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the European Union

Hyperkyphosis: Scheuermann's disease

Surgery Collaborative and Long-term Practical Experience Learning (SCaLPEL) Erasmus +
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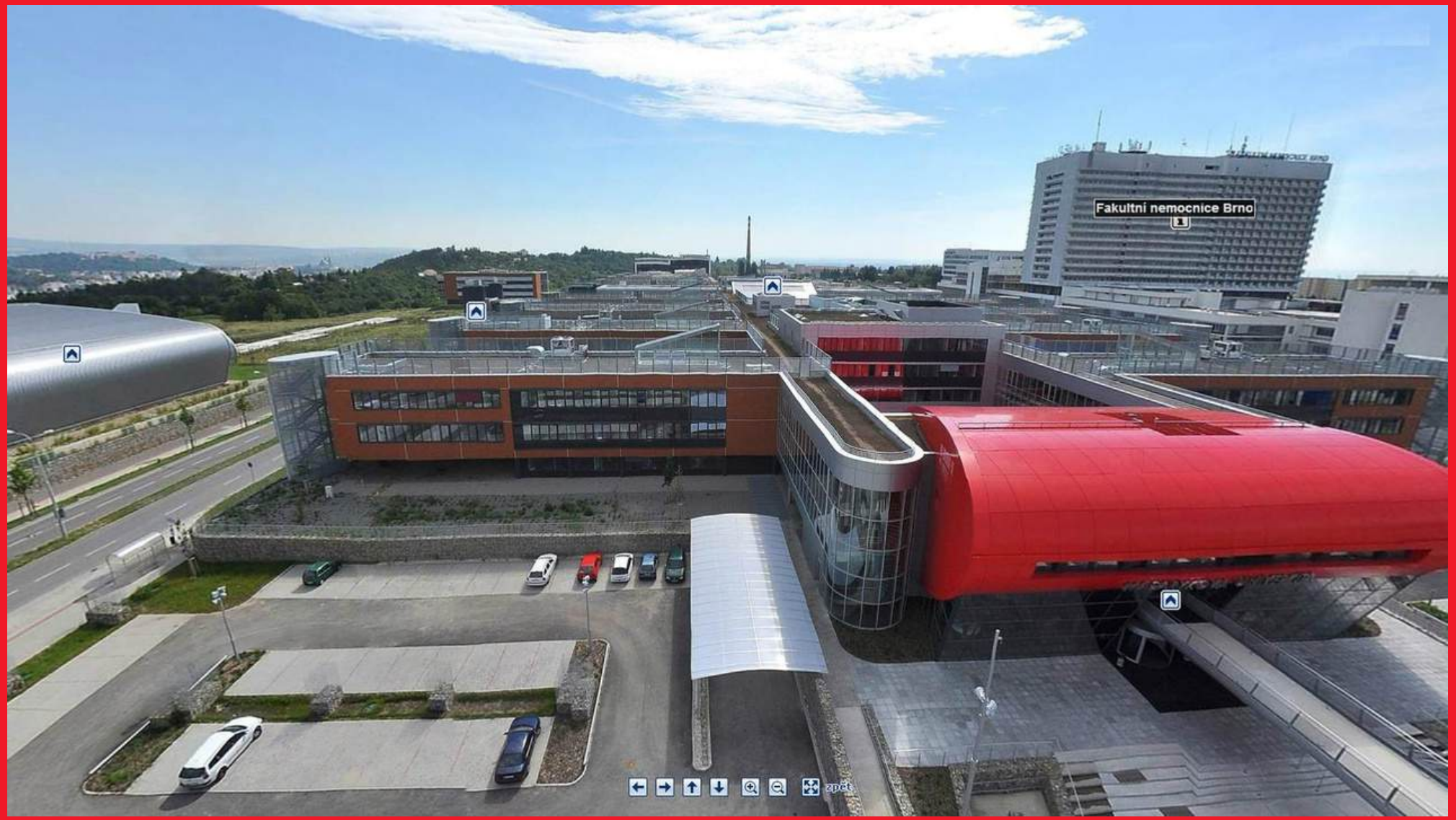

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Definition

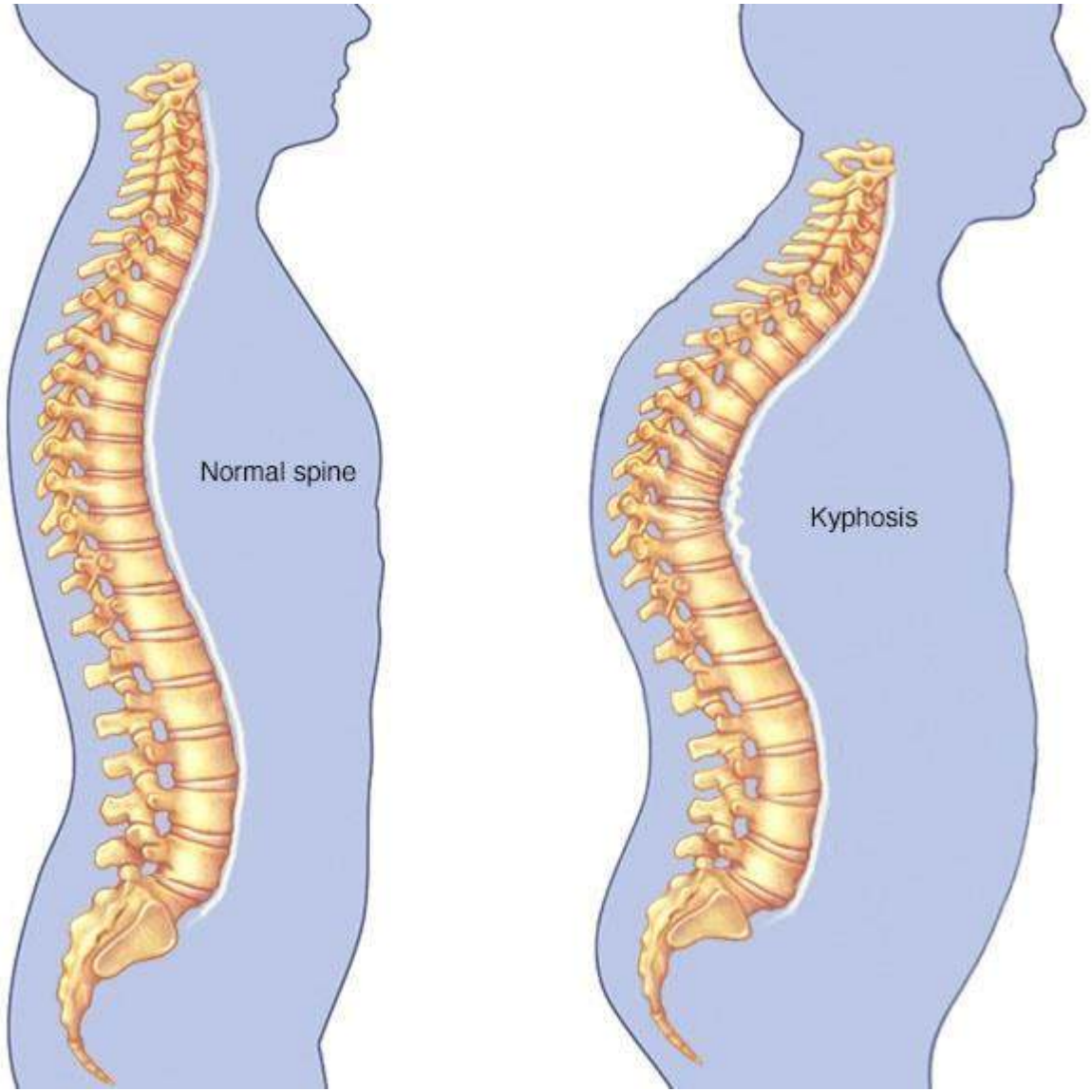

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Table 3 Age-specific spinal kyphosis angles and spinal mobility of the study participants

Characteristics	50s	60s	70s	80s	$F_{3,248}$ value of ANOVA	*P*-value of ANOVA
Male, N	22	79	106	45		
Angle, degree						
Thoracic kyphosis	32.3 (16.5)	33.9 (14.4)	32.4 (13.4)	39.8 (18.1)	2.807	0.0403
Lumbar kyphosis	−14.6 (8.1)	−13.5 (10.9)	−12.9 (11.4)	−11.5 (13.8)	0.464	0.7078
Spinal inclination	4.9 (4.2)	3.2 (4.5)	3.8 (4.5)	6.4 (5.6)$^{b',c'}$	5.055	0.0020
Mobility, degree						
Thoracic spine	27.8 (25.4)	27.9 (24.9)	19.3 (25.1)	17.3 (26.4)	2.731	0.0444
Lumbar spine	42.6 (14.1)	43.2 (18.4)	41.3 (14.6)	30.5 (20.4)$^{b',c}$	6.024	0.0006
Spinal inclination	103.1 (33.5)	115.5 (33.8)	117.8 (27.4)	95.8 (35.5)$^{b'',c}$	6.084	0.0005
Characteristics	**50s**	**60s**	**70s**	**80s**	$F_{3,316}$ value of ANOVA	*P*-value of ANOVA
Female, N	(35)	(126)	(125)	(34)		
Angle, degree						
Thoracic kyphosis	32.8 (11.6)	32.6 (14.3)	31.3 (15.6)	34.0 (21.3)	0.347	0.7914
Lumbar kyphosis	−18.2 (8.3)	−18.3 (9.3)	−13.5 (10.6)$^{b'}$	−10.1 (14.3)$^{a',b'}$	8.498	<0.0001
Spinal inclination	2.2 (4.9)	2.0 (4.2)	3.7 (4.2)$^{b''}$	7.5 (7.6)^{a,b,c}	12.919	<0.0001
Mobility, degree						
Thoracic spine	23.9 (31.3)	23.2 (34.6)	19.8 (25.9)	21.4 (19.1)	0.339	0.7970
Lumbar spine	50.8 (14.8)	48.5 (15.2)	41.0 (17.0)$^{a',b'}$	39.4 (16.7)$^{a',b''}$	7.422	<0.0001
Spinal inclination	123.5 (29.8)	130.1 (29.4)	119.1 (34.1)	117.5 (30.9)	3.051	0.0288

Notes: Results of an ANOVA with Scheffe's multiple comparison method. Data are presented as mean (standard deviation). $^{a}P<0.0001$, $^{a'}P<0.05$ vs those in their 50s, $^{b}P<0.0001$, $^{b'}P<0.01$, $^{b''}P<0.05$ vs those in their 60s, $^{c}P<0.01$, $^{c'}P<0.05$ vs those in their 70s.
Abbreviation: ANOVA, analysis of variance.

Definition

Definition

- Scheuermann kyphosis, also known as Scheuermann disease, juvenile kyphosis or juvenile discogenic disease, is **a condition of hyperkyphosis that involves the vertebral bodies and discs of the spine identified by anterior wedging of greater than or equal to 5 degrees in 3 or more adjacent vertebral bodies**

Morbus Scheuermann

Holger Werfel Scheuermann(1877-1960)-Denmark-1920 osteochondritisdeformansjuvenilisdorsi

Abnormal increase in lower thoracic kyphosis in puberty with rigidity and typical X-ray changes (ASCANI and co. 1985)

- Disparity between growth hormone production and sex hormones with vertebral fragility (Bradford 1985)

The cause is not yet fully known

- Genetics/Multifactorial

Epidemiology and Etiology

MorbusScheuermann

- Asepticnecrosisofthevertebrae (Scheuermann1920)
- Herniationofdiscsintovertebrae (C.G. Schmorl2 May 1861 –14 August 1932 1930)

  Mechanicaloverload("apprentice'sback," Mau 1927, Keim1975)

- Hereditarytalents(Sörensen1964, prof. Vlach a spol. 1990–36%)
- Hormonalinfluences(Ipolito1981)
- 0.5 -8 % ofthepopulation
- More oftenboys2:1 (but612, F:M 1,2:1; ORTK FN, odb.as.Filipovic2001)
  - Age 12-18 years
  - Enchondral ossification disorder
  - More oftenlowerthoracicspine

Pathophysiology

- Scheuermann kyphosis is still undetermined

  genetic inheritance

- discordant vertebral endplate mineralization and ossification during growth
- disproportional vertebral body growth with the resultant classic wedge-shaped

  vertebral bodies that lead to kyphosis

Pathophysiology

MorbusScheuermannin literature

„…autosomal genetic component of high penetrance and variable expressivity, with 74% heredity…“

DamborgF, EngellV, Andersen M, KyvikKO, ThomsenK. Prevalence, concordance, and heritabilityofScheuermannkyphosisbasedon a s

oftwins. J Bone Joint SurgAm. 2006;88(10):2133–2136

„….Its origin has been associated with avascular necrosis of the epiphyseal rings….“

ScheuermannHW. Kyphosisdorsalis juvenilis.OrthopChir.1921;41:305–317

„…juvenile osteoporosis…“

GilsanzV, GibbensDT, CarlsonM, King J. Vertebralbone densityin Scheuermanndisease.J Bone Joint SurgAm.1989;71(6):894–897

LopezRA, BurkeSW, LevineDB, Schneider R. Osteoporosisin Scheuermann'sdisease.Spine.1988;13(10):1099–1103

„…shortening of the ischiotibial musculature…“

LopezRA, BurkeSW, LevineDB, Schneider R. Osteoporosisin Scheuermann'sdisease.Spine.1988;13(10):1099–1103

„….mechanical factors that would trigger secondary remodelling responses, such as reduction of sternal size…“

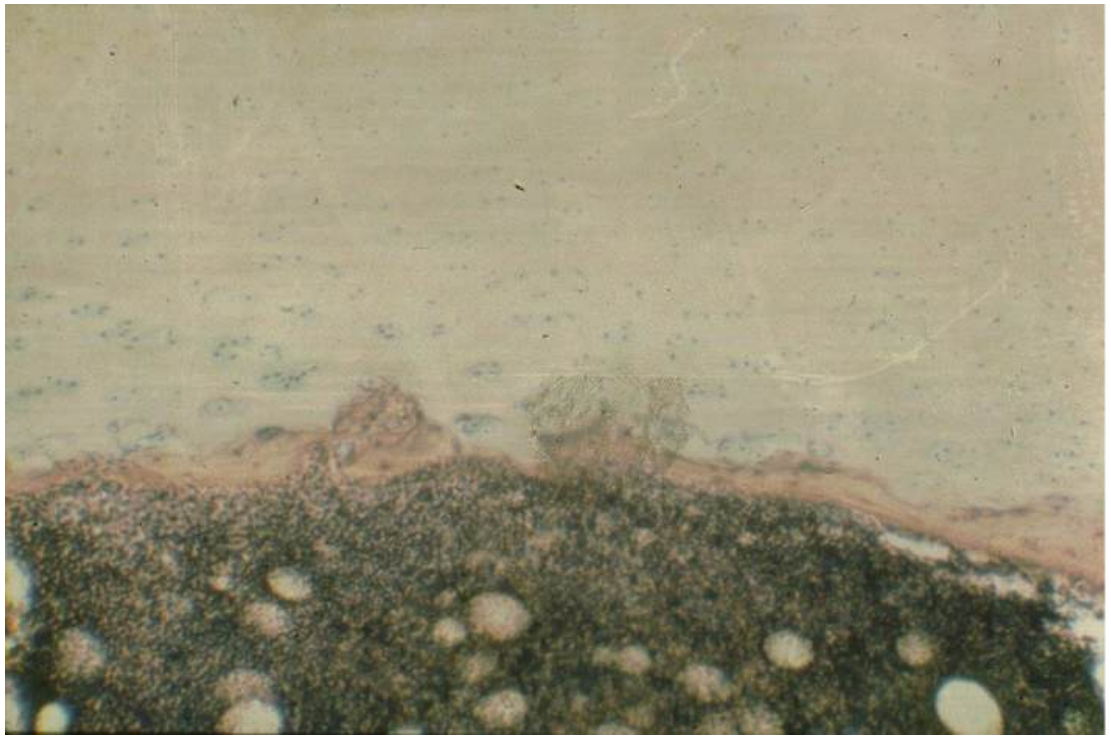
SorensenKH.Scheuermann'sJuvenileKyphosis: clinicalappearances, radiography, aetiologyand prognosis.Munksgaard; Copenhagen:

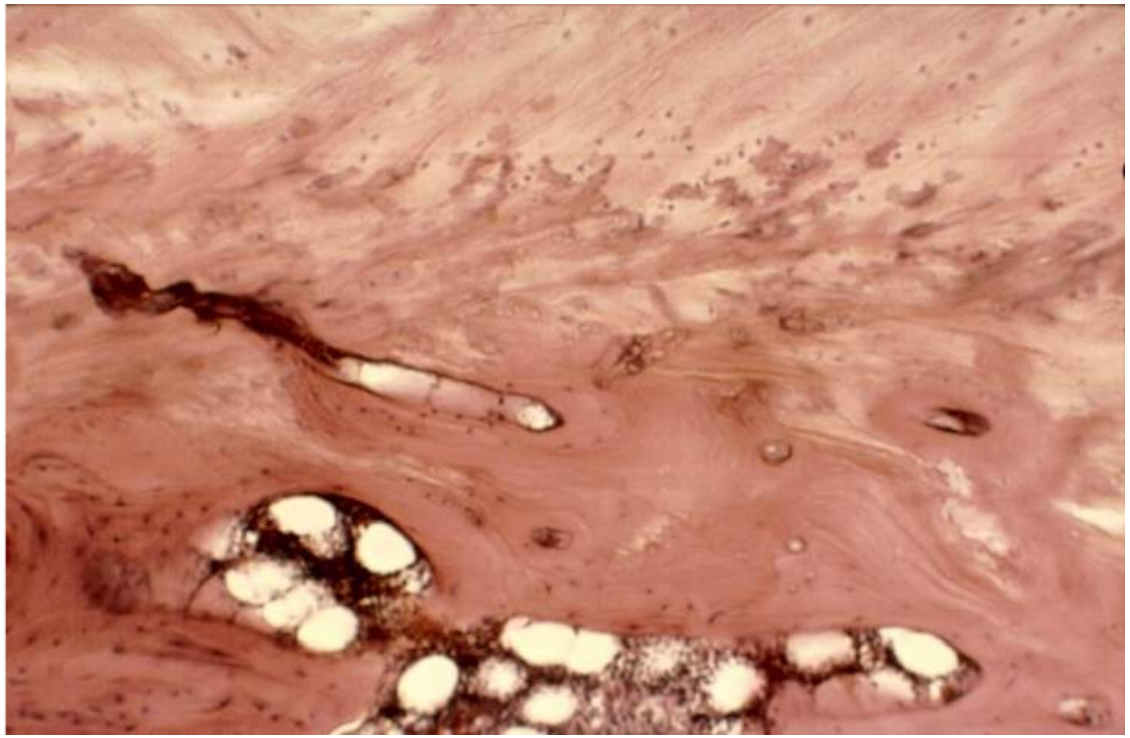
Ferguson AB., Jr The etiology of preadolescent kyphosis.J Bone Joint Surg Am.1956;38(1):149–157

Histopathology

- Abnormal vertebral endplate cartilage
- Irregular mineralization
- Altered endochondral ossification
- Decreasedcollagento proteoglycanratios(i.e., increasedproteoglycan levels)

Histology





Classification

Type I (Classic)- Thoracic spine involvement only, with the apex of curve T7-T9

Type II - Thoracic and lumbar involvement, with the apex of curve T10-T12

Stages Morbus Scheuermann

early –deformities-consequences

- Stage I early on set
  - 9-12 years, round loose back with pain, muscle changes
- Stage II deformities
  - 13-16 years, stiffness, x-ray changes
- Stage III of the consequences
  - chronic back pain

Degrees Morbus Scheuermann

Montgomery 1981

- Grade I – up to 45° kyphosis
- Grade II - up to 55° kyphosis
- Grade III - up to 65° kyphosis
- Grade IV - 75° and up

Clinical examination

- RoundbackatthebottomT8-9 (48%)

Thoracicorlumbarspine pain(28%)

- Rigidity ofdeformity
- Scoliosisin 49%
- Muscledysbalance "texasattitude"
- Reflectivechangesin soft tissues
- Positive test (Matthias, Frank, hyperextension)

Clinical examination

Matthias

hyperextension

Franke

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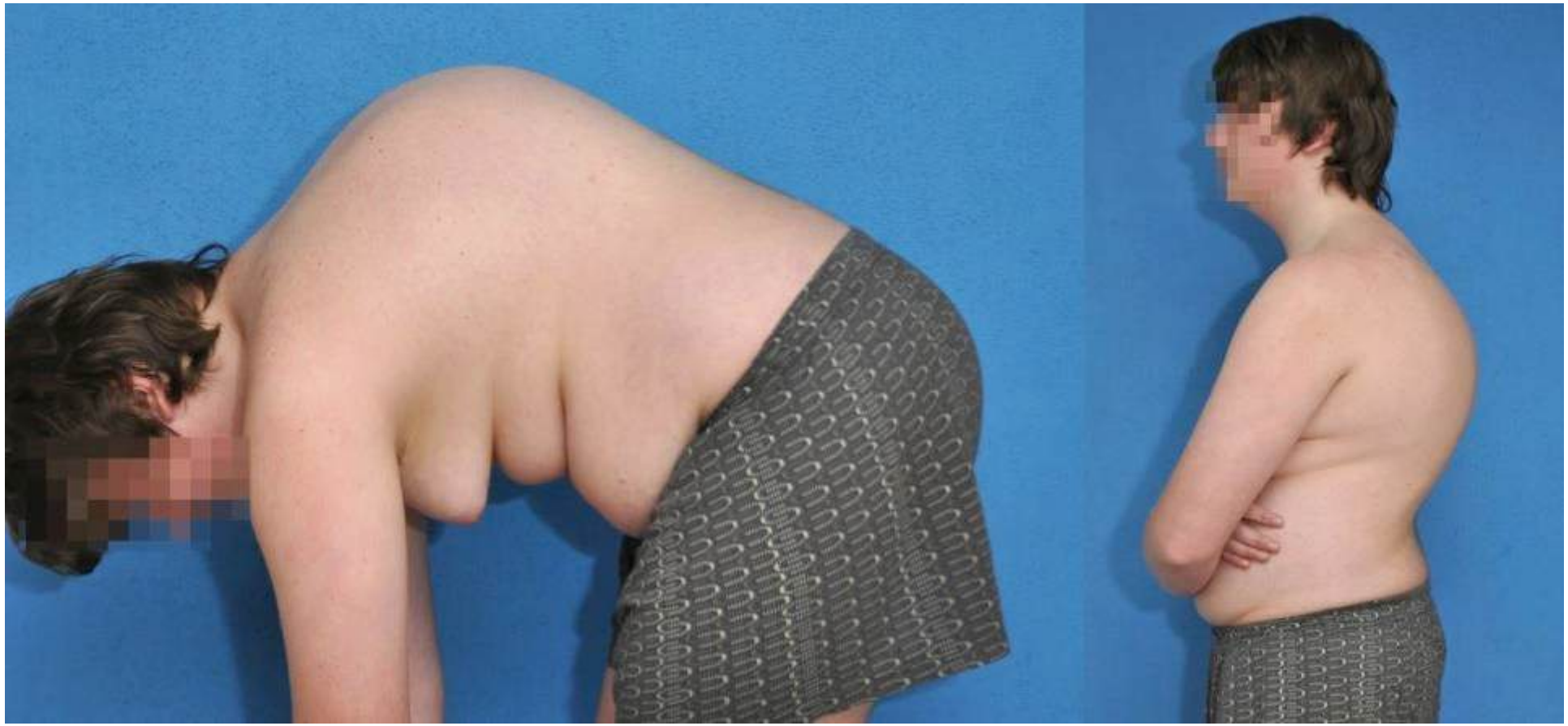
Clinical examination

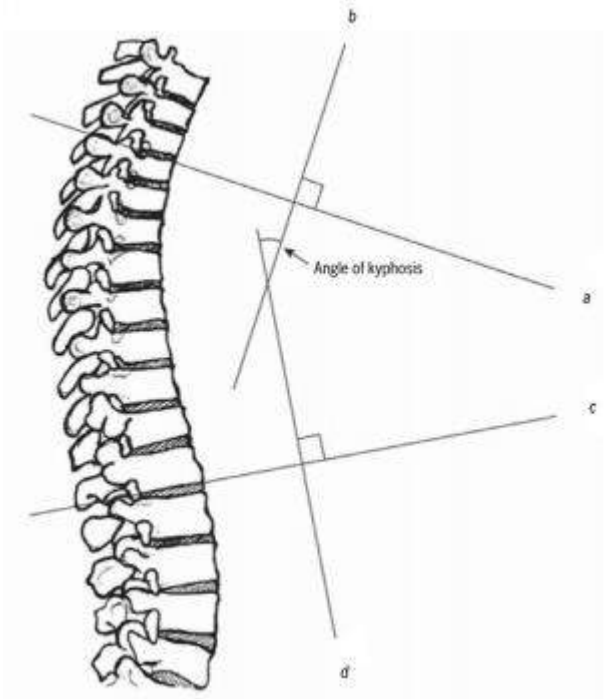


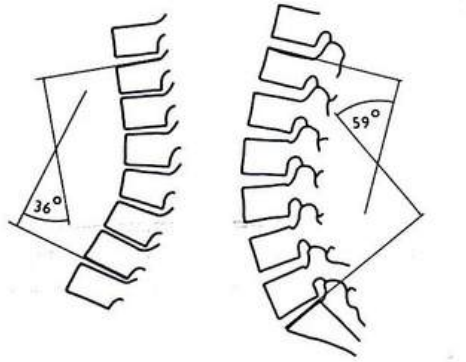
Morphology

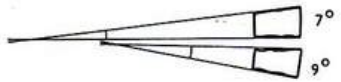
- Histology, X-ray, CT, MRI
- C lordosis, Thkyphosis, L lordosis

  Thkyphosis: 20°-40°(< 20°hypo; > 45°hyper)
- Radiologicalcriteriaaccordingto Bradford1985:
- Chestkyphosisabove40°accordingto Cobb

  Vertebralwedgesabove5°(43% in 3 vertebrae)
- Unevennessofcoveringsurfacesand discnarrowing
- Stretchingofvertebralbodies
- SchmorInodes(up to 42%)







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Xrays

- AP + lateralstandinglong films

  re - evaluation

- Cobb angle T3/4 – T12

  reclination

- SVA

- PT, PI, SS

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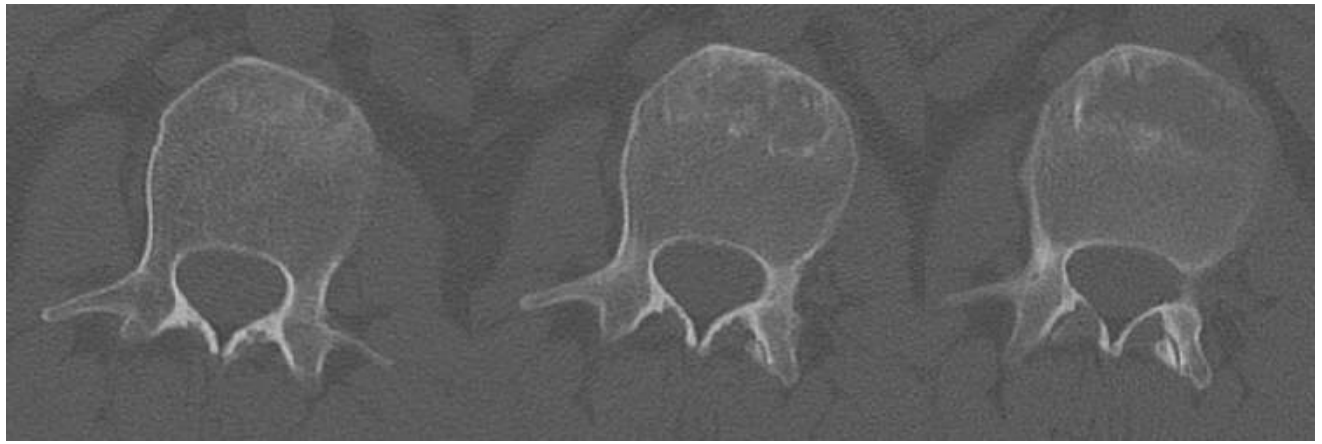
CT

- CT - bone window

  fresh Schmorl knot:

  - character of osteolysis
  - around the edge break
  - In addition, STIR MRI

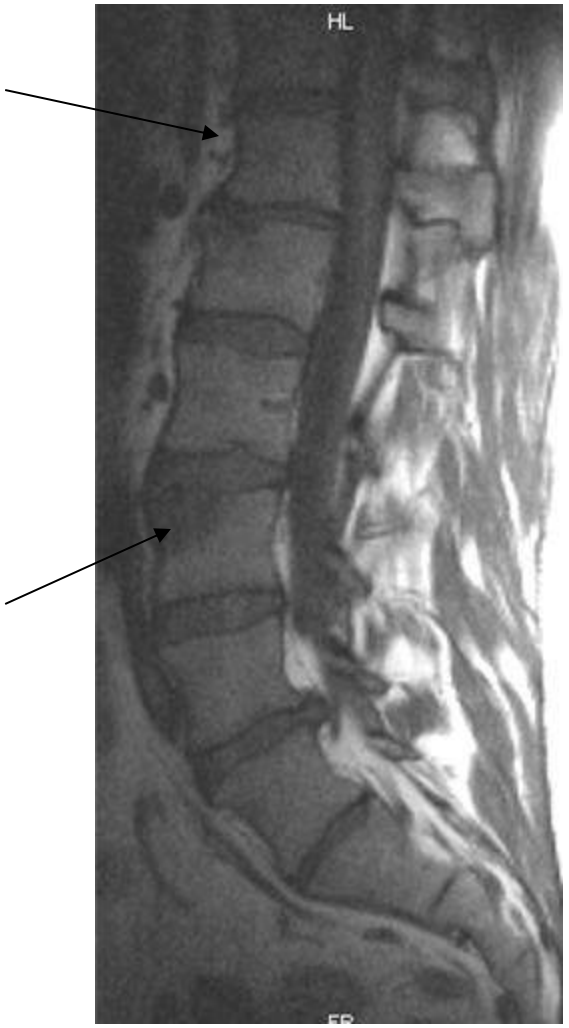
- Differential diagnosis!



MRI

- old Schmorl's knot:
  - Consolidated
  - Inactive
- fresh Schmorl knot:
  - Character of osteolysis around the edge break
- on T2, better STIR MRI
- Differential diagnosis

T2



T1

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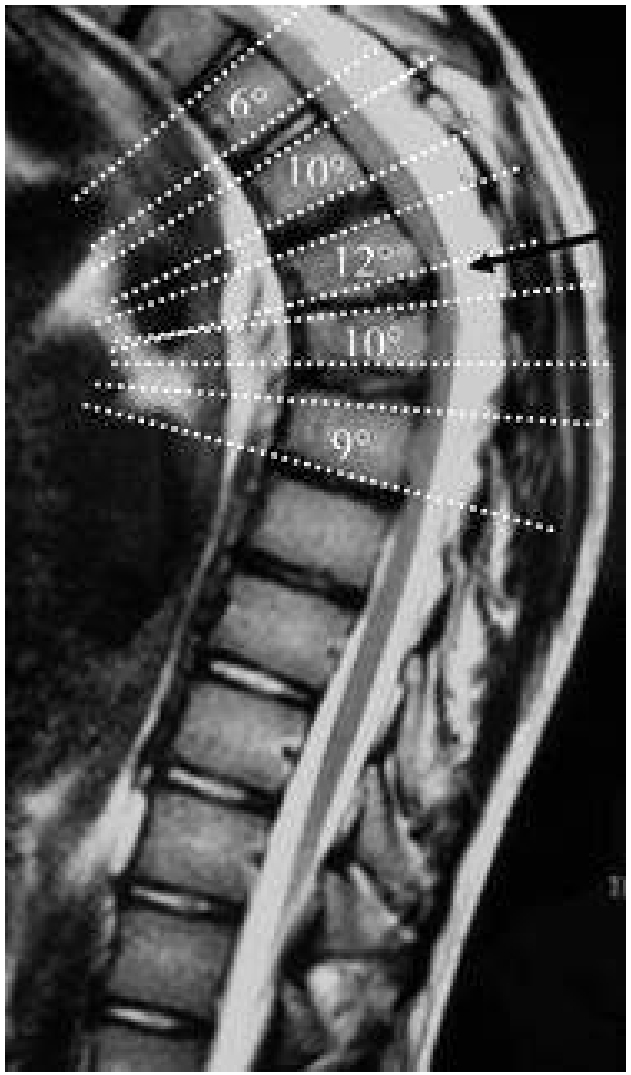

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Differential Diagnosis

- Postural kyphosis (flexible postural deformity)
- Hyperkyphosisattributableto anotherknowndiseasestate

- Postsurgical kyphosis
- Ankylosing spondylitis

- Scoliosis

Treatment/ Management

Conservative - nonoperative

- Exercising

  orthosis and exercises

  antigravity corset followed by orthosis and RHB plan

- "Lyon method" De Mauroy and Stagnar´s 1978

OperativeManagement

Indications:

Absolute:

- neurological deficiency (extremely rare)

Relative:

- Rigid deformity above 70°
- Pain
- Cosmetics
- Posterior spondylodesis
- SPO/PSO

Nonoperative Management

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Nonoperative Treatment

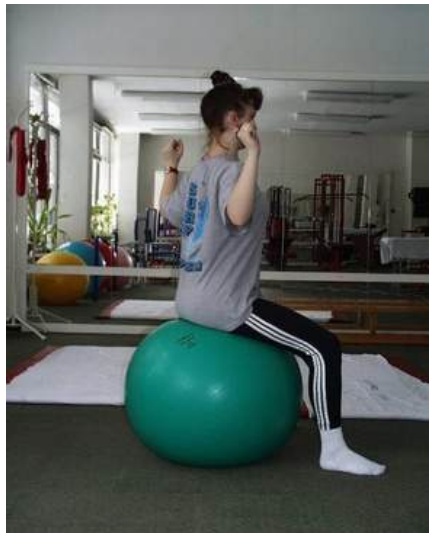
- Stretching, lifestyle modification, NSAIDs

  plus/minus physicaltherapy

- Extension bracing

Nonoperative Treatment

- Exercise+ bracing
- Physicaltreatment – Stop: competitivesport – Stop: heavyloads
- NSAIDs, analgesics?
- Myorelaxantia?



Modified Milwaukee Orthosis (Hudecek- Wernio – Nobility 2004)

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Antigravity brace

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Rehabilitationand prosthetics

23h/16h night mode, „NO“ night mode, intense, daily exercise

- Exercising
- Physical treatment
- Prohibition of competitive sport
- Prohibition of heavy loads
- NSAIDs, analgesics

Anti-gravity brace

Rehabilitationand prosthetics

23h/16h night mode, „NO“ night mode, intense, daily exercise

Individualrehabplan+ instruction

Individual+ specialtechniques(Brunkow, Brügger, Klappand others)

- Group and Motivational(swimming, hippotherapy, dancing)
- Braces
  1. Milwaukeebrace
  2. Kyphologicbrace
  3. Thoracolumbosacralorthosis-style Boston brace

Rehabilitationand prosthetics

Brunkow

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Rehabilitationand prosthetics

Brügger

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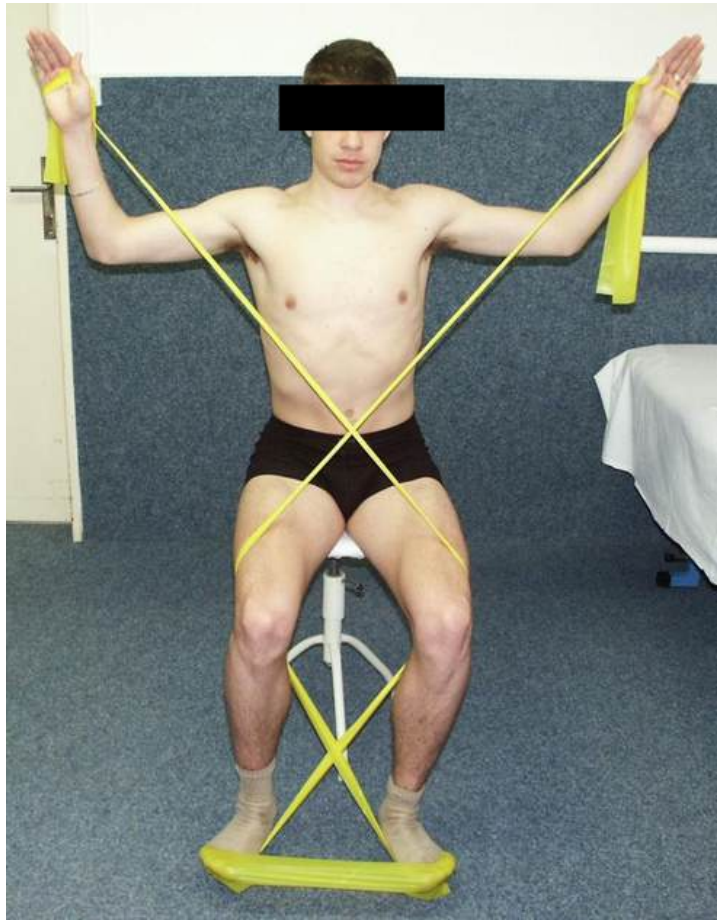
Rehabilitationand prosthetics

Brügger



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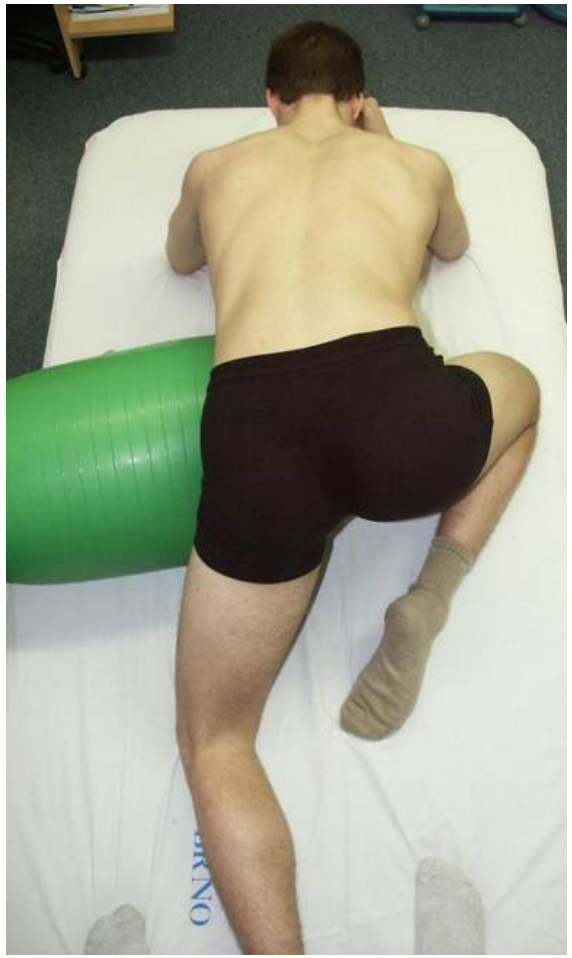
Rehabilitationand prosthetics

Klapp



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TLSO brace

- Stop/mitigate the progression of spinal deformity
- Maintain steady position of the fuselage

- NMS sometimes questionable and problematic

Corsetotherapy

Indications:

- Scoliosis: Congenital, Idiopathic, Neuromuscular, Degenerative
  Traumas: primarily, event. postoperativetreatment
- Oncology: primarily, event. postoperativetreatment

- Degeneration: postoperativetreatment
- Objective: stabilization, correction

Principleofthree-point fixation

Pelvic belt–neckcircle–sidepressurepellets

- Primaryforces:
  - actsindirectlyon thespine throughsurroundingstructures
  - axis: tensile–fordeformity in thesenseofstretching: pelvis –cervicalpelotes
  - sides: pressure–throughtheribcageby pressureon thevertebra

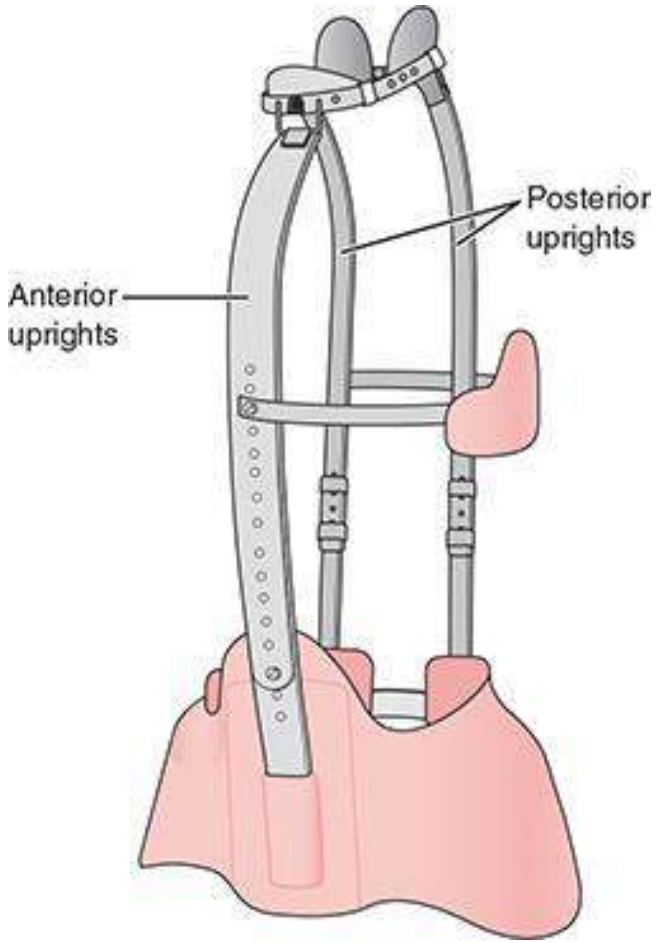
MilwaukeeBrace

Thorakolumbosacral orthosis (TLSO)

- Two-part cervikothoracolumbusalorthosis(CTLSO).
- Carlsonand Payette(2017) bracessupportingsed

Principleofthree-point fixation

Milwaukee Brace (May & Lockard, 2011)



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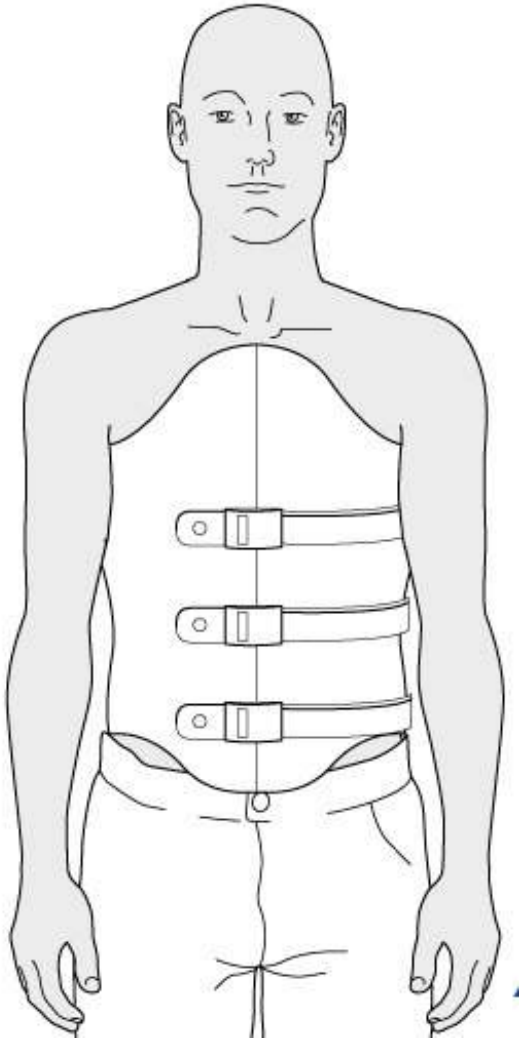
Principleofthree-point fixation

Thorakolumbossacral orthosis (author unknown, 2018)



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Principleofthree-point fixation

Thoracosocal corset of synthetic material

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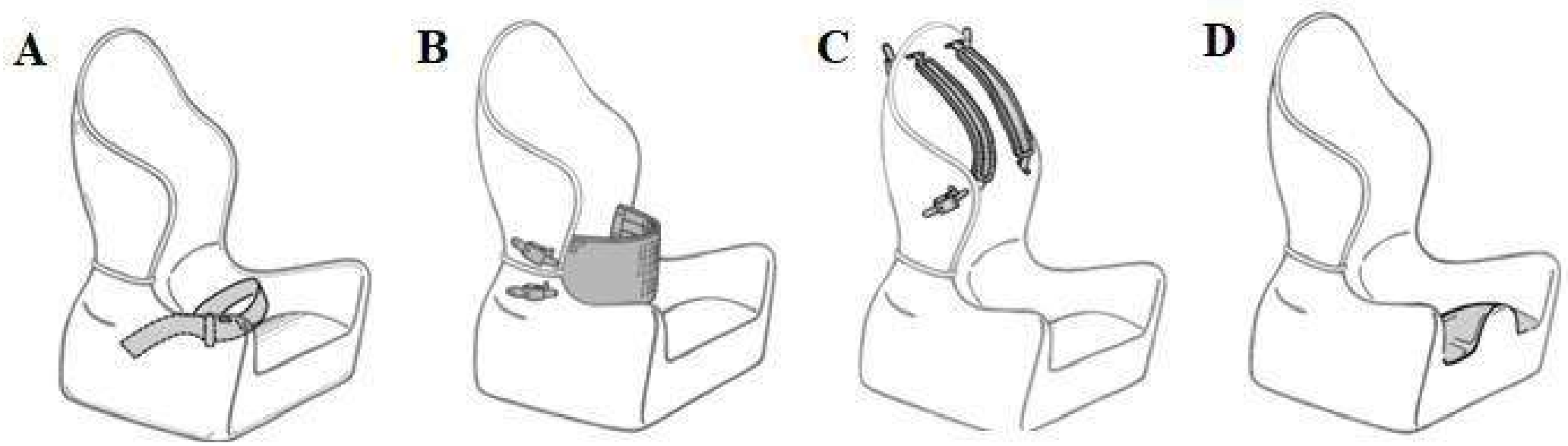
Principleofthree-point fixation

Sample sit-supporting orthosis supplemented with additional compensatory aids (Carlson & Payette)



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Antigravity brace

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Complications of conservative therapy

Patientand parents

- CAST SYNDROME!!!
- Care for antigravity corset (exanthema, decubitus)

  Long-term treatment
- Small cooperation in puberty
- Little motivation
- Lifestyle
- Assessment problems:
- improved with the abolition of compulsory military service
-

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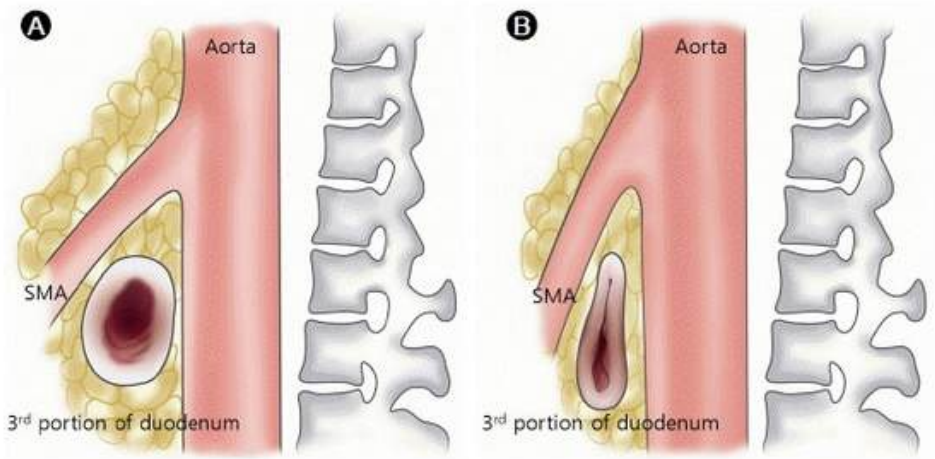
Complications



CAST SYNDROME = ACUTE CONDITION = THERAPY IMMEDIATELY

SMAS= superior mesentericarterysyndrome (mesentericarterysyndrome)

dilation of the stomach with partial or complete obstruction of the duodenum

Conservativetherapy: castings, plastercorsets, corsets:

in allpatientswithmesentericarterysyndrome

NSG (nasogastricdecompression), pharmacologicaltreatment: Metoclopramidi.v.

Positioning: left, knee-to-chestpositionorGoldthwaitemaneuver

Enteralnutritionusinga double lumen tube, soyurallyguideddistalto obstructionunderfluororoscopicassistance

Surgicaltherapy:

Failureofconservativetreatment= surgicalintervention:

duodenojejunostomyorgastrojejunostomyto bypass obstructionorduodenalderotationaltimeter

mobilizationofduodenum by laparotomyorlaparoscopy

duodenojejunostomiestomy rarely

Pathophysiology:

compressionoftheduodenum betweentheuppermesentericarteryforward and theaorticand spine attheback.

obstructionmayoccurwithina fewhoursto daysaftersurgeryorcasting orplastercorsetormaynot developforseveralweeks.

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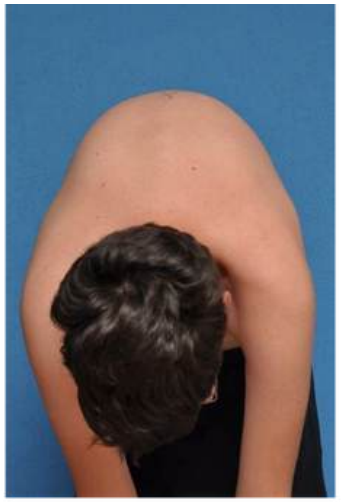
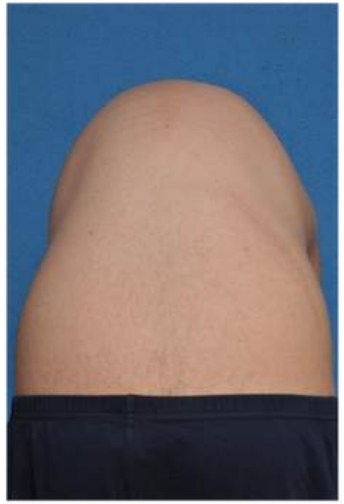
Case report –JH 1997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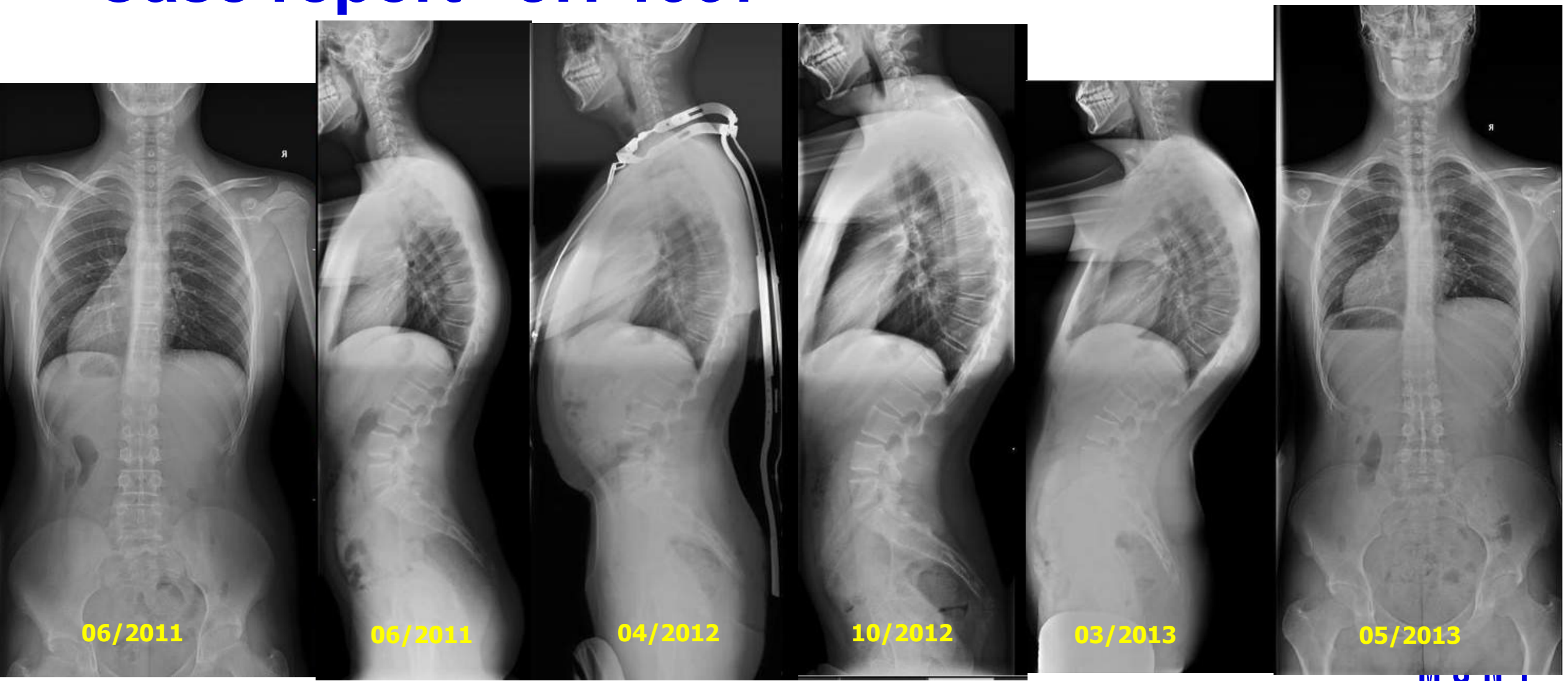
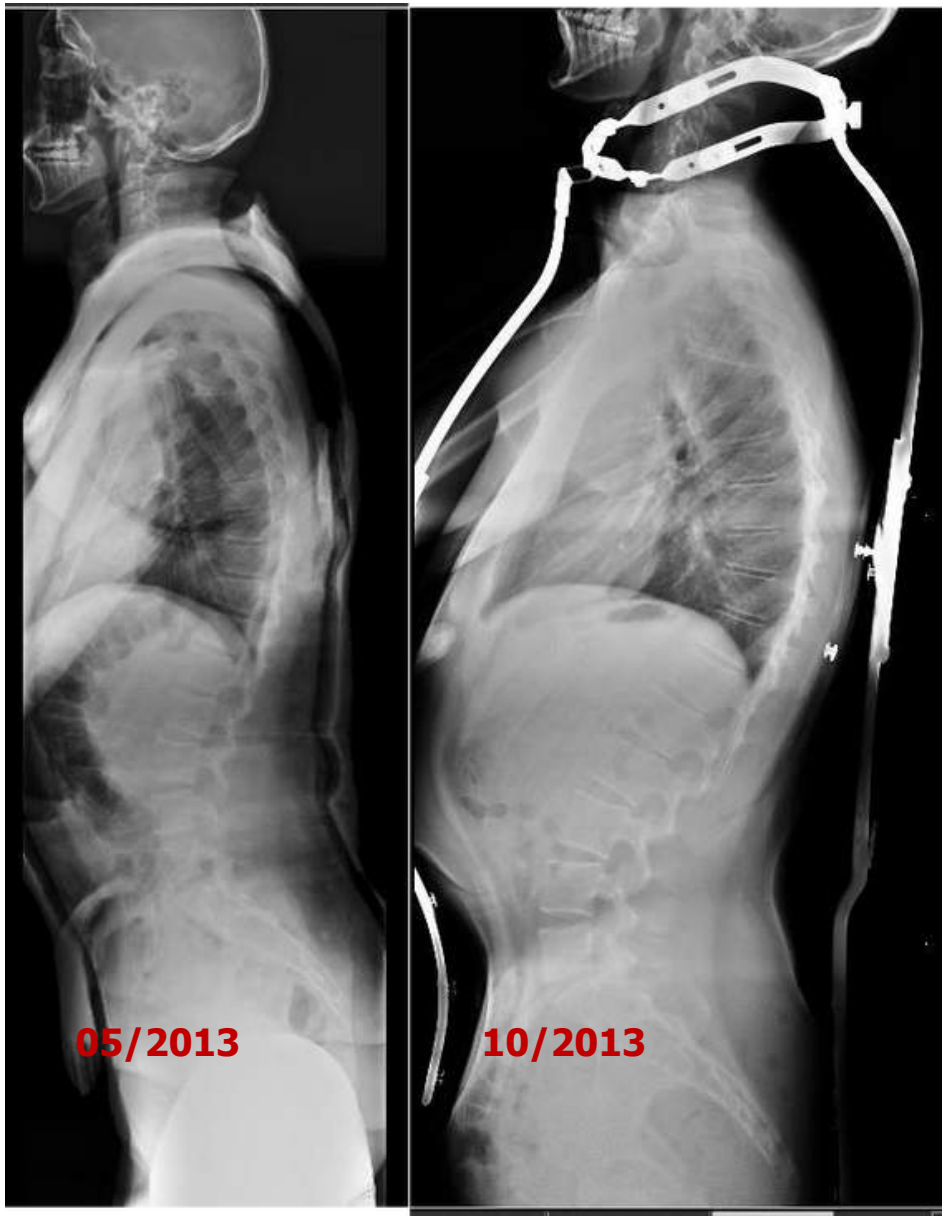
Case report –JH 1997



Case report –JH 1997



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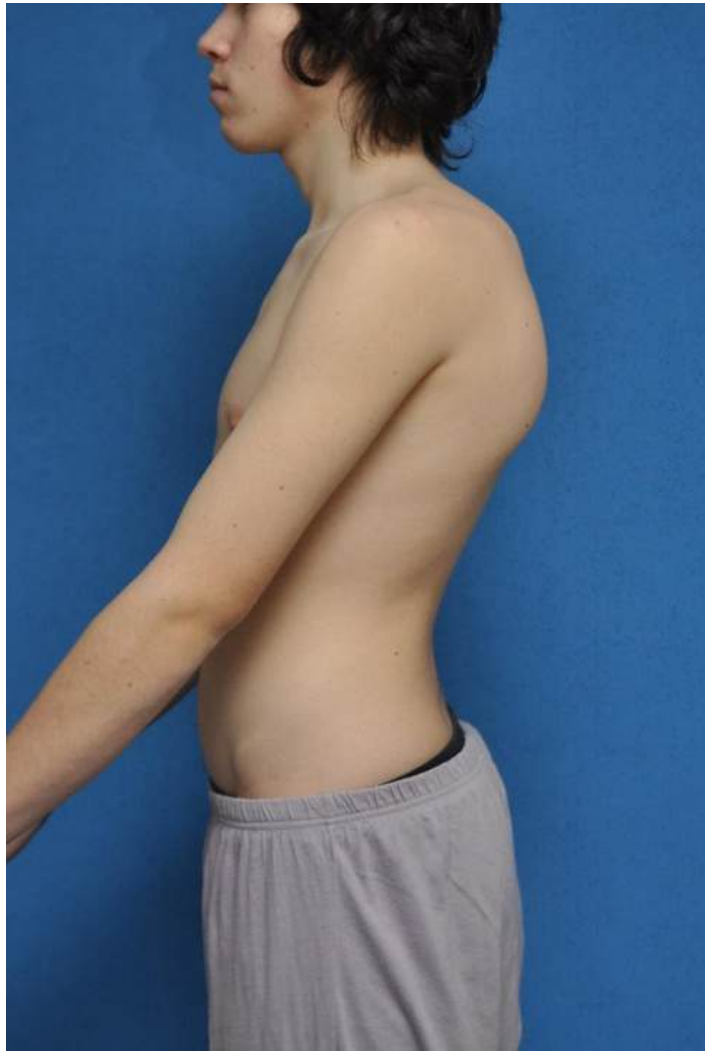
Case report –AF 1999



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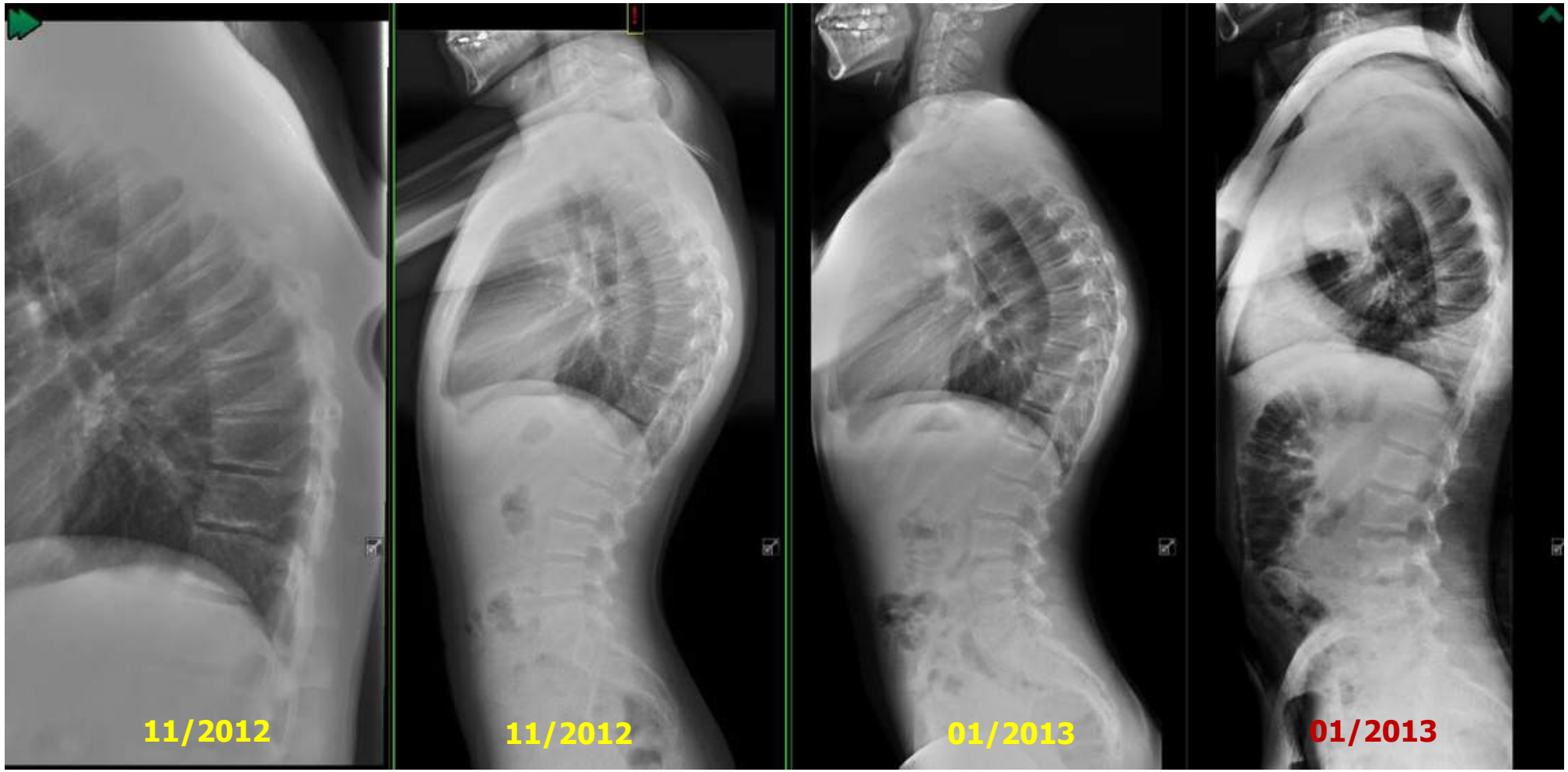
Case report–AF 1999



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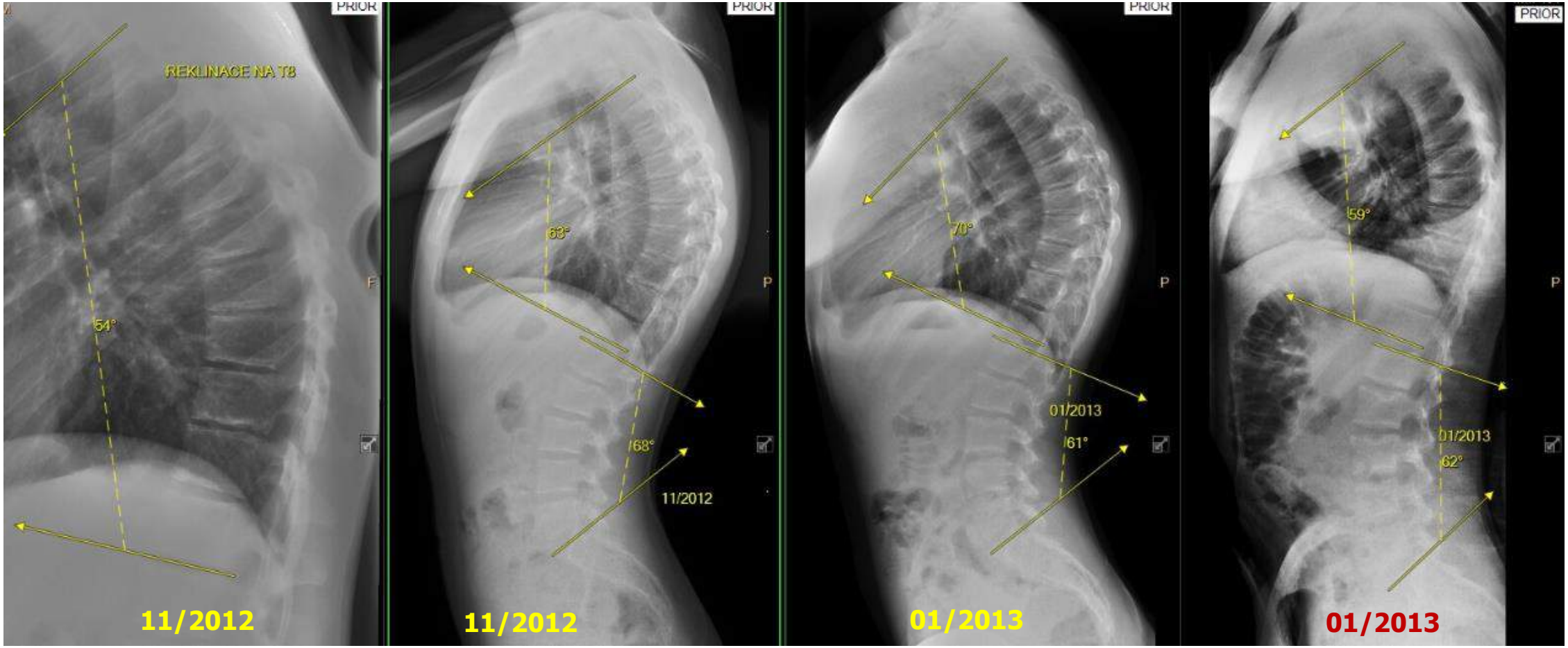
Case report –AF 1999



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CR –AF 1999

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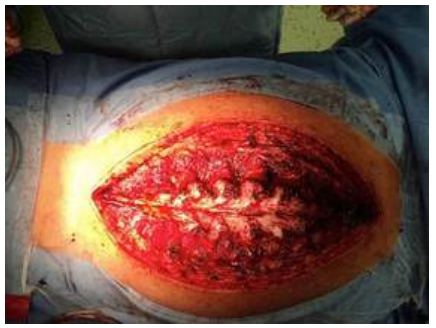
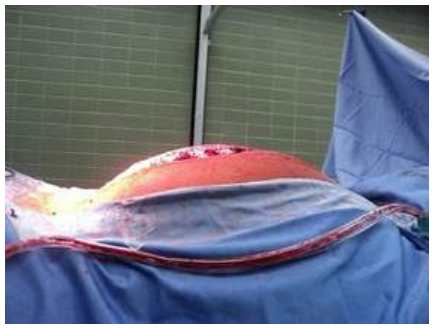
Surgical treatment

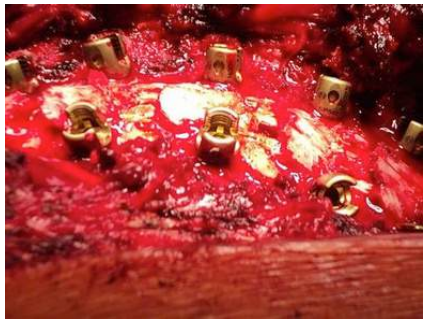
Surgical treatment

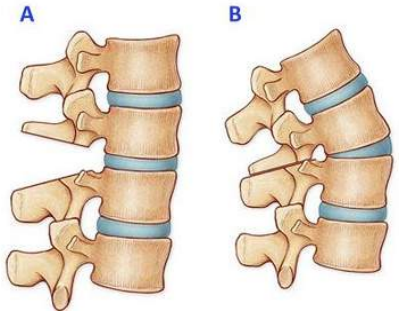
Late, severe diagnosis

- Posterior spondylodesis
- Osteotomy: SPO/PSO

+ treatment in TLSO



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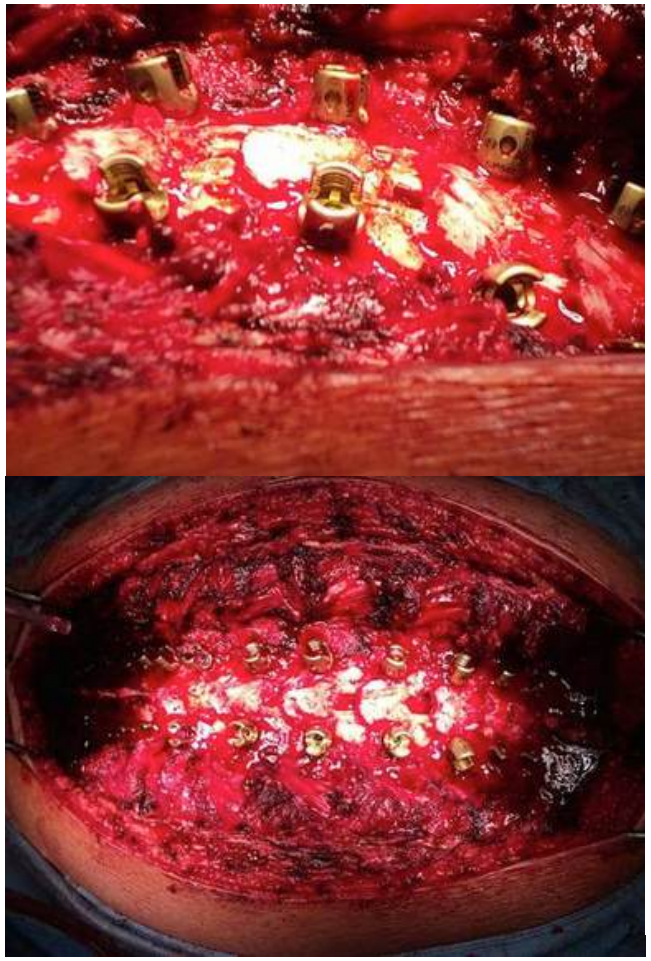
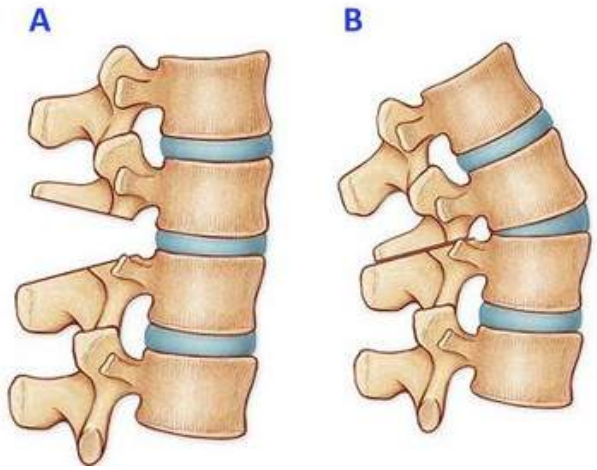
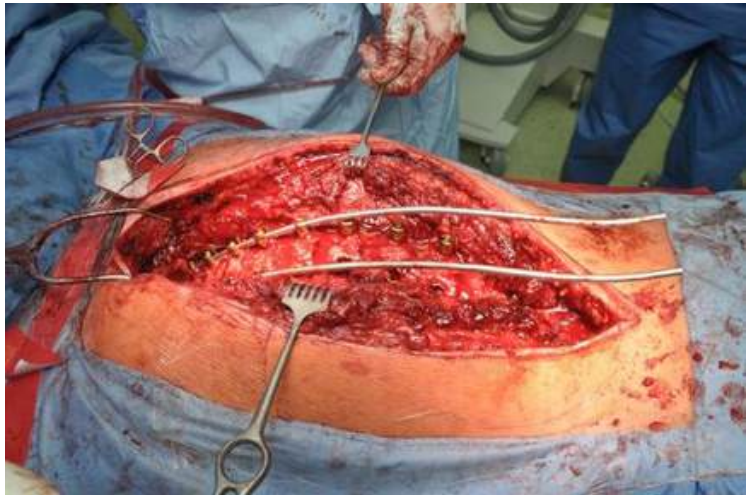
Surgical therapy

Smith-Petersen osteotomies







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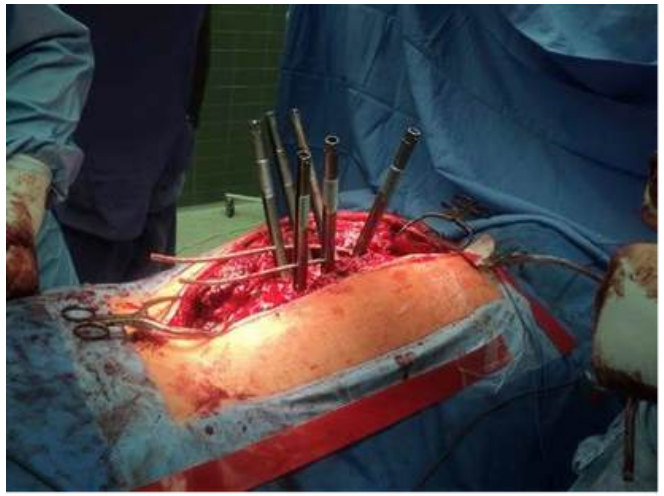
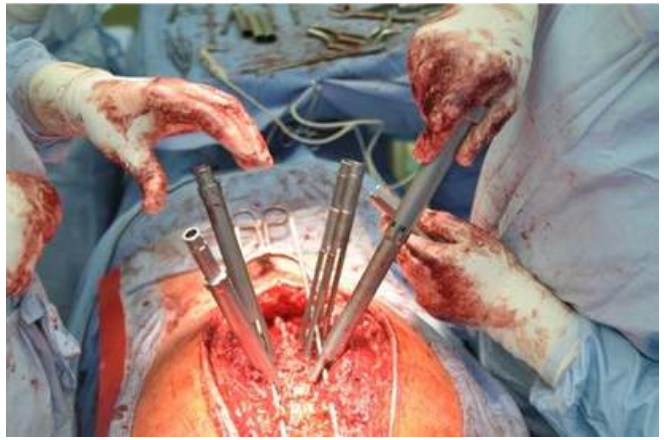
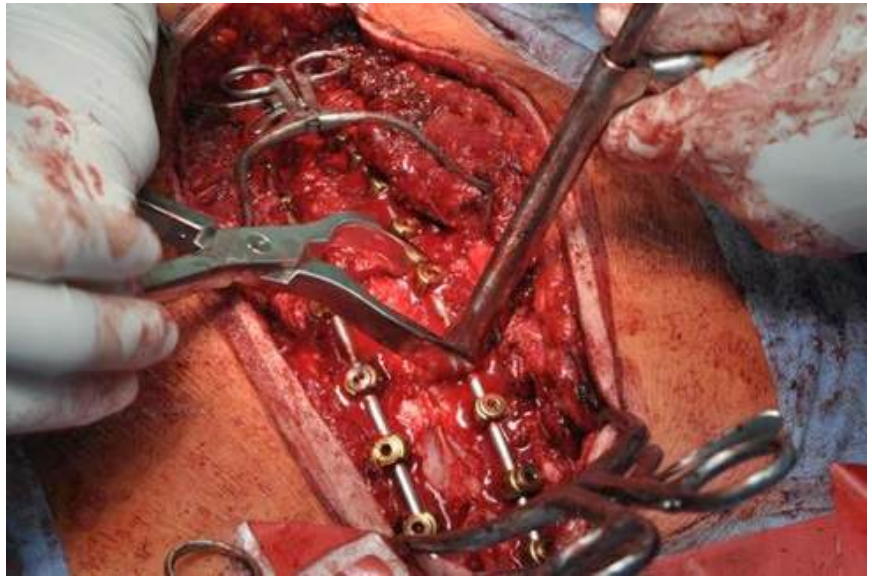
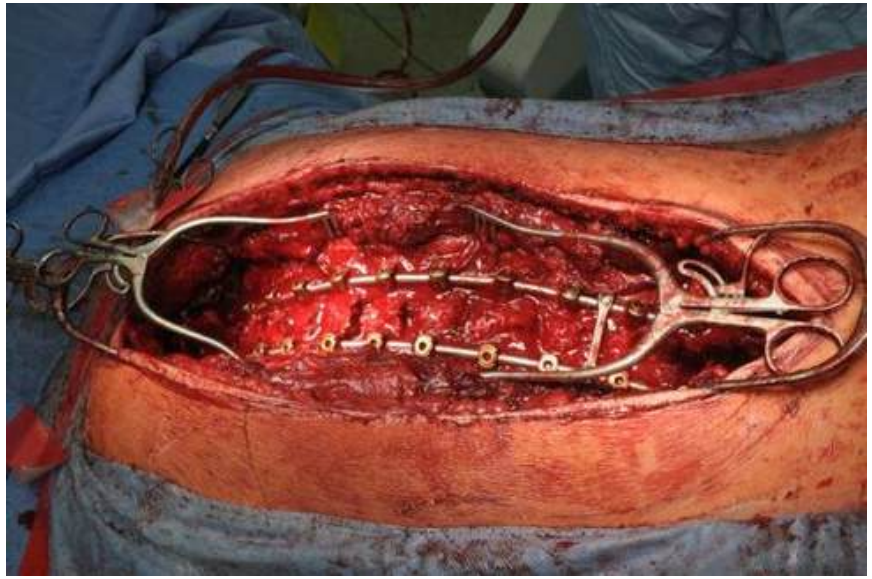
Surgical therapy

Cantilever maneuver









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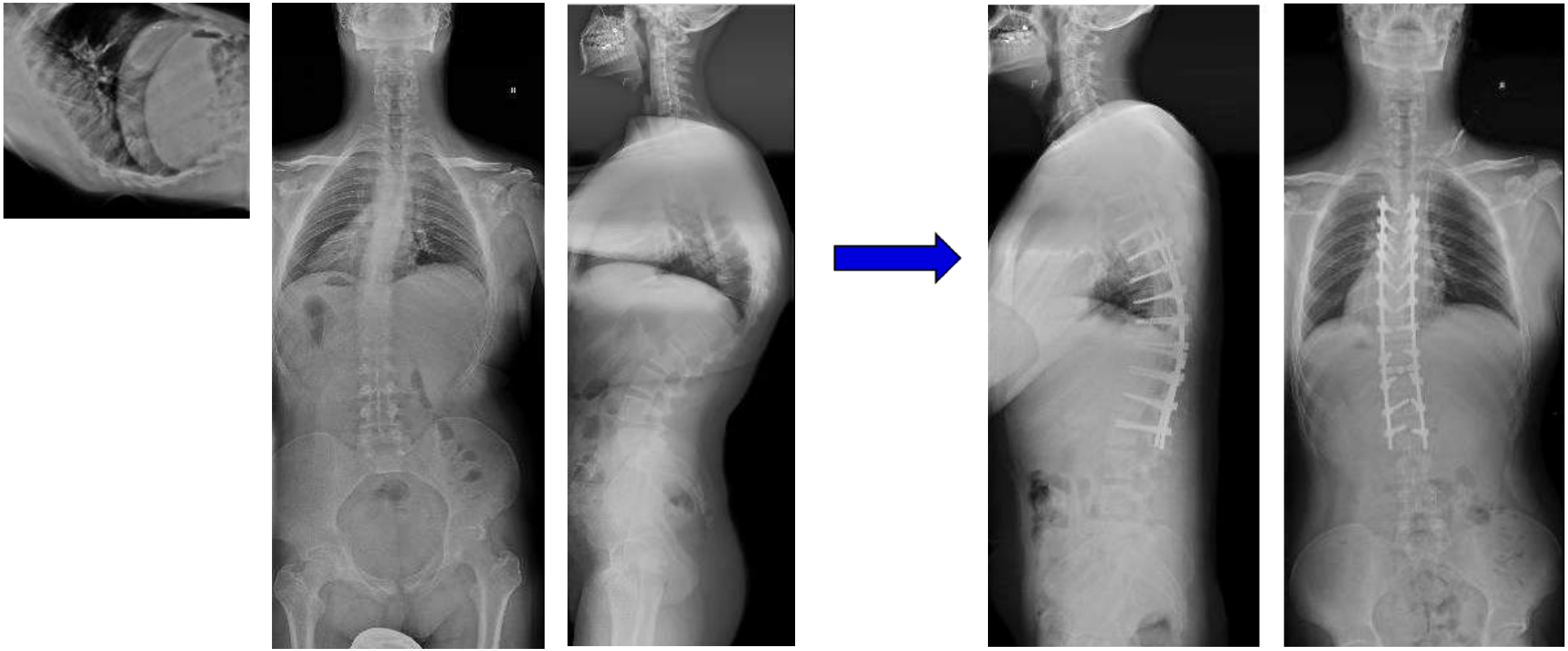
Surgical therapy

XraysFollowups(16y + 2m)



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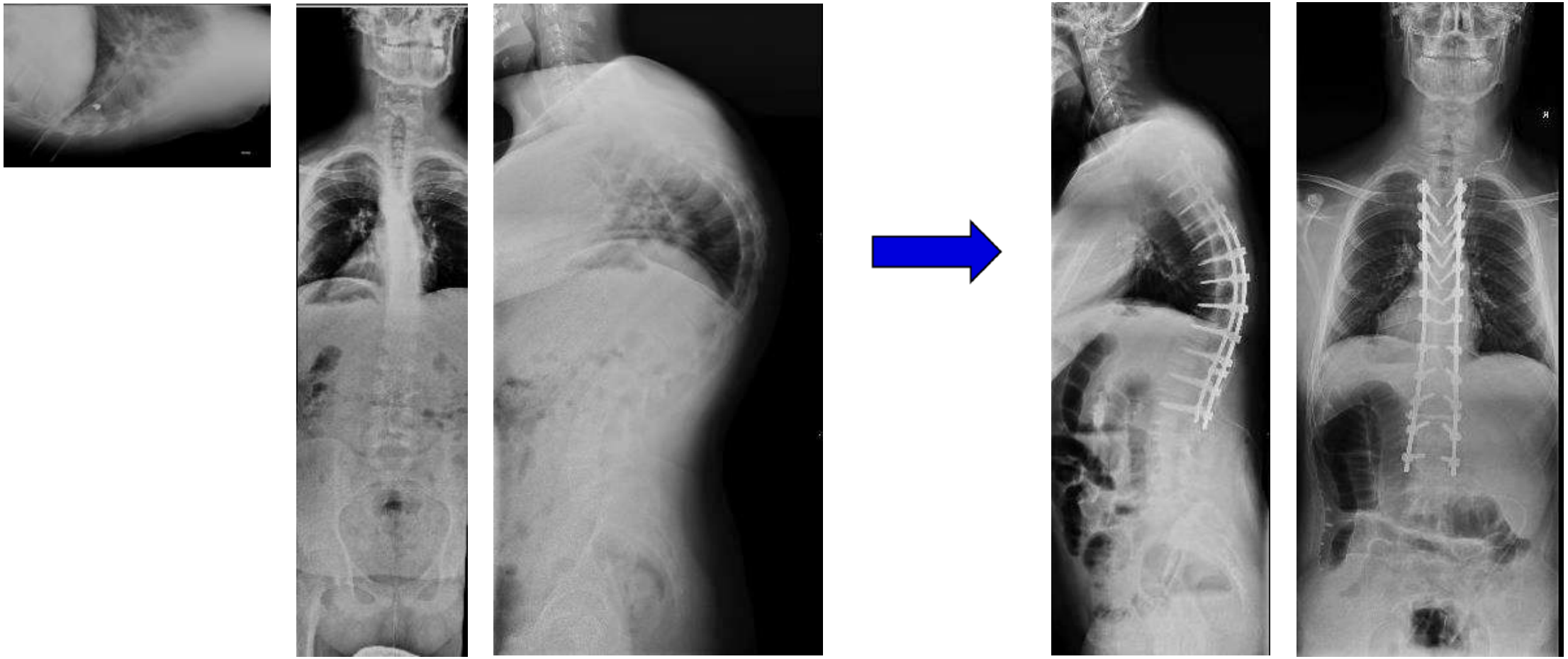
Surgical therapy

XR FU (17y + 3m)



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Faulty posture

Most common

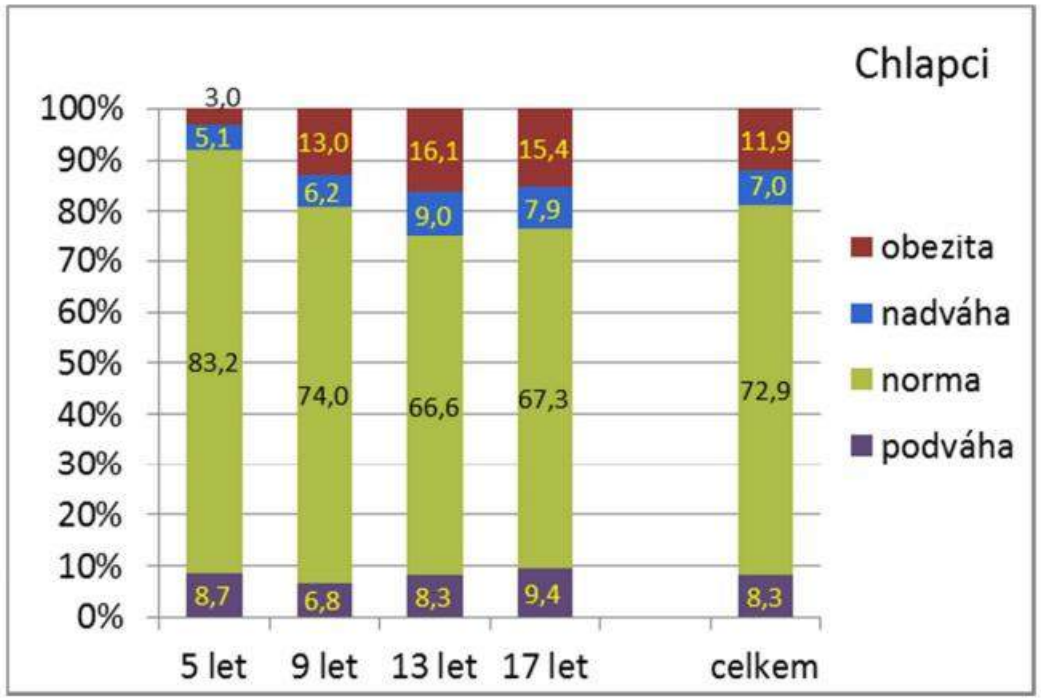
- It arises with muscle imbalance, lack ofexerciseand „sitting“ lifestyle.
- Poor musculature of the back and abdominal.
- Increased lumbar lordosis and thoracic kyphosis
- Treatment:

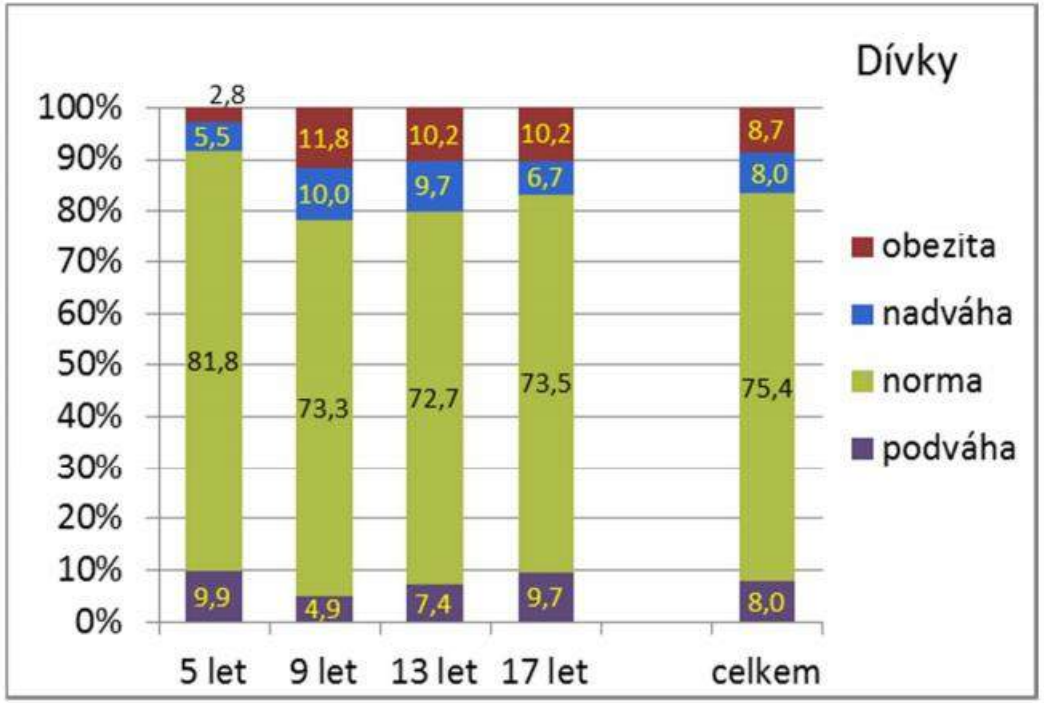
  "Good lifestyle"
  Regular exercises of back and abdominal muscles
  Endurance
  Physiotherapist

Faulty posture

BMI a „badposture“?

Graf č. 14 a 15. Hodnoty BMI u chlapců a dívek podle věku





Zdroj: http://www.szu.cz/uploads/documents/chzp/odborne_zpravy/OZ_16/OZ_BMI_VDT.pdf
Výsledky studie „Zdraví dětí 2016“ Tělesná hmotnost a vadné držení těla

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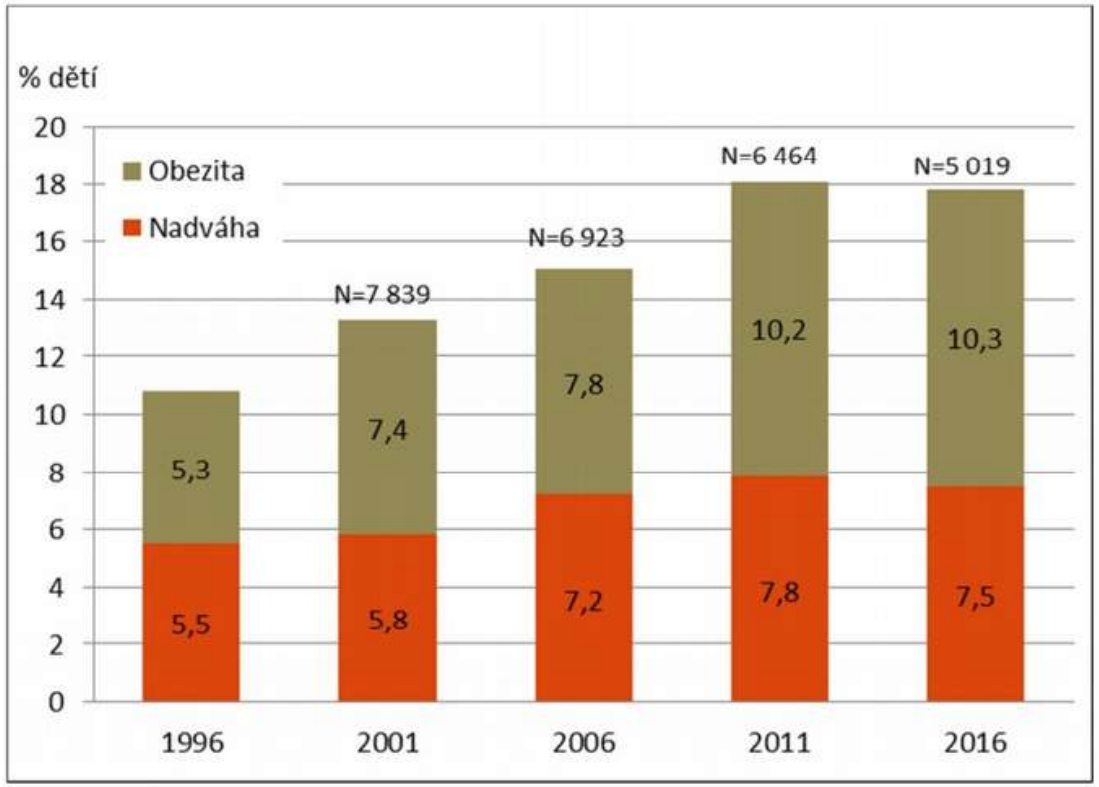
Faulty posture

Graf č. 16. Vývoj prevalence nadváhy a obezity u dětí (věkové skupiny 5, 9, 13 a 17 let) mezi lety 1996 až 2016



Zdroj: http://www.szu.cz/uploads/documents/chzp/odborne_zpravy/OZ_16/OZ_BMI_VDT.pdf
Výsledky studie „Zdraví dětí 2016" Tělesná hmotnost a vadné držení těla

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Faulty posture

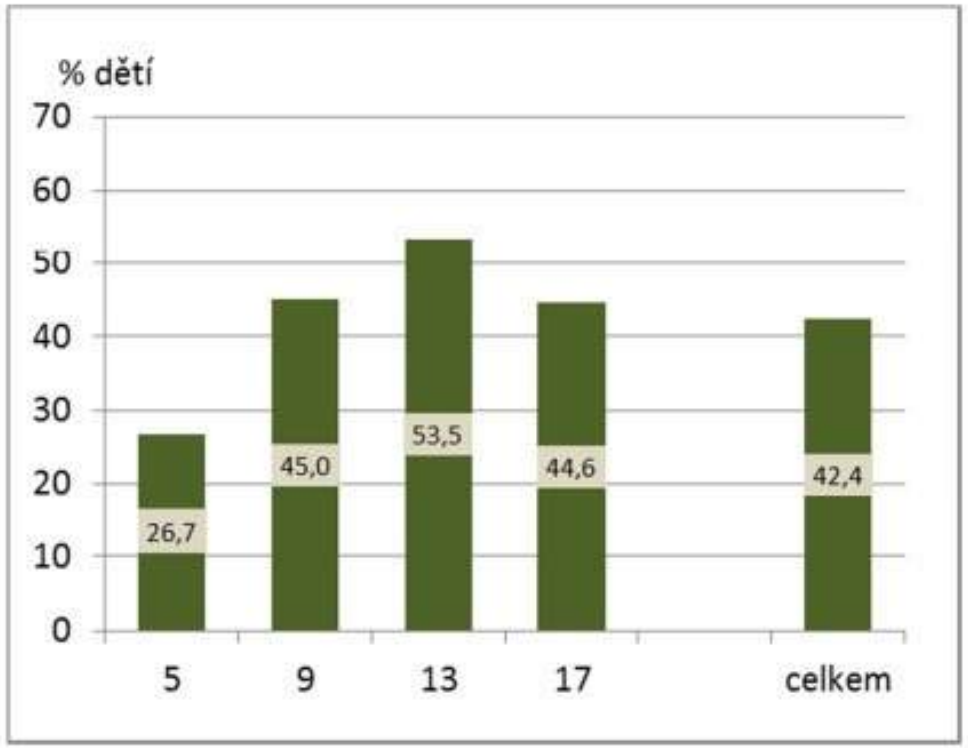
Nejčastější zjištěnou vadou v držení těla byl předsun hlavy (25,5% dětí), kulatá záda / zvýšená hrudní kyfóza (14 %) a skoliotické držení (13 %). Předsun hlavy a kulatá záda byly častější u chlapců, ve výskytu skoliotického držení se chlapci a dívky nelišili. Všechny tyto tři vady byly nejčastější u třináctiletých dětí.

Nejzávažnější z posuzovaných vad je skolióza. Jedná se o již fixovanou poruchu zakřivení páteře, kterou není možné zvýšeným svalovým napětím vyrovnat a která ovlivňuje celou funkci páteře a ve svých důsledcích může vést k snížení funkce plic. Skoliózu mělo celkem 79 dětí (1,5 % souboru), nejčastěji byla diagnostikována u 17letých (45 dětí, 4 % všech 17letých).

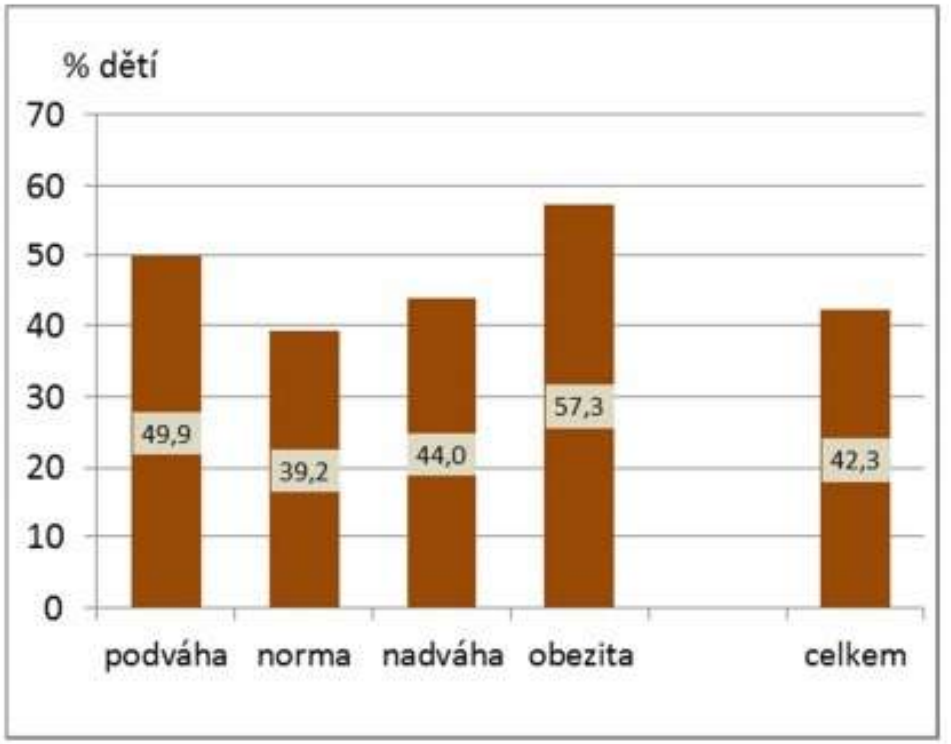
Součástí rodičovského dotazníku byly otázky zjišťující, jestli děti trpí bolestmi hlavy a páteře.

Bolestmi hlavy trpělo 21,2 % dětí, významně častěji dívky (23,1 % dívek, 19,4 % chlapců; p=0,001). Podíl dětí s bolestí hlavy narůstal s věkem (graf č. 19), nejčastěji ji trpěli sedmnáctiletí (34,8 %; více jak pětina z nich pociťovala bolest hlavy nejméně jedenkrát za týden). Častěji bolestmi hlavy trpěli děti s vadným držením těla (24,7 %) v porovnání s držením fyziologickým (18,0 %). Bolesti krční i bederní páteře uváděli rodiče shodně u 7 %

Graf č 17. Prevalence VDT dle věku



Graf č. 18. Prevalence VDT dle BMI



Zdroj: http://www.szu.cz/uploads/documents/chzp/odborne_zpravy/OZ_16/OZ_BMI_VDT.pdf
Výsledky studie „Zdraví dětí 2016" Tělesná hmotnost a vadné držení těla

Evaluation Morbus Scheuermann

adolescent damage to the spine with lifelong consequences
requires 100% cooperation between patients and families

- Conservative therapy: in combination treatment with orthosis and rehabilitation
- Surgical therapy:

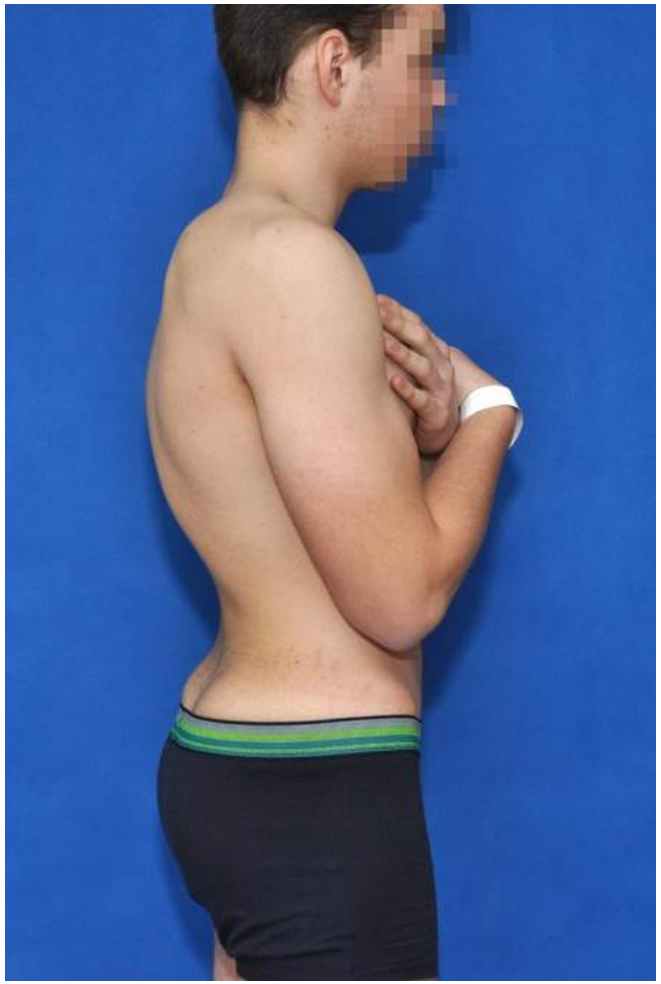
Evaluation morbus scheuermann

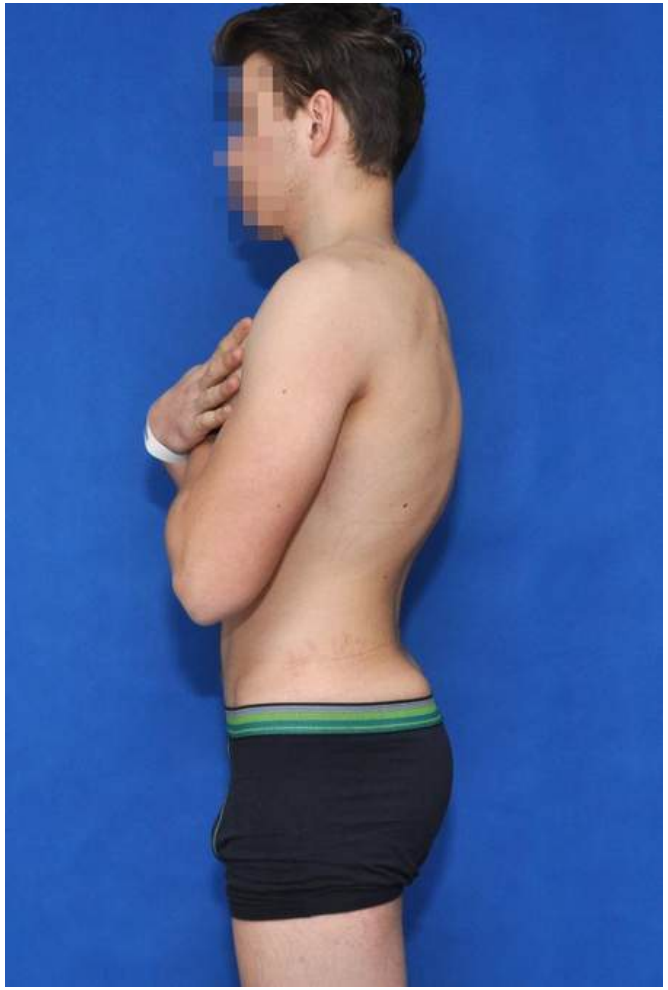
Exercise: affecting up to 5%

TLSO braces: up to 30% influence

- Operation: today over 70%

CR –RS 1999





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CR –RS 1999

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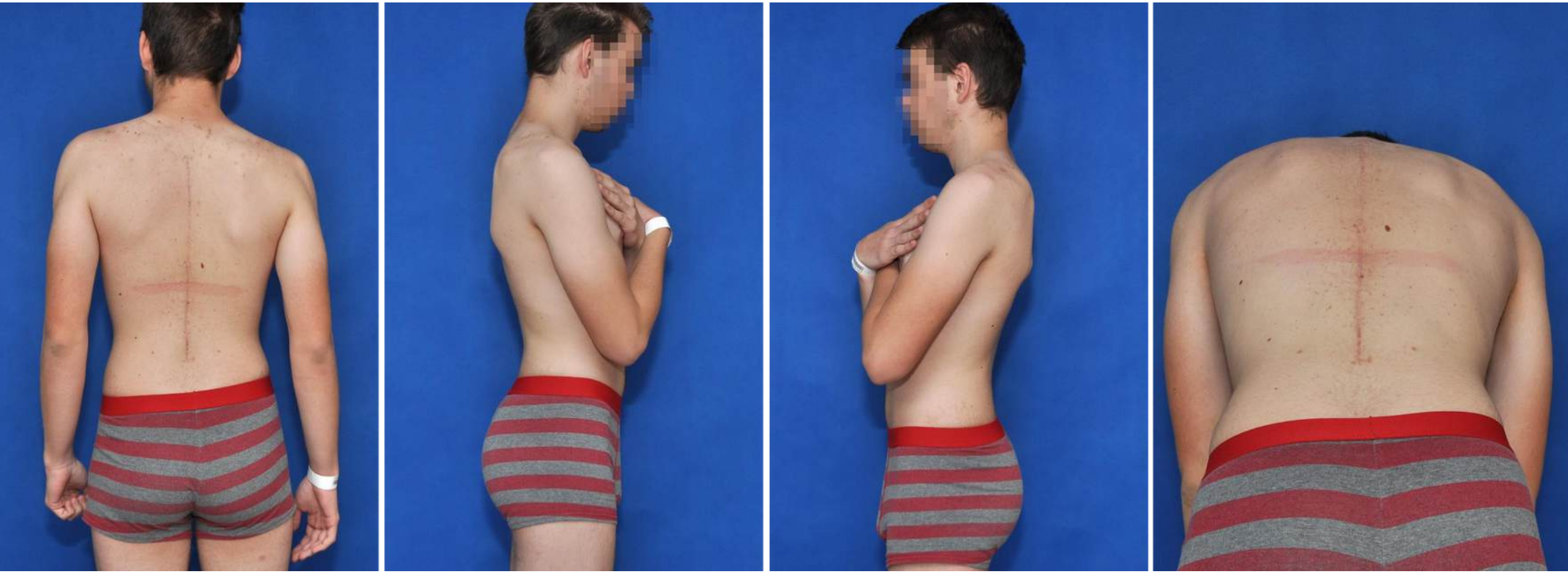
CR –RS 1999



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CR –RS 1999

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TLSO brace

- Stop/mitigate the progression of spinal deformity
- Maintain steady position of the fuselage

- NMS sometimes questionable and problematic

Corsetotherapy

Indications:

- Scoliosis: Congenital, Idiopathic, Neuromuscular, Degenerative
  Traumas: primarily, event. postoperativetreatment
- Oncology: primarily, event. postoperativetreatment

- Degeneration: postoperativetreatment
- Objective: stabilization, correction

Principleofthree-point fixation

Pelvic belt–neckcircle–sidepressurepellets

- Primaryforces:
  - actsindirectlyon thespine throughsurroundingstructures
  - axis: tensile–fordeformity in thesenseofstretching: pelvis –cervicalpelotes
  - sides: pressure–throughtheribcageby pressureon thevertebra

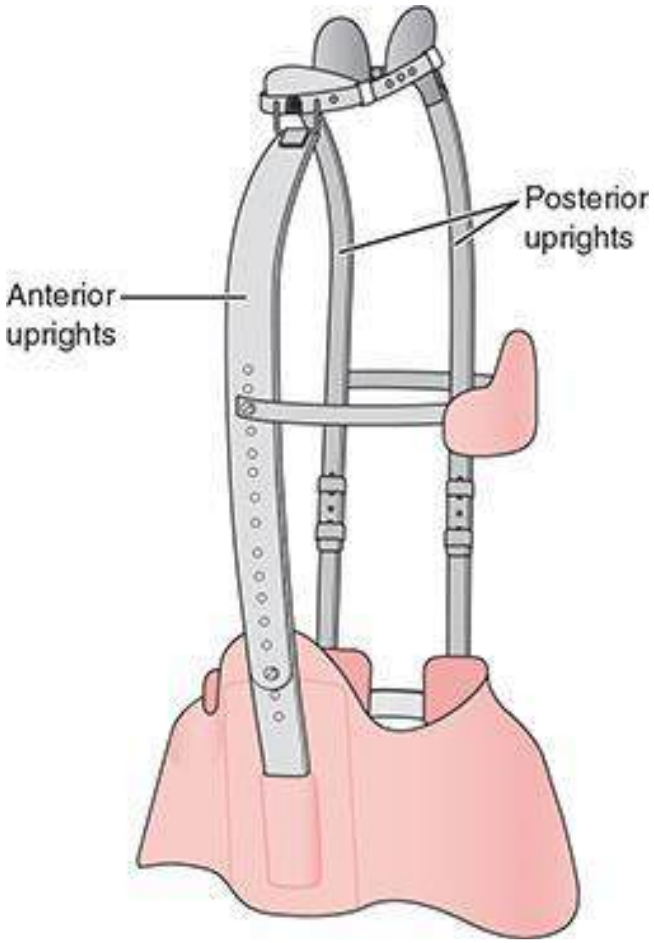
MilwaukeeBrace

Thorakolumbosacral orthosis (TLSO)

- Two-part cervikothoracolumbusalorthosis(CTLSO).
- Carlsonand Payette(2017) bracessupportingsed

Principleofthree-point fixation

Milwaukee Brace (May & Lockard, 2011)



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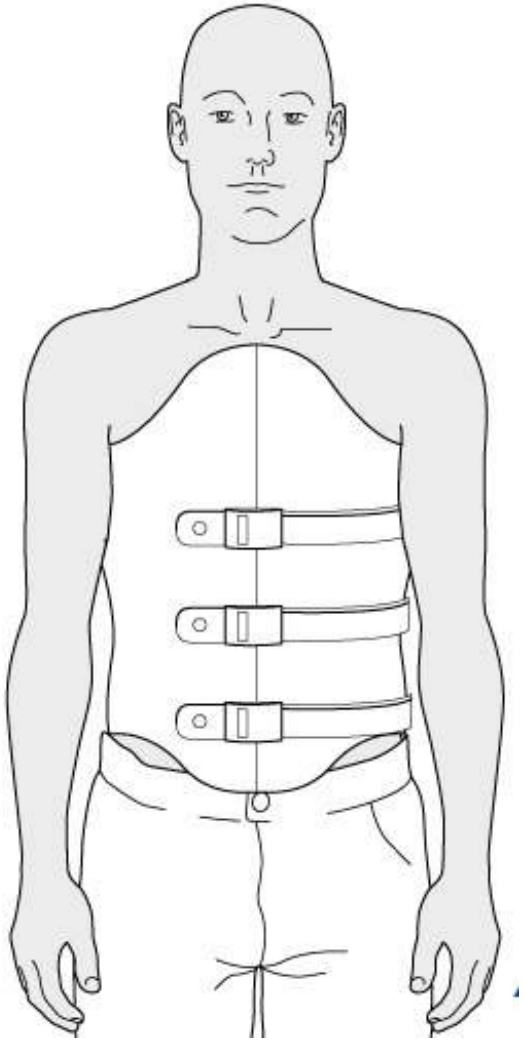
Principleofthree-point fixation

Thorakolumbossacral orthosis (author unknown, 2018)



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Principleofthree-point fixation

Thoracosocal corset of synthetic material

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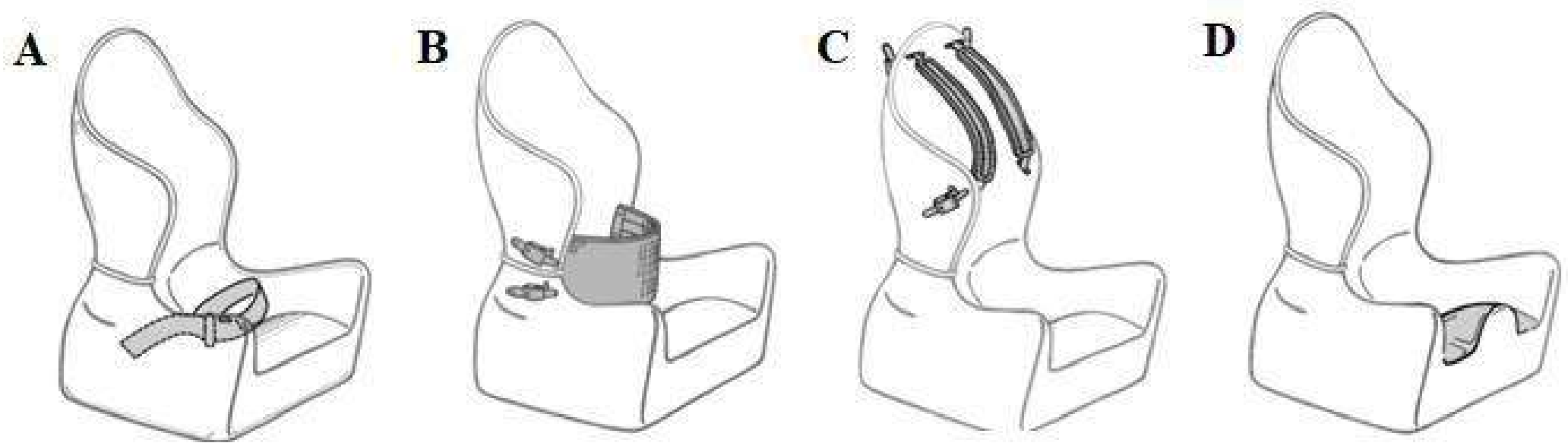
Principleofthree-point fixation

Sample sit-supporting orthosis supplemented with additional compensatory aids (Carlson & Payette)



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Conservative treatment of trauma

- Rest
- Th fracture: Jewet's brace/TLSO
- Th-L fracture: Jewet's brace, lumbar belt
-

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Conservative treatment of trauma

- PlasterTLSO: not adequatein traumatology these days

Conservative treatment of trauma

Adjuvatics - aids

teaching on operator aids

- Disabled persons and daily tasks
  - locomotive, hygiene and self-sufficiency, safety
  - practical and graphomotor activities
- Sports

Adjuvatics

teaching of operator aids

- Immobile patients, wheelchair users, seniors
- Long-term bed treatment

- After demanding orthopedic – surgical procedures

Adjuvatics

teaching of operator aids

positioning and fixing

for locomotion, its training and compensation

Hygiene

facilitating the performance of practical activities

for the implementation of leisure, work activities

Adjuvatics

positioning and fixing

- position optimisation, verticalization of persons with impaired momentum
- equipped with a controller to adjust the necessary height and slopes

Adjuvatics

positioning and fixing

Positioning wedges, tubes:

Fixation lying on the back, side, abdomen
Rotation of positions and 30min, prevention of dekubitus

Brace:

Stabilization of posture, spine, chest and joints

Seats:

Specially adapted, adjustable
Safe seat, headrest

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Adjuvatics

positioning and fixing

Positioning, verticalizing stands:

Fixation in the areas of the feet, calves, knees and thighs, pelvis, hips and hare

+ working stations

Sliding plate:

- Makes it easy to move from trolley to bed or car

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Adjuvatics

For locusming, practicing and compensating

- Medical strollers:

  For children of early age

  Combination with duct wedges, backrests, tables ap

- Rehabilitation carts:
- according to the drive - mechanical x electric

  according to the environment - interior x exterior

  by age - for children, young people and adults

  according to construction - fixed x folding

  according to the purpose - standard x special (sports, hygienic, transport).

Adjuvatics

wheelchair – mechanical: activating, mechanical, multi-blow, for hemiparetics, amelia, dysmels

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Adjuvatics

Special sports carts: basketball, rugby, tennis, bencykl

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Adjuvatics

Forsports: handbike, monocross, monoski

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Adjuvatics

Limb movement trainers, e.g. after operations

- Motopeds:
- Motoding:
- Upper limbs
  - Lower limbs:
  - Knee and hip joint
  - Ankle joint

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Adjuvatics

Limb movement trainers, e.g. after operations

- Climbers: nana for children withcerebralpalsy- diparetic form
- Walkers: walking practice:
  - Four-point immobile/mobile
- Two-wheeled: mobile
- Three-wheeled....

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Adjuvatics

Crutches: support function

four-point, French, children's elbow crutches, armpit, walking sticks

height adjustable, folding outing sticks

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Adjuvatics

Overcomingbarriers

- Stairplatforms: oblique, vertical

  „stairclimbers“

  ramps

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Adjuvatics

Forhygiene

increase the user's potential in self-service and independence from the assistance of the other person

- Jacks, bath/shower seats, toilet trolleys
- Attachments, backrests, toilet handles

Adjuvatics

Usnadňující výkon praktických činností

- fixing boards, plates
- Cutlery, handles
- Special knives
- Feeders

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Adjuvatics

IT

- Trackball, mouse
- Keyboard






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Adjuvatics

IT

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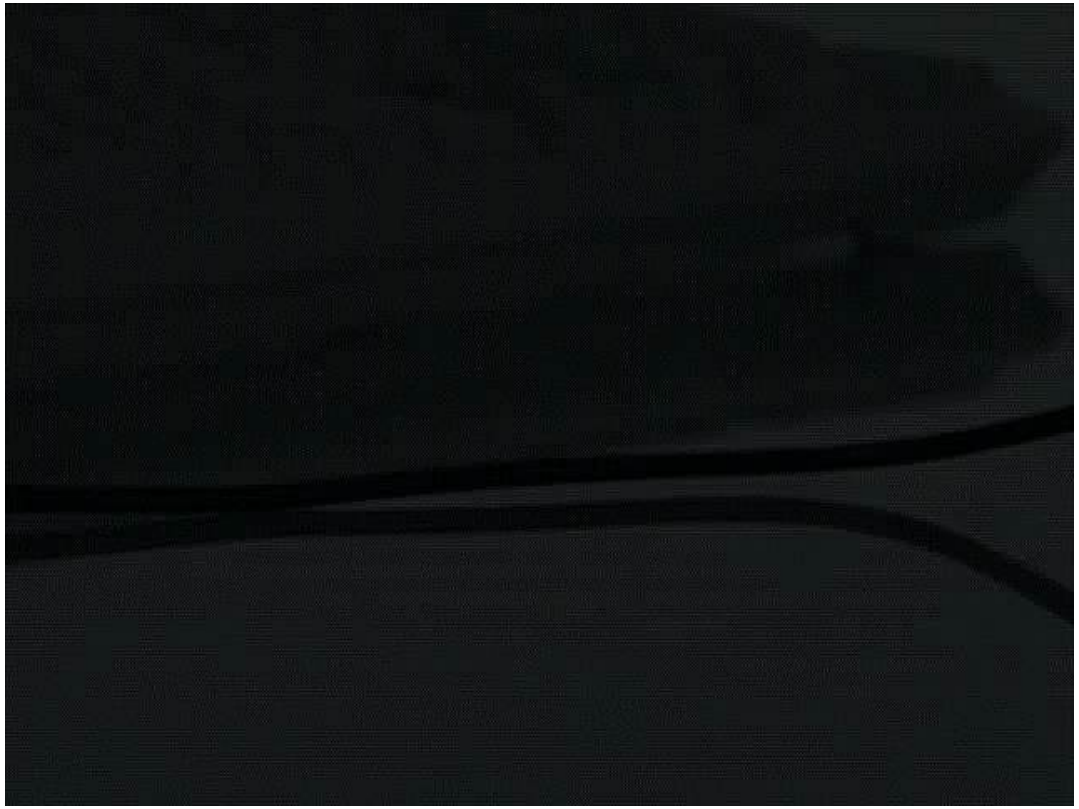
Adjuvatics

Smart NAV a 14 Control



Adjuvatics

Strollers, trolleys

- Medical strollers:

  For children of early age

  Combination with abduction wedges, armrests, tables ap

  Rehabilitation carts:

- according to drive - mechanical x electric
- according to the environment - interior x exterior

  by age - for children, young people and adults

  according to the design - fixed x folding

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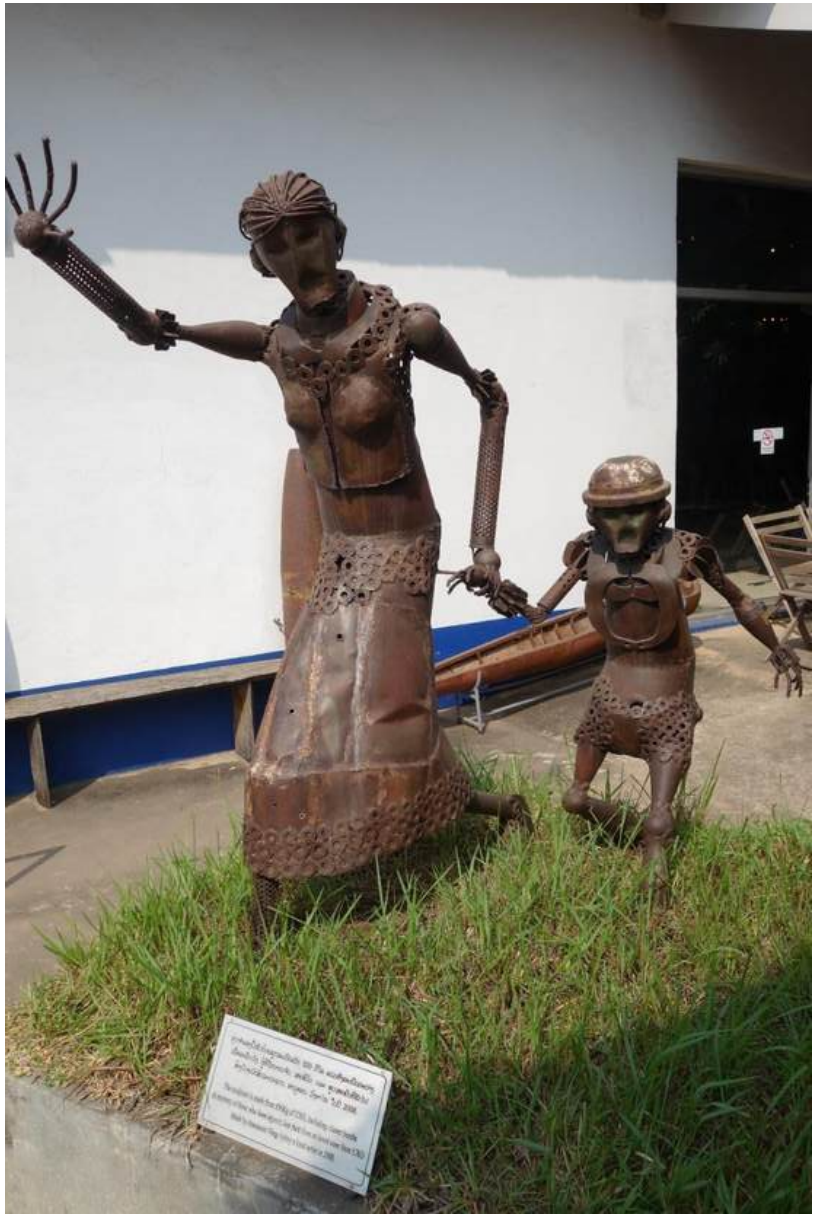
Conclusion



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Conclusion

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Conclusion

21st century

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Source

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Fotografie z LAOS (soukromá databáze Jan Kocanda)

Source

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Thank you for your attention.

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