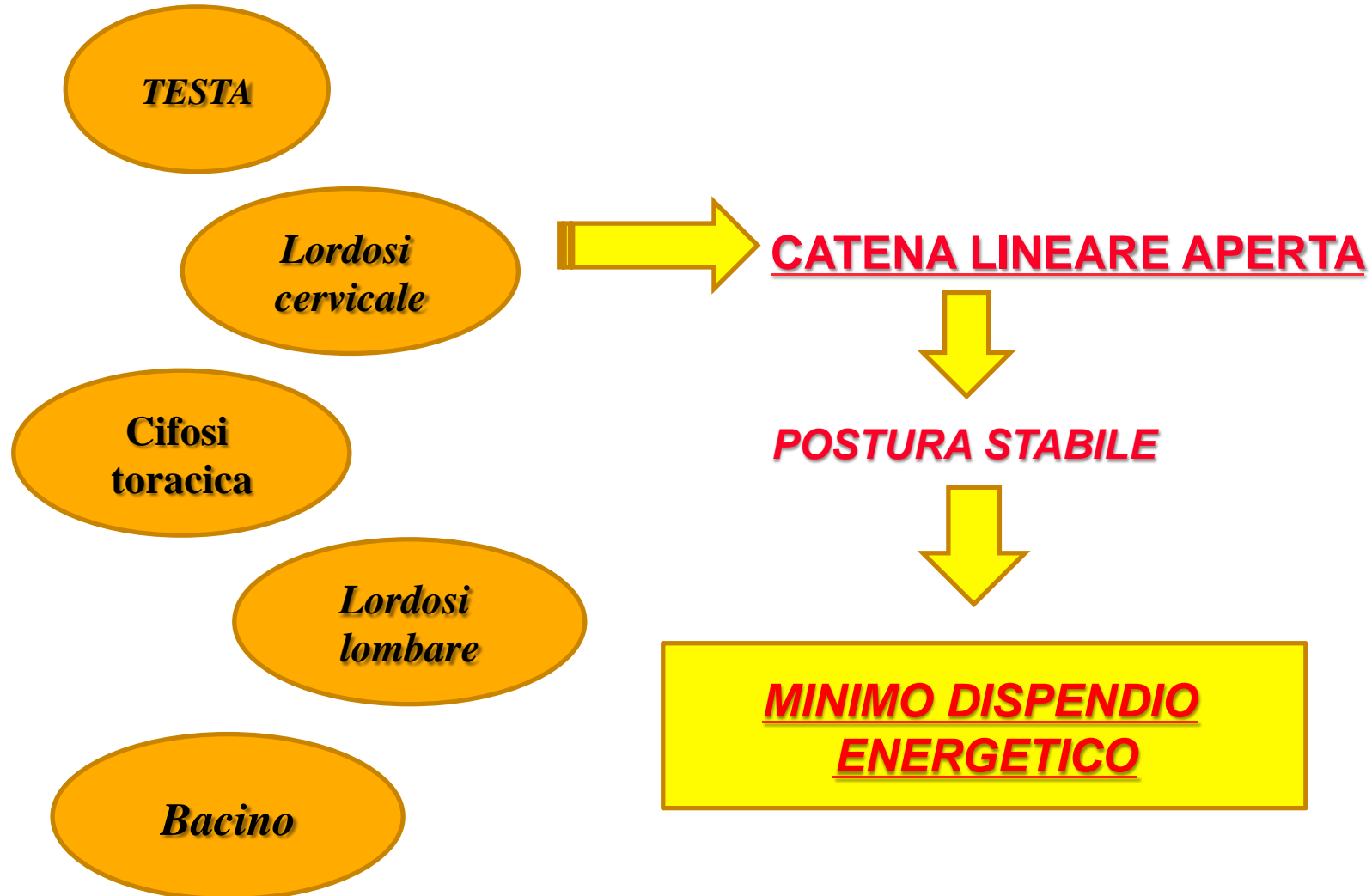




EQUILIBRIO SAGITTALE GLOBALE



VISIONE "DINAMICA" del PIANO SAGITTALE

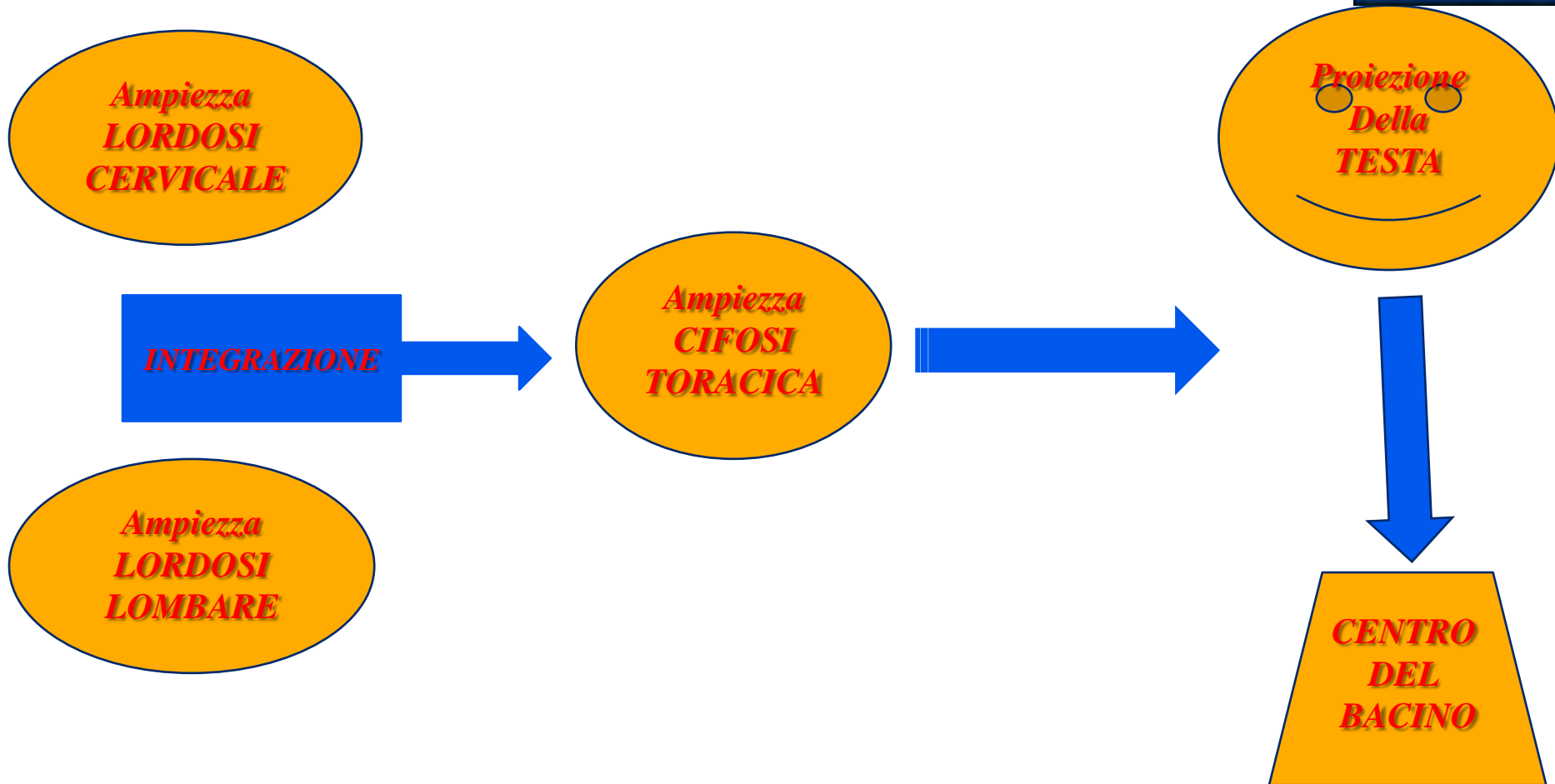




EQUILIBRIO SAGITTALE GLOBALE



VISIONE "DINAMICA" del PIANO SAGITTALE





EQUILIBRIO SAGITTALE GLOBALE

COME MISURARE..?

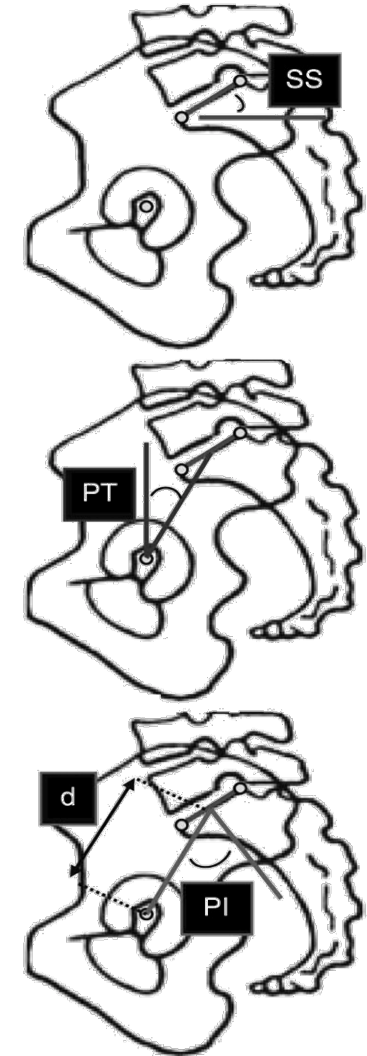
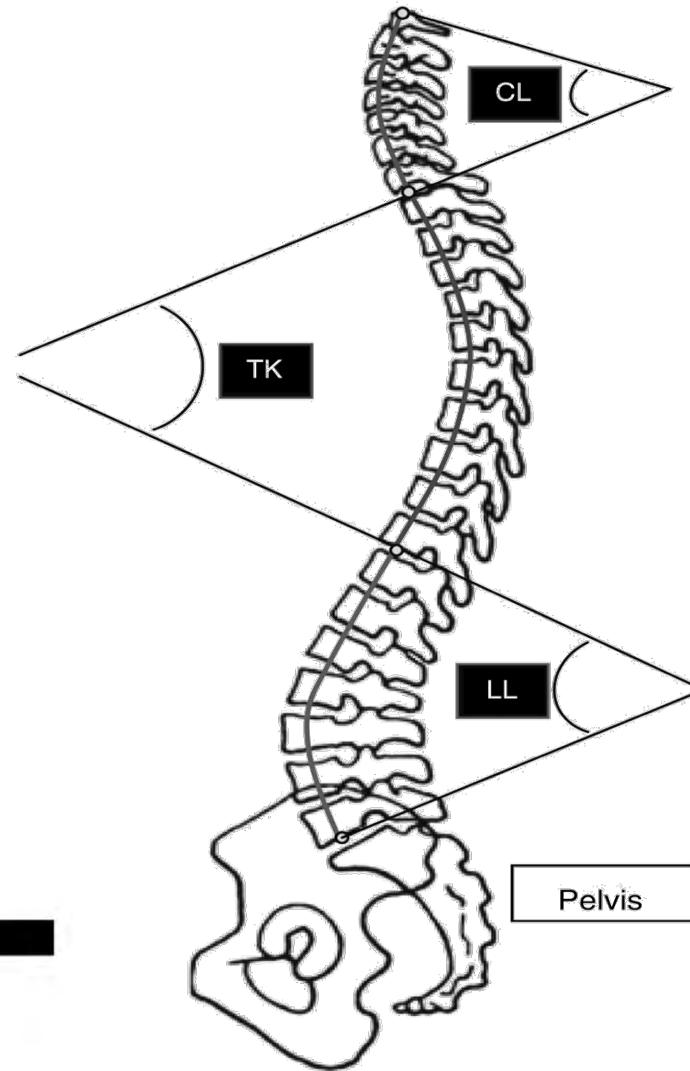




PARAMETRI PELVICI



- Fattori chiave per comprendere l'equilibrio sagittale
- Riflettono la geometria del bacino



Eur Spine J (1998) 7: 99–103
© Springer-Verlag 1998

ORIGINAL ARTICLE

J. Legaye
G. Duval-Beaupère
J. Hecquet
C. Marty

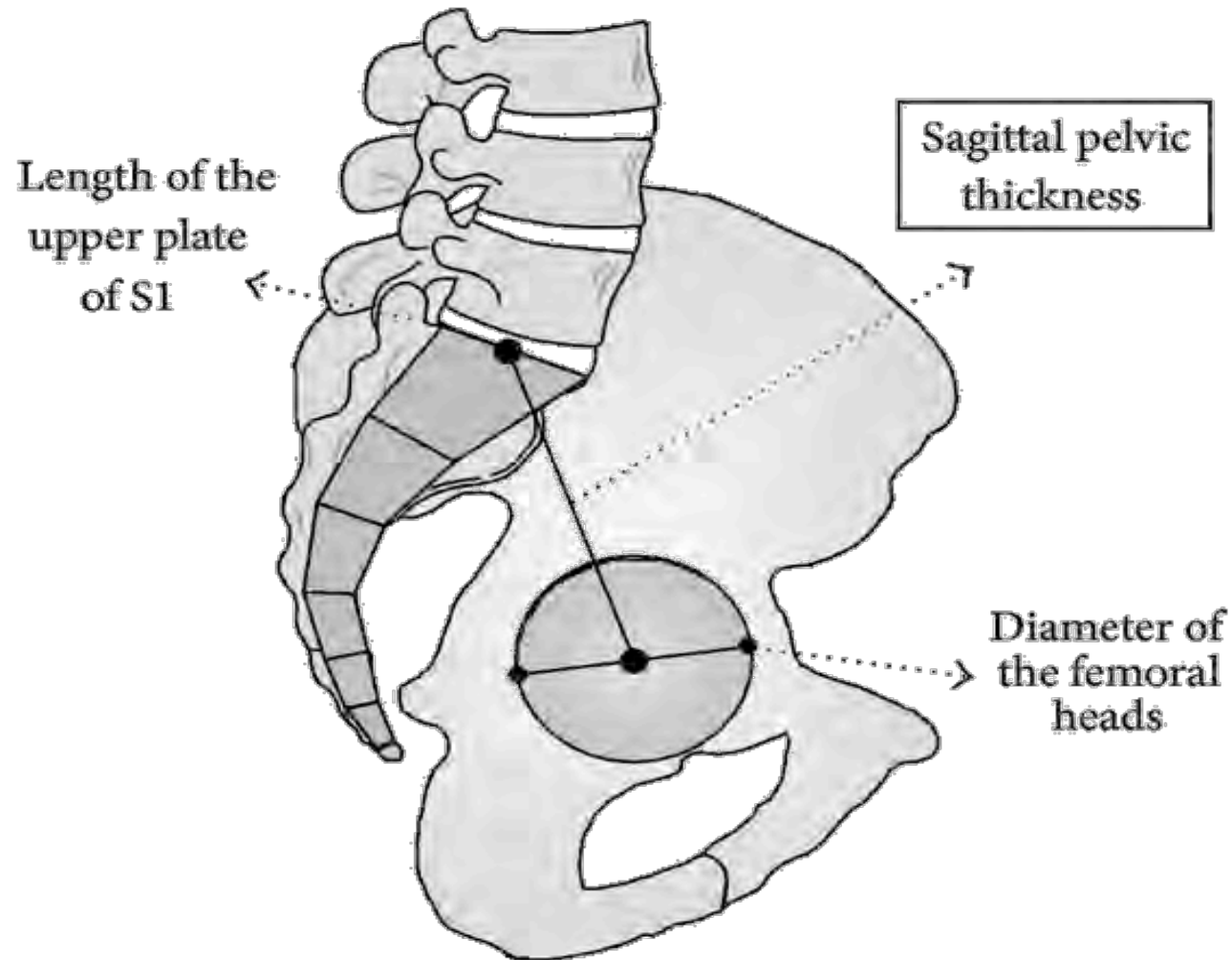
**Pelvic incidence:
a fundamental pelvic parameter
for three-dimensional regulation
of spinal sagittal curves**



PARAMETRI PELVICI



La larghezza della base pelvica





PARAMETRI PELVICI

Incidenza pelvica (PI)



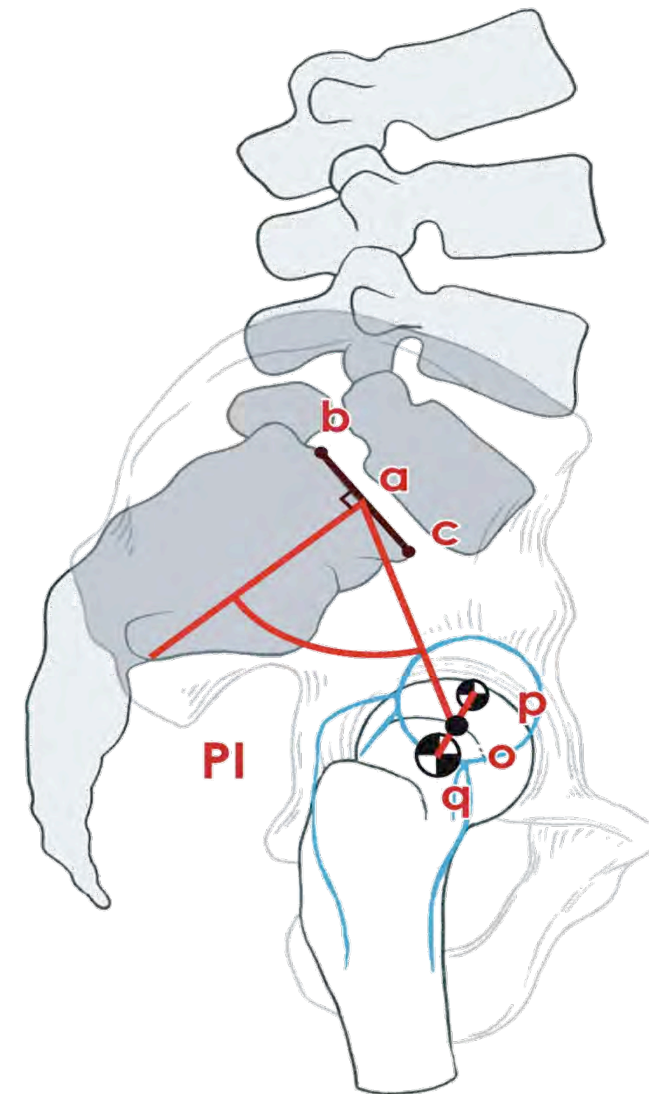
Angolo formato tra

1. Perpendicolare al piatto sacrale

2. Linea congiungente

- centro delle teste femorali
- centro del piatto sacrale

Parametro anatomico, costante, che caratterizza ciascun individuo.





PARAMETRI PELVICI

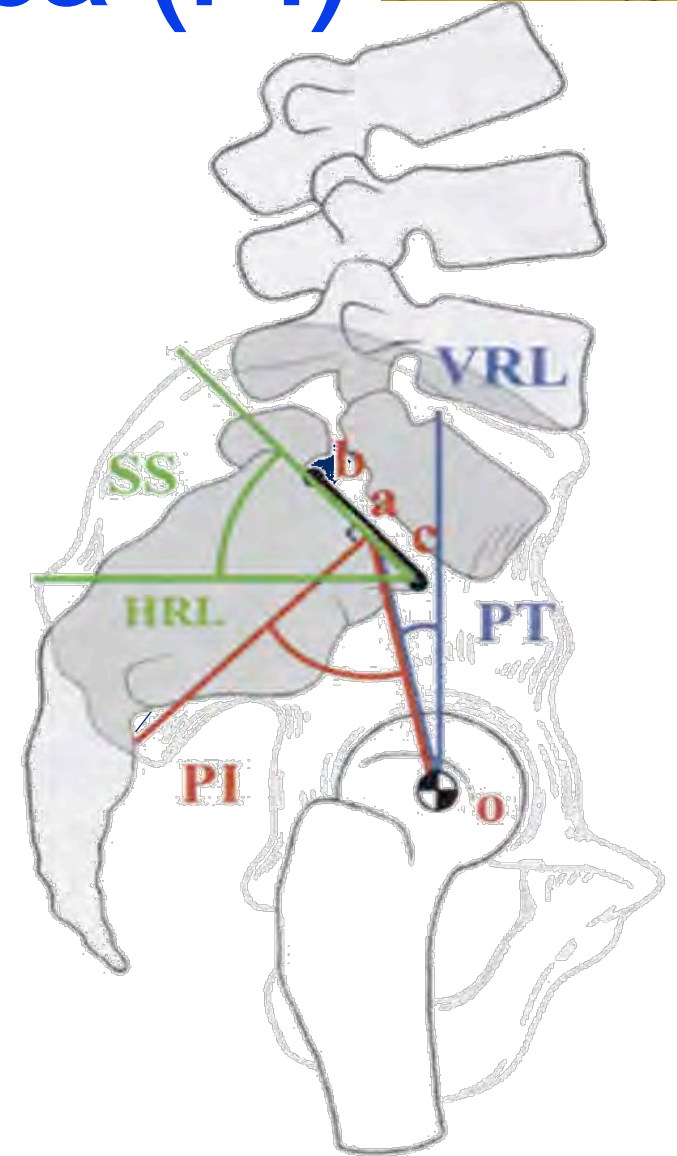
Incidenza pelvica (PI)



Somma di 2 parametri
posizionali

1. Versione pelvica (PT)
2. Inclinazione sacrale (SS)

$$PI = PT + SS$$





Versione pelvica (PT)

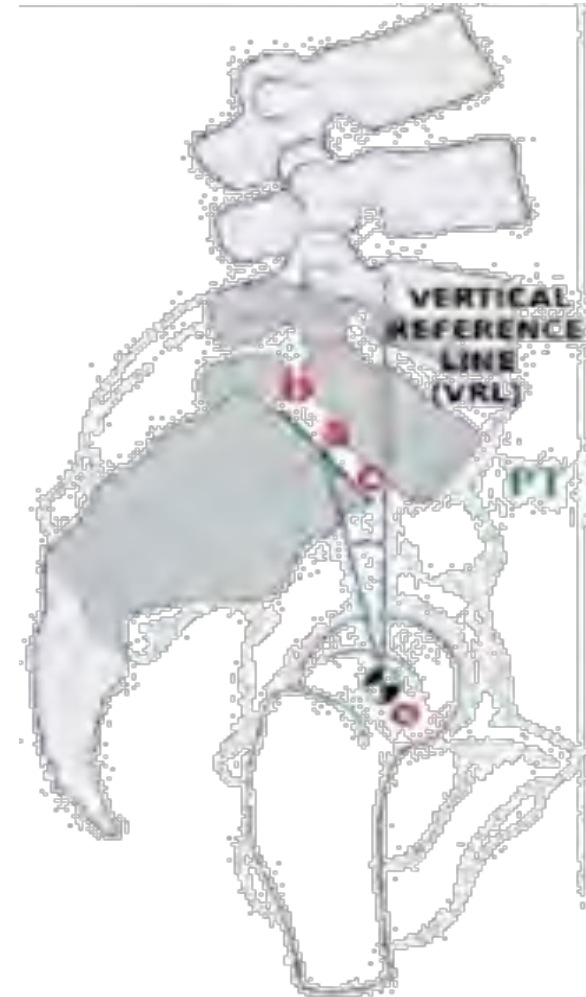


Angolo formato tra

1. Asse verticale
2. Linea congiungente
 - centro delle teste femorali
 - centro del piatto sacrale



larghezza base sacrale





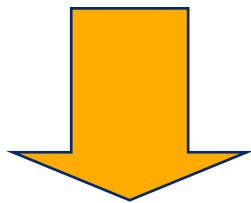
PARAMETRI PELVICI

Inclinazione sacrale (SS)



Angolo formato tra

1. Asse orizzontale
2. Piatto sacrale



inclinazione della base





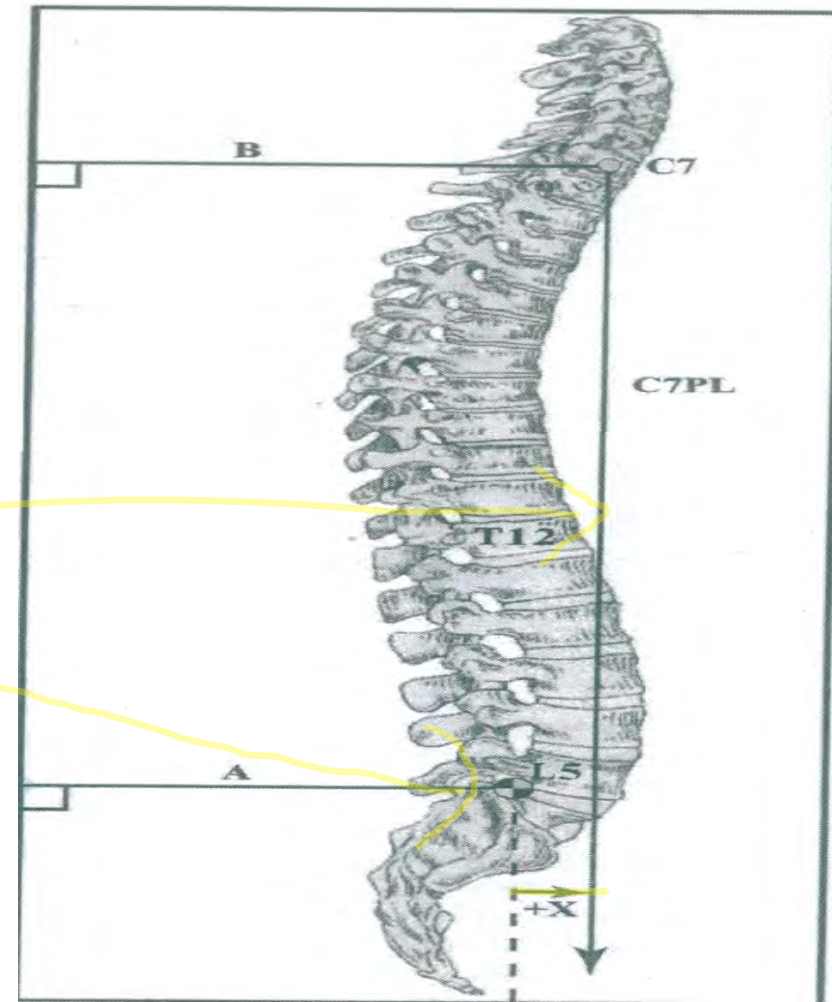
PARAMETRI SPINO- PELVICI



1

SAGITTAL VERTICAL AXIS (SVA)

E' definito come la distanza tra la linea verticale , che origina a livello del corpo di C7, e l'angolo postero – superiore del piatto sacrale (in mm)





PARAMETRI SPINO-PELVICI



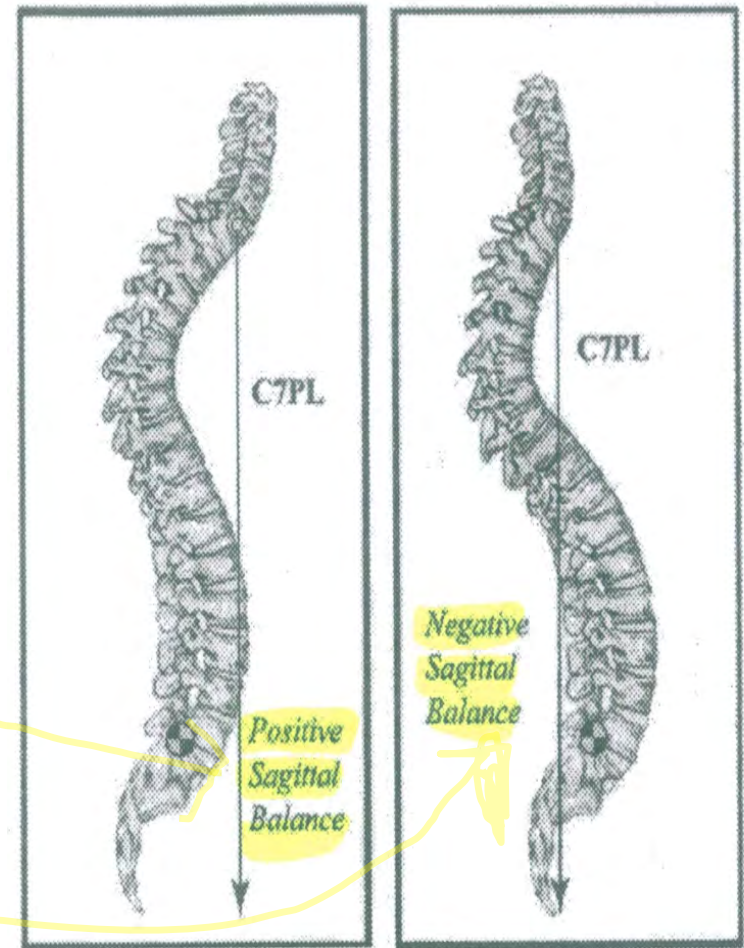
SAGITTAL VERTICAL AXIS

Può essere:

NEUTRO

POSITIVO

NEGATIVO





PARAMETRI SPINO-PELVICI



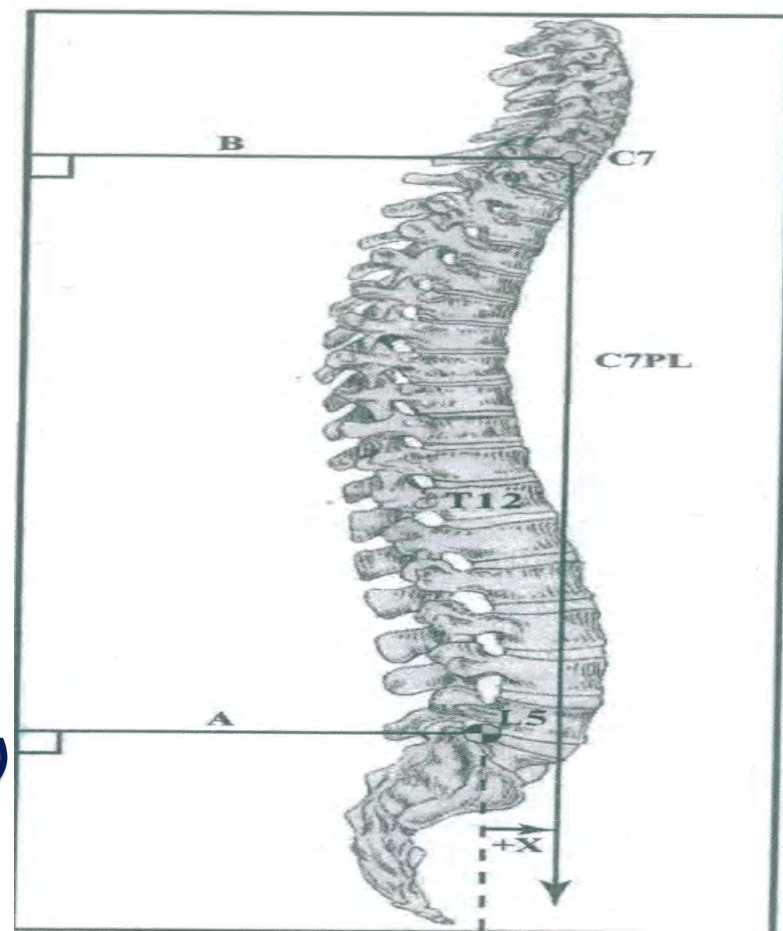
SAGITTAL VERTICAL AXIS

*In uno studio MULTICENTRICO
su 752 pz adulti, con scoliosi > 30°*



*E' stata dimostrata una CHIARA EVIDENZA
di incremento del DOLORE e
della LIMITAZIONE FUNZIONALE
nei pz con
SVA POSITIVO*

(direttamente proporzionale al valore del SVA stesso)





PARAMETRI SPINO- PELVICI



SAGITTAL VERTICAL AXIS

- ***Parametro più utilizzato nella pianificazione chirurgica***
- ***Distanza lineare.. poco precisa..***
- ***Non semplice da rilevare con screen protractor***
- ***Da noi non utilizzato!***



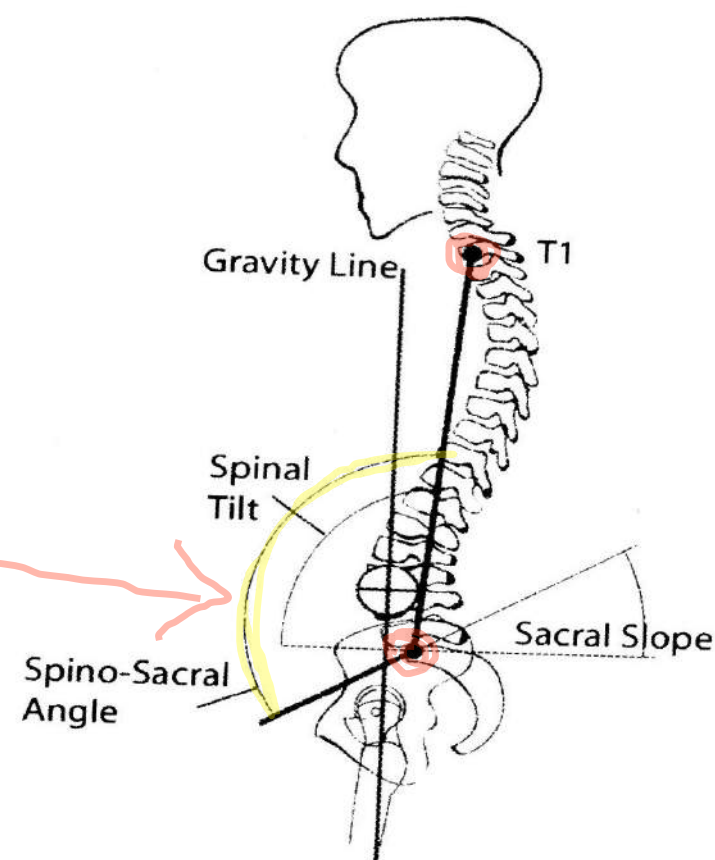
PARAMETRI SPINO- PELVICI



2

ANGOLO SPINO SACRALE (SSA)

- **Misura la posizione di C7 rispetto alla base della colonna**
- **Indicatore costante dell' equilibrio sagittale in soggetti sani**
(**Cifosi globale della colonna**)



$$\begin{aligned} \text{Spino-Sacral Angle} &= 0.9 * \text{Sacral Slope} + 99^\circ \\ \text{Spinal Tilt} &= 95 - 3.32 \end{aligned}$$

P. Rossouly et al., Eur Spine J 2011

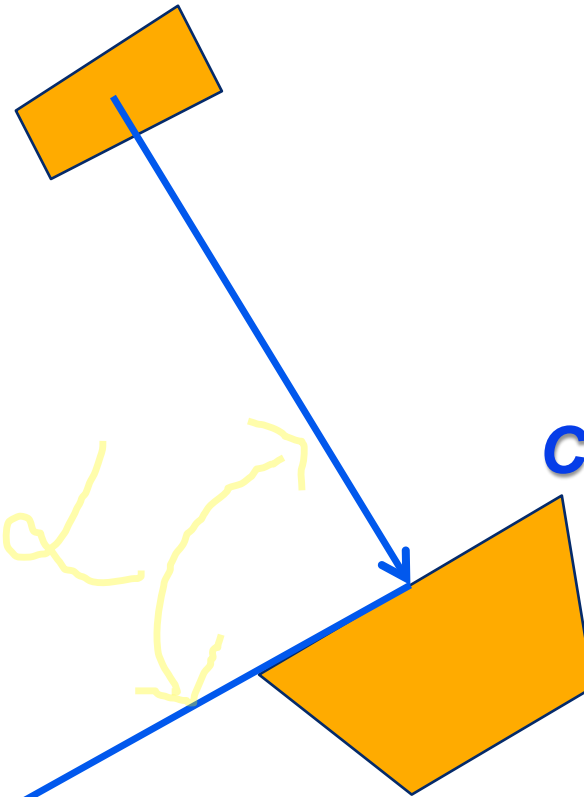


PARAMETRI SPINO- PELVICI



ANGOLO SPINO SACRALE (SSA)

Centro del corpo di C7



Centro del piatto sacrale

Sacral Slope



PARAMETRI SPINO- PELVICI



ANGOLO SPINO SACRALE (SSA)

- **Misura angolare..più precisa e comparabile**
- **in soggetti adulti sani: ottima correlazione con **SS** e **LL****



$$**SSA = 0.9 \times SS + 99^\circ**$$



PARAMETRI SPINO- PELVICI



ANGOLO SPINO SACRALE (SSA)

VALORI MEDI:

- **In soggetti adulti sani** \longrightarrow **$131^{\circ} \pm 8^{\circ}$**
- **In soggetti in età evolutiva ($3 < \text{età} < 10\text{aa}$)** \longrightarrow **$130^{\circ} \pm 10^{\circ}$**
- **In soggetti in età evolutiva ($10 < \text{età} < 18\text{aa}$)** \longrightarrow **$133^{\circ} \pm 8^{\circ}$**



PARAMETRI SPINO- PELVICI



3

ANGOLO SPINO-PELVICO (SPA)

• *Misura la posizione di C7 rispetto agli AAll*

• *Si può calcolare con la formula*



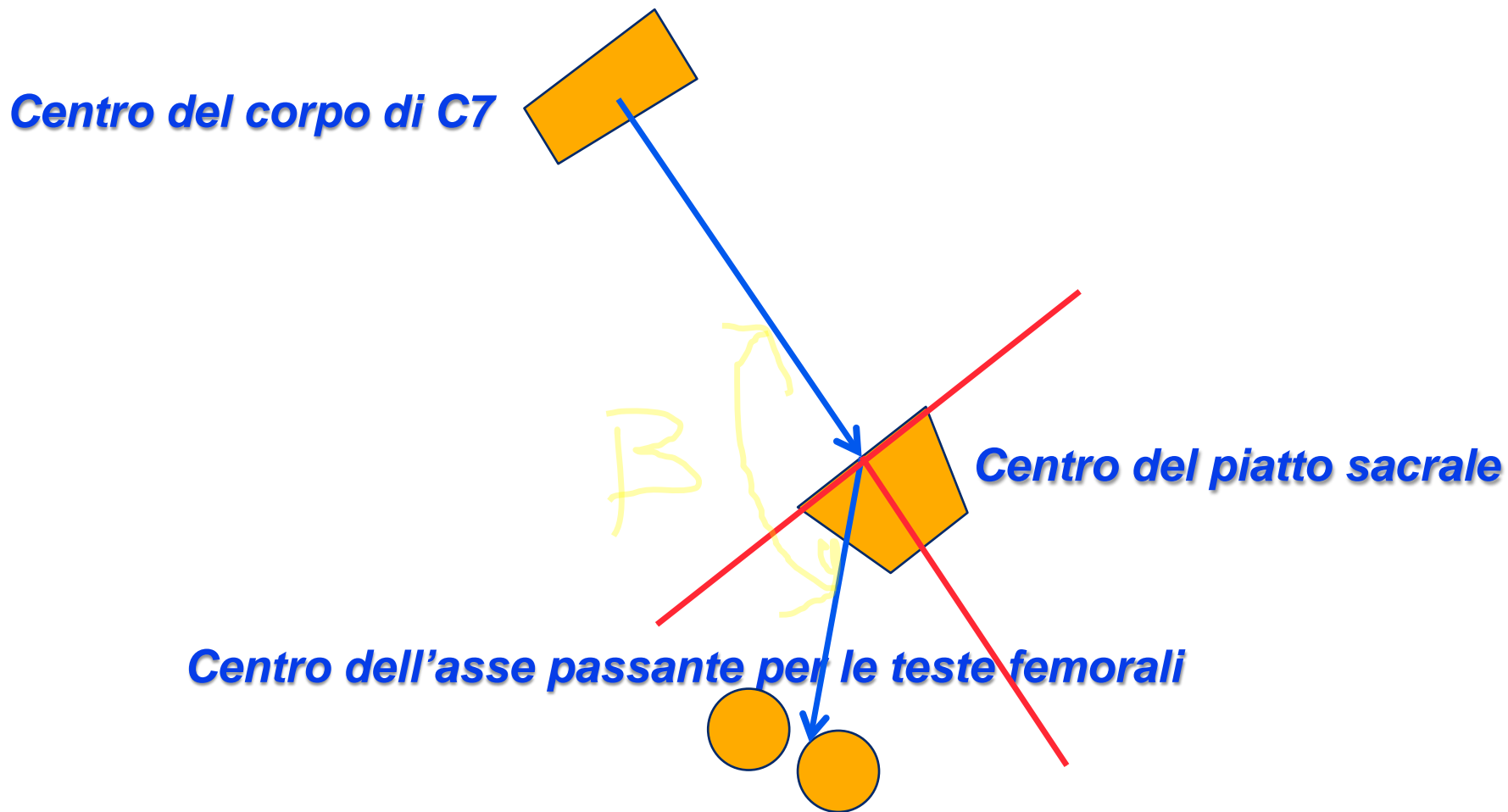
$$SPA = SSA + (90 - PI)$$



PARAMETRI SPINO-PELVICI



ANGOLO SPINO-PELVICO (SPA)





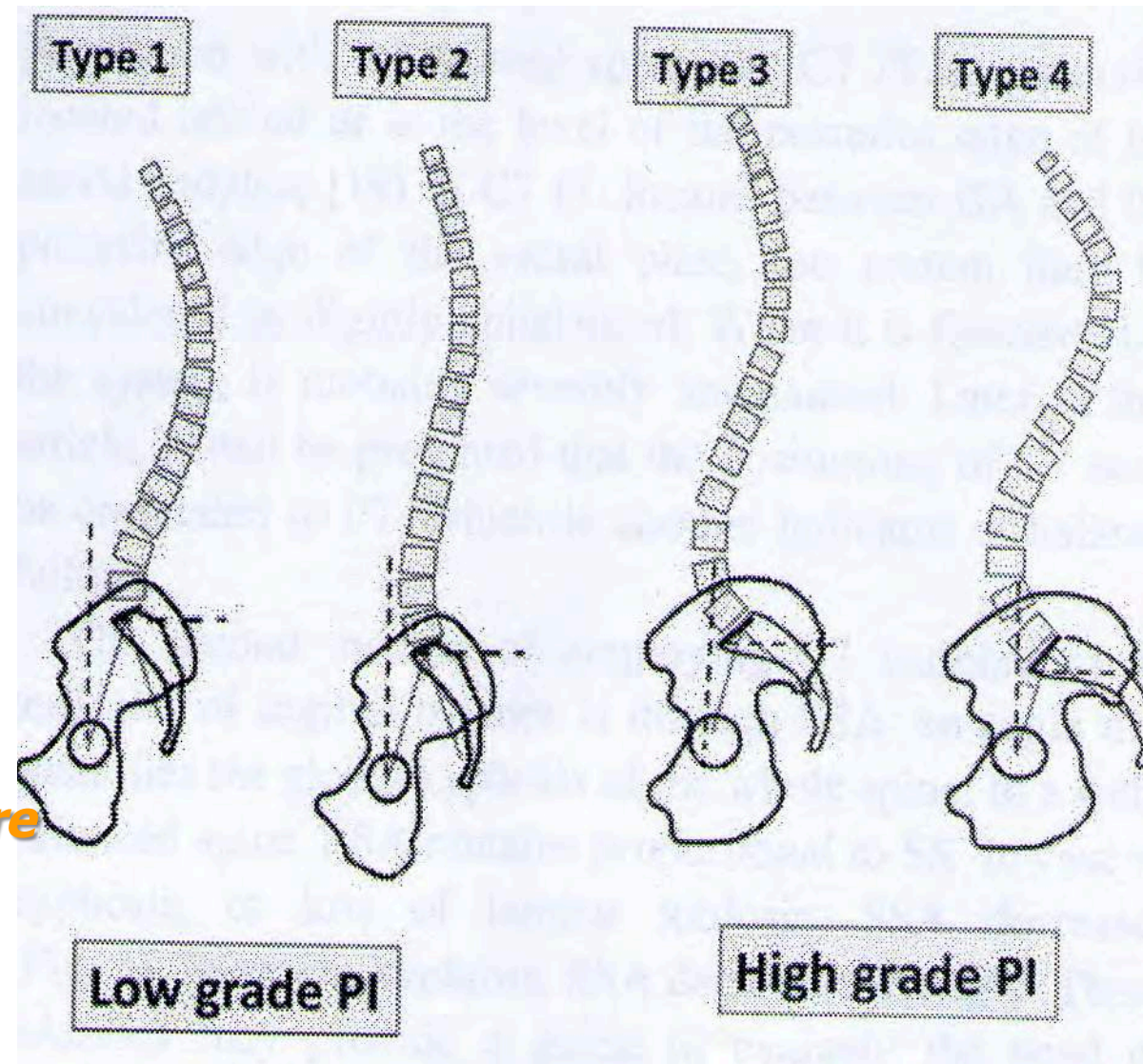
CLASSIFICAZIONE DI ROUSSOULY

TIPO 1 : $SS < 35^\circ$
Lordosi corta ed ipercifosi lunga

TIPO 2: $SS < 35^\circ$
Ipercifosi ed Ipolordosi

TIPO 3: $35^\circ < SS < 45^\circ$
Punto di flesso alla giunzione DL
Rachide bilanciato

TIPO 4: $SS > 45^\circ$
Lordosi prominente con >5 vertebre

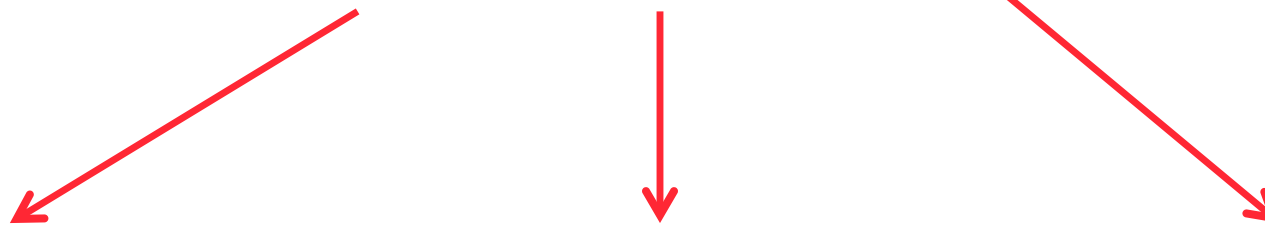




CLASSIFICAZIONE DI SCHWAB

DISEQUILIBRIO SAGITTALE ***(nelle deformità vertebrali dell'adulto)***

3 Modificatori



PI – LL

0: < 10°

+ moderata: 10-20°

++ marcata: >20°

Global Alignment

0: SVA <4 cm

+: 4 <SVA <9,5 cm

++: SVA > 9,5cm

PELVIC TILT

0: PT <20°

+: 20° <PT <30°

++: PT > 30°



CLASSIFICAZIONE DISEQUILIBRIO SAGITTALE ISICO

- **IPERCIFOSI DORSALE:** solo vertebre dorsali
- **CIFOSI LUNGA:** fino alle prime vertebre lombari, ma rachide armonico
- **IPERCIFOSI LUNGA:** fino alle prime vertebre lombari, ma cifosi più accentuata
- **CIFOSI GIUNZIONALE DL:** fino alle prime vertebre lombari, ma rachide disarmonico (ad es.: dorso piatto)



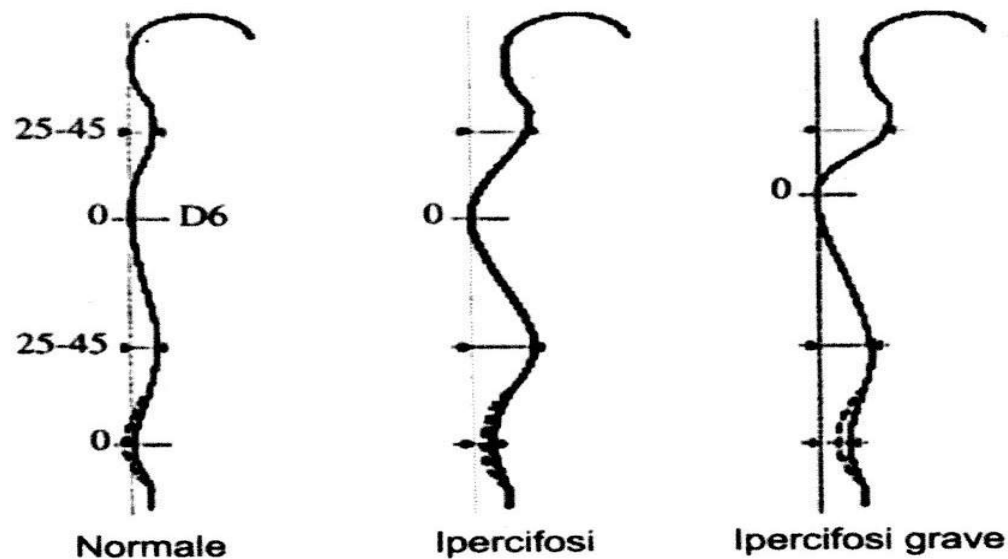
CLASSIFICAZIONE DISEQUILIBRIO SAGITTALE ISICO

- **CIFOSI DORSALE ALTA:** *pendenza prossimale della cifosi più accentuata*
- **IPERLORDOSI**
- **DORSO PIATTO**
- **INVERSIONE COMPLETA DELLE CURVE SAGITTALI**
- **DORSO CAVO**
- **CIFOSI LOMBARE**

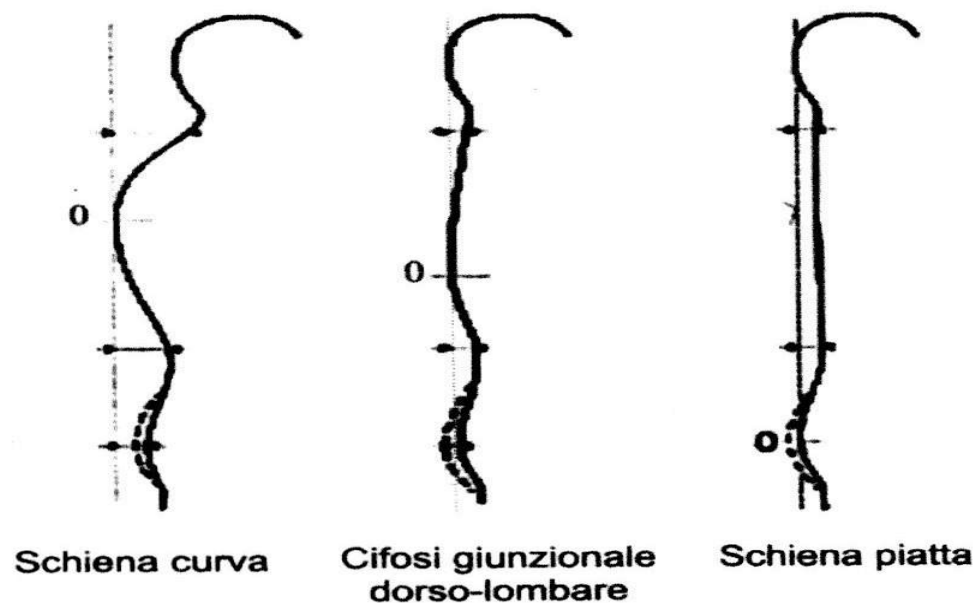


HYPERKYPHOSIS: **Acquired forms**

Idiopathic hyperkyphosis



Scheuermann's kyphosis





BACKGROUND



HYPERKYPHOSIS

ACCORDING TO SRS CRITERIA



THORACIC KYPHOSIS

According to COBB DEGREES in LL Rx ———→ GOLD STANDARD)

20° < NORMAL RANGE < 40°

Tribus CB.J Am Acad Orthop Surg, 1998

Wenger DR. In the art and practice of Children's Orthopaedics, 1993

Lowé TG. J Bone Joint Surgery[Am], 1990



BACKGROUND



HYPERKYPHOSIS

WHEN



THORACIC KYPHOSIS > 45°

(According to COBB DEGREES in LL Rx → GOLD STANDARD)

UPPER LIMIT IN A STUDY OF 316 HEALTHY SUBJECTS

Fon GT, Pitt MJ, Thies ACJ. AJR Am J Roentgenol, 1980



BACKGROUND

EPIDEMIOLOGY

There's ***NO CERTAIN DATA*** about

PREVALENCE and ***INCIDENCE***

during ***childhood.***

Wengerr DR, Frick SL. Spine, 1999

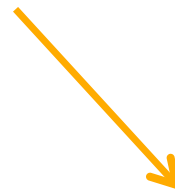




BACKGROUND

EPIDEMIOLOGY

Just two data



PREVALENCE
of
HYPERKYPHOSIS in
Scheuermann
disease about
1-8%

PREVALENCE
changes during
growth being **higher**
in adolescence
than in childhood





BACKGROUND

ACCORDING TO

SRS CLASSIFICATION:

1) CONGENITAL FORM
rare

2) ACQUIRED FORM
more frequent





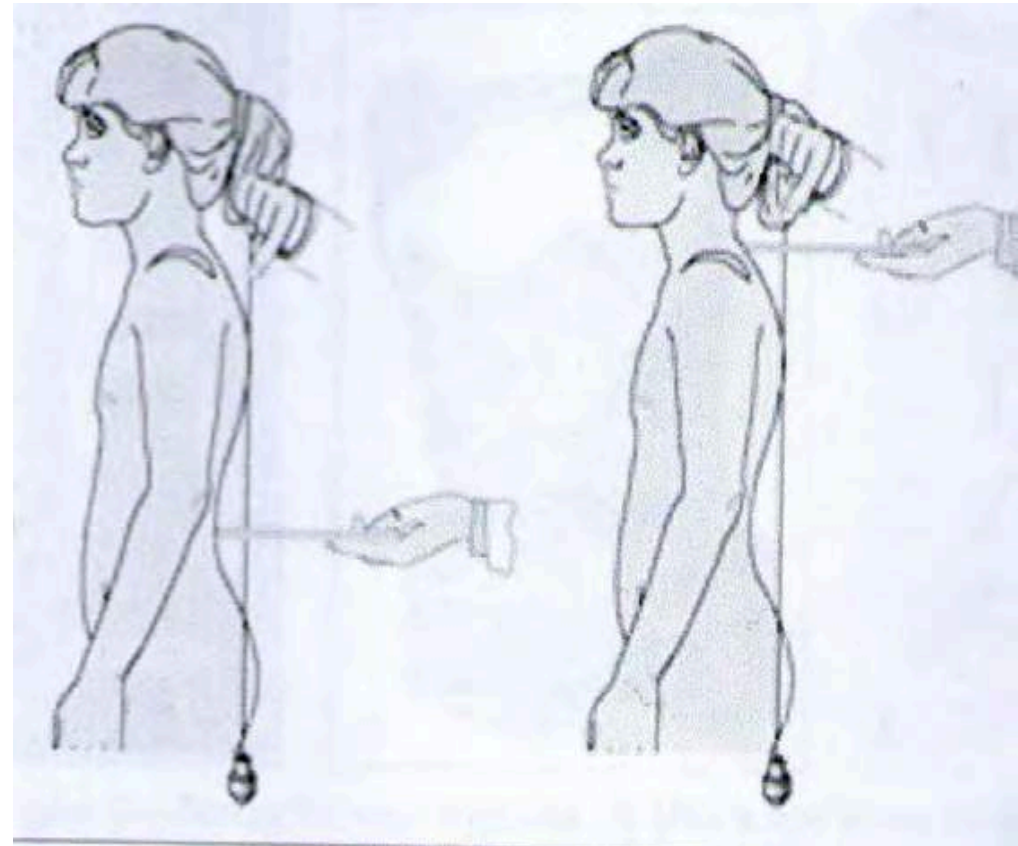
DIAGNOSI CLINICA

CLINICAL TOOLS:

Plumbline distance at C7

Plumbline distance at L3

Sagittal index (C7+L3)





DIAGNOSI CLINICA

CLINICAL TOOLS:

Plumbline distance at C7 → correlation with Kyphosis

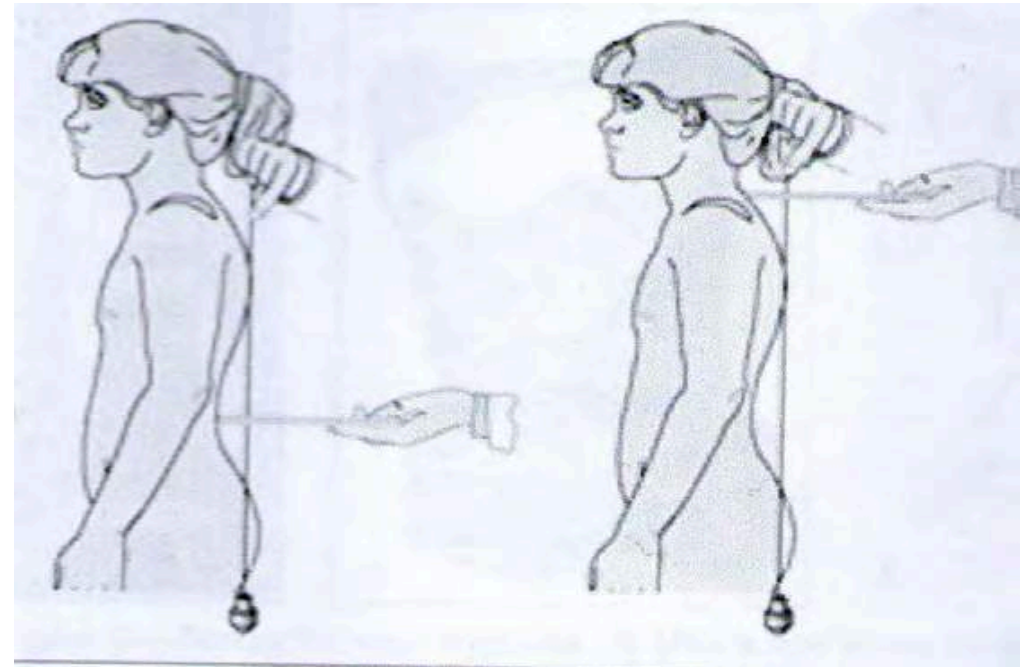
Plumbline distance at L3 → correlation with Lordosis

Sagittal index (C7+L3) > 95 → risk of hyperkyphosis



DIAGNOSI CLINICA

CLINICAL TOOLS:



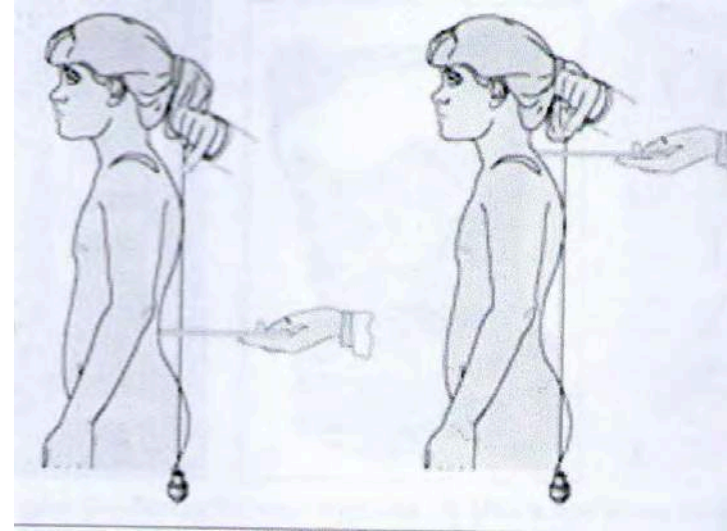
Plumbline distance at C7: 34 ± 11 mm (F) and 34 ± 10 mm (M)

Plumbline distance at L3: 34 ± 15 mm (F) and 48 ± 10 mm (M)



DIAGNOSI CLINICA

CLINICAL TOOLS:



MEASUREMENTS ERRORS

C7:
0.9 intra-rater
1.7 inter-rater

L3:
1.2 intra-rater
2.2 inter-rater



DIAGNOSI STRUMENTALE

GOLD STANDARD



LL X-RAY





VALUTAZIONE STRUMENTALE



FORMETRIC

- **Differenza tra tracciato base ed autocorrezione**
- **Angoli**
- **Percentuale del punto di flessione**



TERAPIA

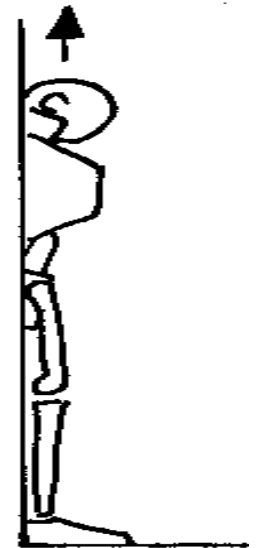
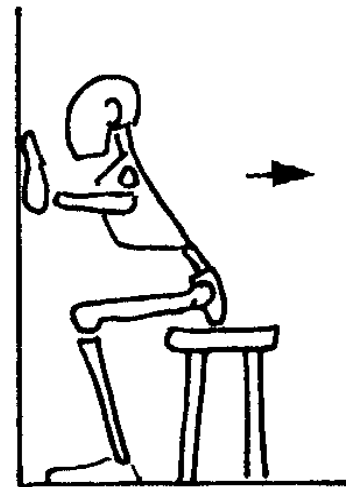
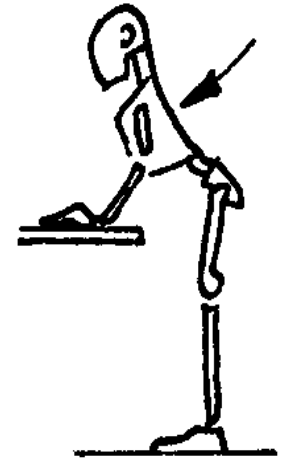
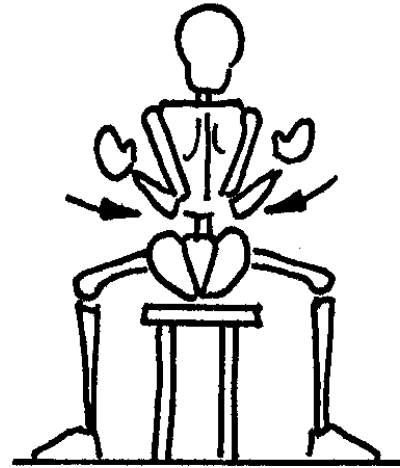
SPECIFIC EXERCISES for HYPERKYPHOSIS

- **Mobilization**
- **Elongation**
- **Extension**

of Thoracic spine

**with gradually increasing
complexity**

(SEAS Approach)



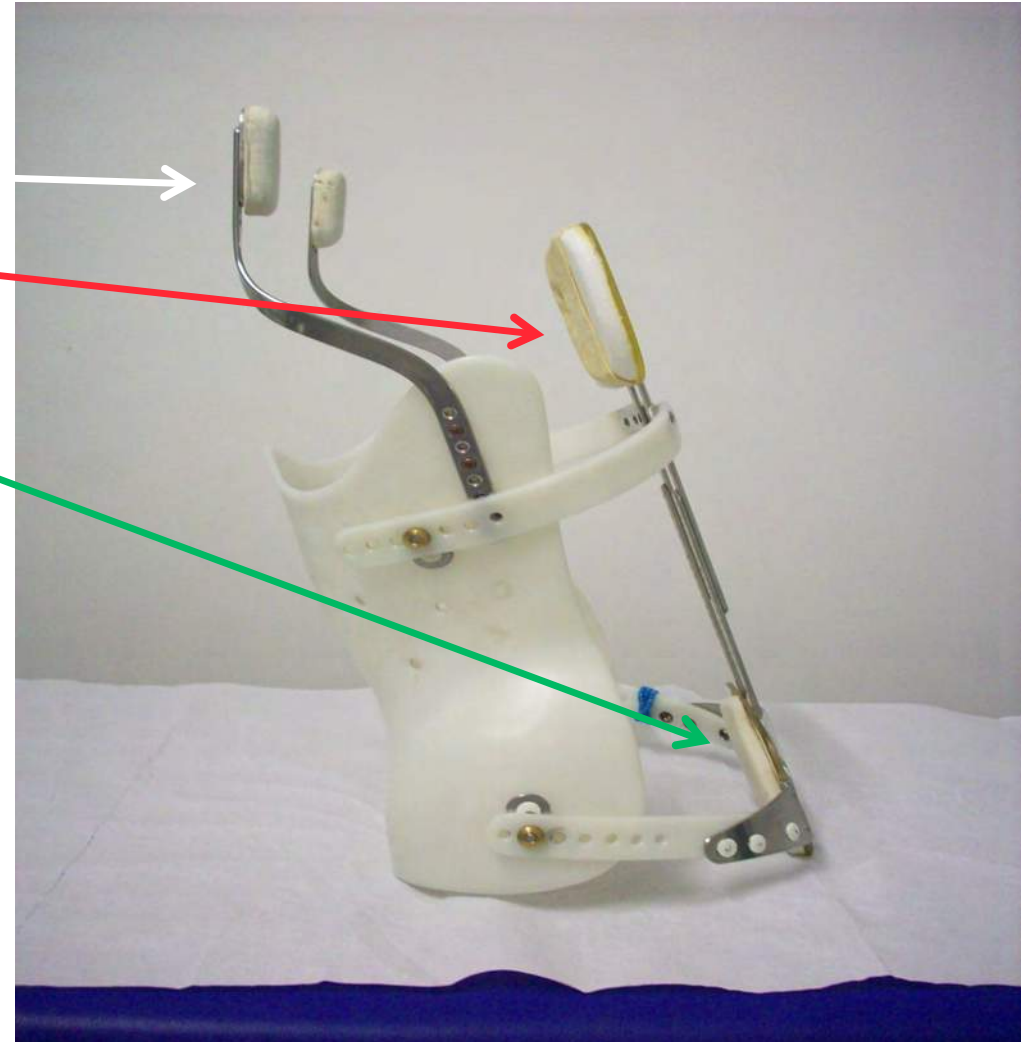


TERAPIA

MAGUELONE Brace

IT's a 3 POINTS BRACE

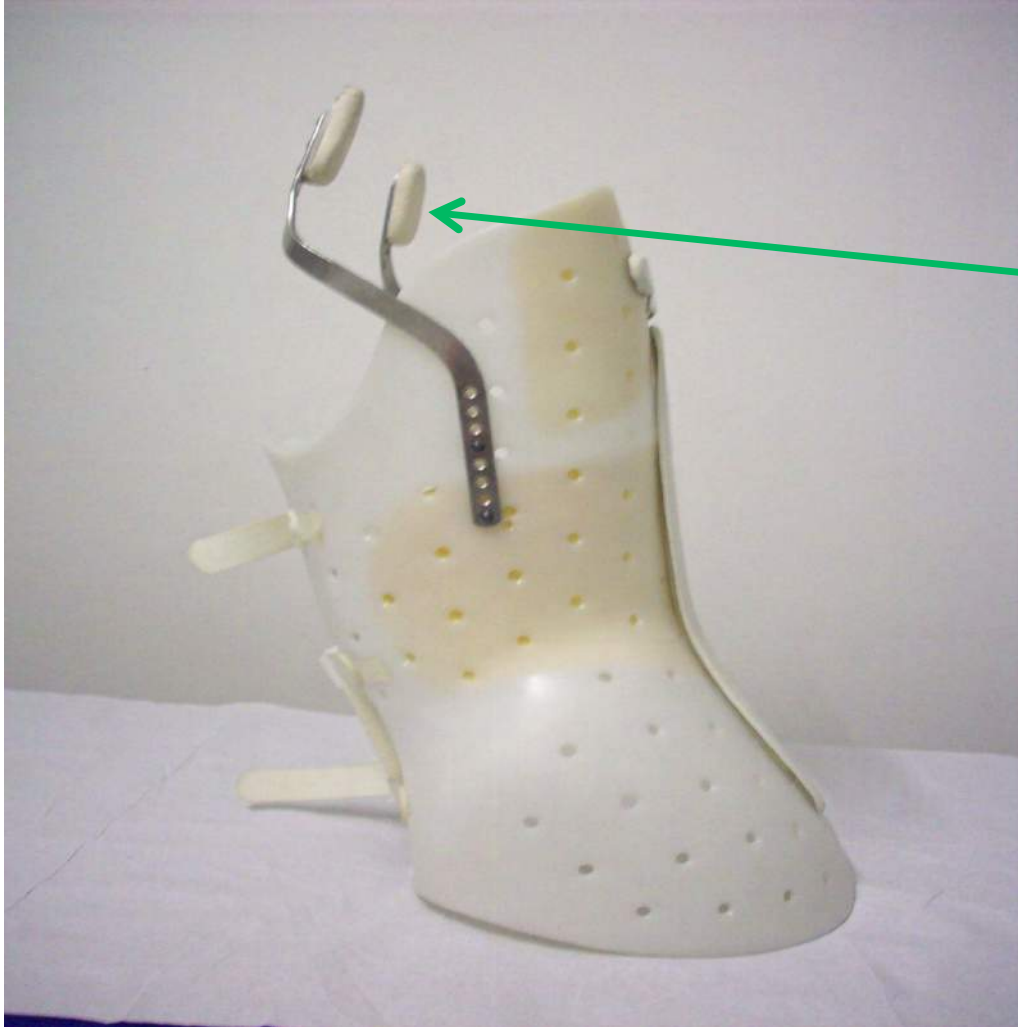
- *Acromial*
- *Thoracic*
- *Sacral*





TERAPIA

LAPADULA –SIBILLA Brace



**IT'S a TLSO BRACE
with
Acromial pressures**

SFORZESCO PER IPERCIFOSI
TLSO BIVALVA
Con spinte acromiali
CASI MISTI





CASO CLINICO





CASO CLINICO



Maria K. 16aa

Prima visita = 07-2014

***Diagnosi: scoliosi idiopatica con curva DL sx 29°
(rx 06-2014)***

Menarca 12-2010 (risser 4)



CASO CLINICO



TRACE: 2, 1, 3, 1= 8

DL sx 8°ATR 9mm, rigidità media



CASO CLINICO



Strapiombo 25 a s

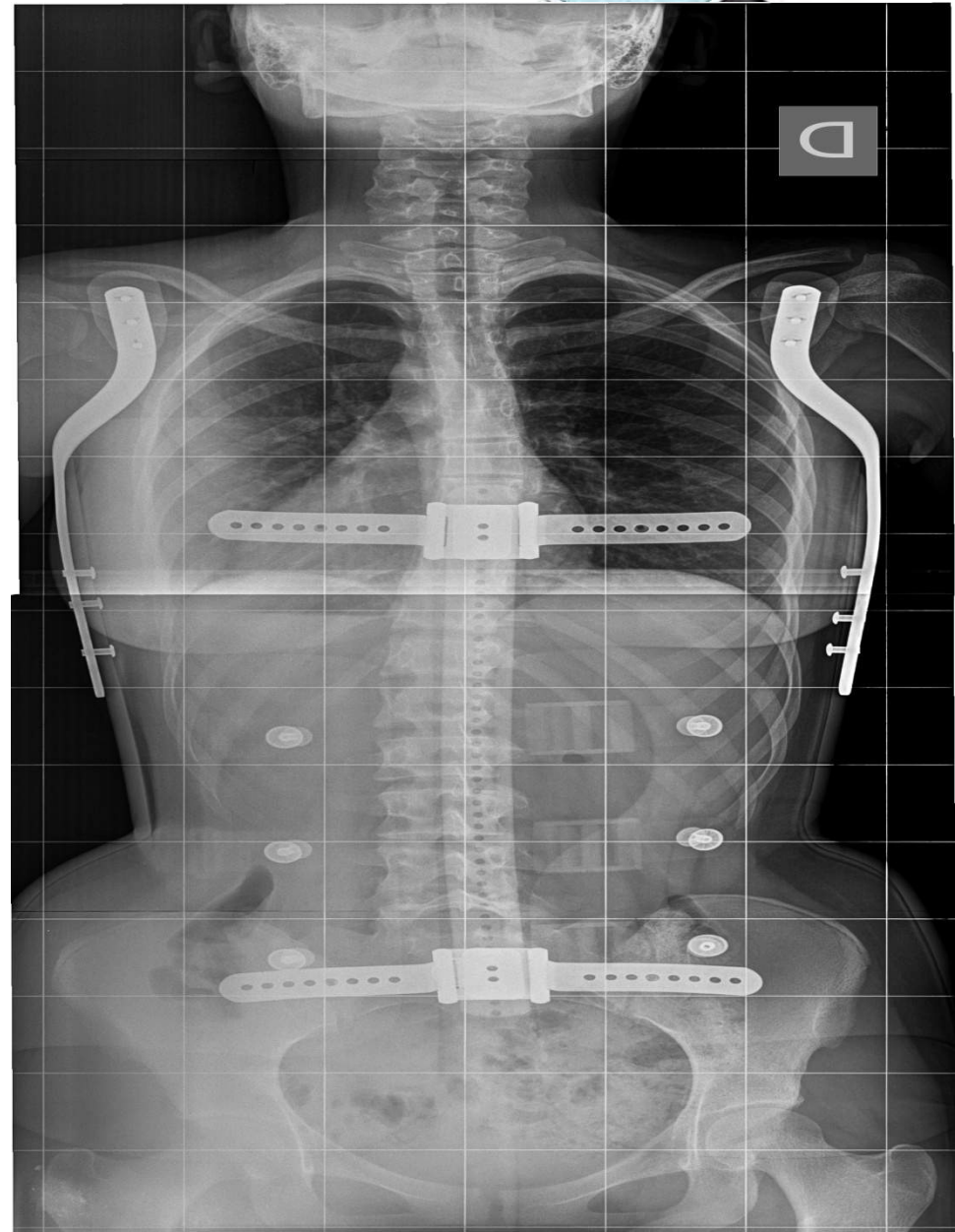
Frecce: 80,0,20,60,40

SI= 140

***Prescrizione: sforzesco per
ipercifosi 20h/die***

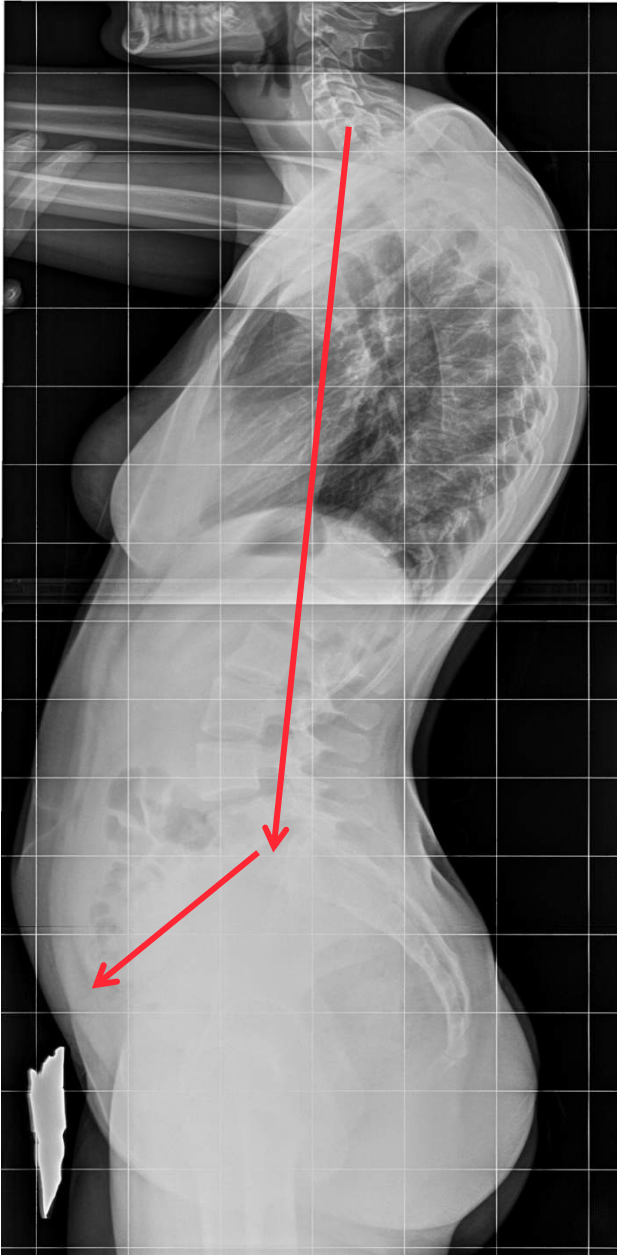


CASO CLINICO





CASO CLINICO

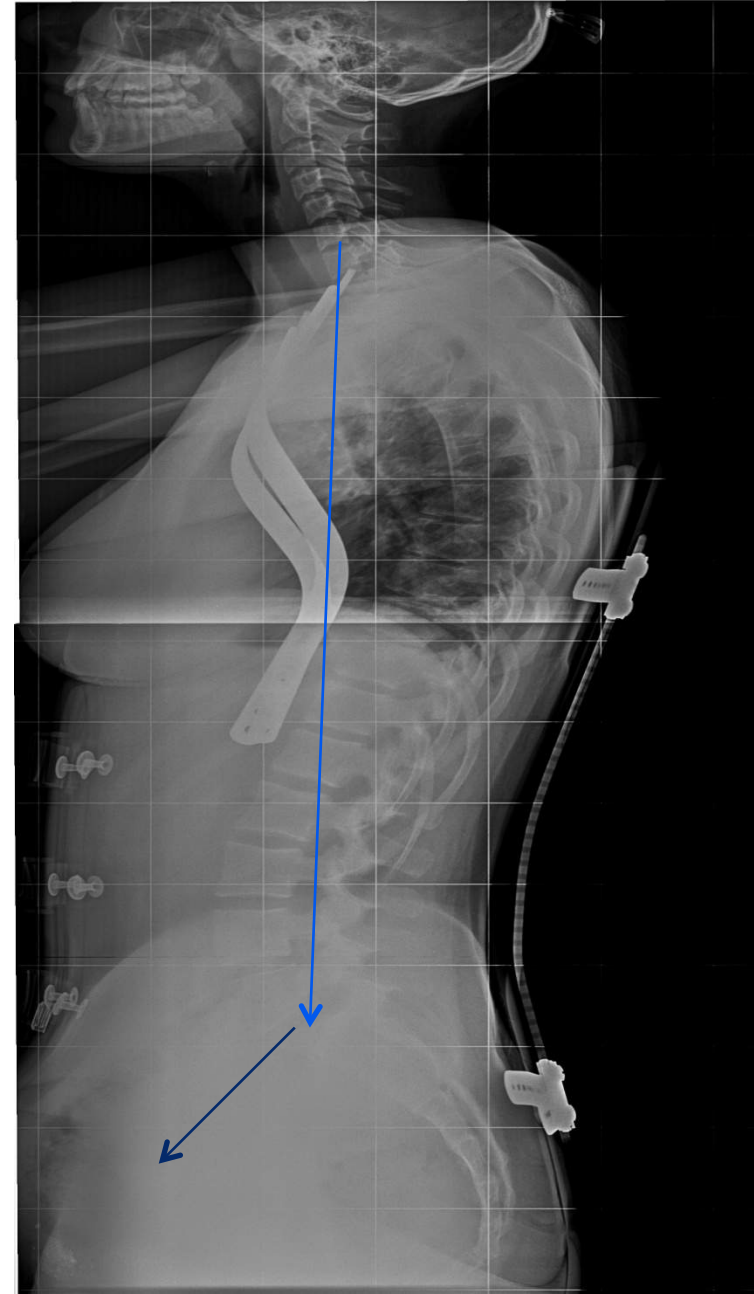


SSA=143

TK= 70°

SSA= 132

TK= 45°





TAKE HOME MESSAGE





TAKE HOME MESSAGE



- Per la valutazione dell'equilibrio sagittale globale risultano sempre più importanti i parametri spino-pelvici angolari (SSA, SPA)***



TAKE HOME MESSAGE



SSA indice costante dell'equilibrio sagittale (cifosi globale)

Se diminuisce = ipercifosi dorsale

Se aumenta = cifosi dorsolombare ?

"The most beautiful thing we can experience is the mysterious . It is the fundamental emotion that stands at the cradle of true art and true science" A.Einstein

Thank you

Salvatore Minnella
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www.isico.it