ORAL PRESENTATIONS

O1 The association between IL-6 and MMP-3 gene polymorphisms and adolescent idiopathic scoliosis: a case-control study
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Background: The nucleus pulposus of scoliotic discs respond to exogenous stimuli by secreting interleukin-6 (IL-6) and other inflammatory cytokines. The association between matrix metalloproteinases (MMPs) and disc degeneration has been reported by several investigators. A human MMP-3 promoter 5A/6A gene polymorphism regulates MMP-3 genes expression, while the G/C polymorphism of the promoter region of IL-6 gene influences levels and functional activity of the IL-6 protein.

Methods: We conducted a case-control study to investigate whether the 5A/6A polymorphism of the MMP-3 gene and the G/C polymorphism of the promoter region of IL-6 gene were associated with the susceptibility to develop AIS.

Results: The frequency of the 5A/5A genotype of MMP-3 gene polymorphism in patients with scoliosis was almost 3 times higher than in controls (30.2% vs. 11.2%, P < 0.001). The frequency of the G/G genotype of IL-6 gene polymorphism was almost 2 times higher than in controls (52.8% vs. 26.2%, P < 0.001). 5A/5A genotype of MMP-3 gene polymorphism and G/G genotype of IL-6 gene polymorphism are independently associated with a higher risk of scoliosis (odds ratio, respectively, 3.34 and 10.54).

Conclusion: This is the first study performed to evaluate the possibility that gene variants of IL-6 and MMPs may be associated with scoliosis. This study suggests that MMP-3 and IL-6 promoter polymorphisms constitute important factors in the genetic predisposition to scoliosis.

References

O2 The skeletal maturity determination in idiopathic scoliosis
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Introduction: In the Physical and Rehabilitation Medicine Service (PRMS) of Hospital Curry Cabral, Lisbon – Portugal, a protocol for idiopathic scoliosis follow-up was established. This protocol has both resemblances and discrepancies to the SOSORT approach approved by the Consensus Meeting 2005.

Objectives: To present the indications for brace treatment from the PRMS follow-up protocol and SOSORT guidelines. Outline a comparison of SOSORT and PRMS approaches.

Materials and methods: Analysis and comparison of the approach in two clinical cases of idiopathic scoliosis by the SOSORT guidelines and by the PRMS protocol.

Results: Clinical Case 1: By the SOSORT guidelines, there is an indication for brace treatment. By the PRMS protocol, there is no indication for brace treatment.

Clinical Case 2: By the SOSORT guidelines, there is no indication for brace treatment. By the PRMS protocol, there is an indication for brace treatment.

Conclusion: Clinical evidence supports the application of more variables in the treatment decision of whether to recommend brace wearing. Cobb angle, Risser sign and chronological age may not be enough. It is important to obtain other data from the observation of the patient, including a hand-wrist X-ray according to Greulich and Pyle Atlas.

Reference
O3  
Changing a “progressive” factor into a “corrective” factor: the effect of intervertebral disc modulation in treatment of idiopathic scoliosis
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Background: The rationale for management of scoliosis during skeletal growth assumes a biomechanical mode of deformity progression, based on the Huerter-Volkmann principle, whereby extra axial compression decelerates growth and reduced axial compression accelerates it. Wedging of the intervertebral disc (IVD) is known to contribute to the progression of idiopathic scoliotic (IS) curves. This report illustrates the effect of IVD modulation and its subsequent benefits in IS treatment. The proposed model is examined on conservative treatment (full- and night-time braces and exercises) and fusionless IS surgery with staples.

Materials and methods: A theoretical model of IVD’s role in progressive IS pathobiomechanics is proposed. The imbibed water through the so called Gibbs-Donnan mechanism, mainly in the apical IVD but also in the adjacent discs, must occur in a greater amount in the convex side than in the concave due to convex-wise asymmetrical distribution of glycosaminoglycans (GAGs) in nucleous pulposus collagen network type II. This asymmetrical pattern of water distribution in the scoliotic IVD, combined with the diurnal variation in the water content of IVDs, imposes asymmetrical, convex-wise, concentrated cyclical loads to the IVD and the adjacent immature vertebrae growth plates of the child during the 24 hours period. The convex side of the wedged IVD sustains greater amount of cyclic expansion than the concave side, leading to the sequela of asymmetrical growth of adjacent vertebrae (Huerter-Volkmann law).

Results: The IVD may be modulated by applying corrective forces on the curve thereby eliminating any asymmetrical accumulation of water in the apical and adjacent discs. This, in turn, restores a close-to-normal force application on the vertebral growth plates through the Huerter-Volkmann principle and consequently may prevent curve progression. The forces are now transmitted evenly to the growth plate increasing the rate of proliferation of chondrocytes at the corrected pressure side, the concave. All the stated treatment methods aim at alteration of the mechanical environment and modulation of the endochondral growth of the immature vertebrae. Application of appropriately directed forces, ideally opposed to the apex of the deformity, likely leads to optimal correction.

Discussion: The wedging of the elastic IVD in the immature scoliotic spine could be reversed by application of corrective forces on it. Reversal of IVD wedging is thus amended into a “corrective”, rather than “progressive”, factor of the deformity. Through the proposed mechanism, treatment of progressive IS with braces, exercises and fusionless surgery by anterior stapling could be effective.

References


O4  
Screening for preadolescent and adolescent Idiopathic Scoliosis of the spine in a Greek ROM population
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Background: Previous school screenings in Greece showed a prevalence of Id. Scoliosis similar to other countries in Europe, America and Asia averaging 1. 5–3% for curves ≥10°. A complete absence of ROM children with scoliosis was noted in contrast to such admissions for other orthopedic ailments.

Objective: The present screening is an attempt to investigate prevalence of Id. Scoliosis in ROM children and if found substantially lower than usual, to seek an explanation for this favorable aberration.

Methods: The Screening was materialized in the years 2002 to 2006 at ROM encampments in Attica and Peloponnesus. With the clinical bending test and demographic data recording, we examined 790 children, 400 boys and 391 girls (191 aged 6 to 8 y and 599 from 9 to 17 y). All children with positive clinical test had X-Ray of the spine the same day.

Results: Of 790 children, 30 had positive test initially. A second examination left 20 children (2.5%) for radiography. Some showed atypical and unstable spine deviations or incomplete curves without rotation. Three girls with prominent humps had normal X-Rays. Two girls 7 and 11 y old with rib hump had 10° and 12° right Thoracic curve with minimal rotation. Therefore 2 girls of 790 children had minor scoliosis (0.25%).

Conclusion: This study shows definitely reduced prevalence of Id. Scoliosis among the usually dark skinned ROM children (0.25%). Screenings in S. Africa showed low scoliosis prevalence in black people (0.03%). A multi ethnic screening from Singapore showed a 2.5% prevalence among fair skinned Chinese girls and 1% in dark skinned Indian and Maley girls. Our original screening in Athens (1979) showed children of dark complexion to be more resistant, than fair skinned blond children to the development of scoliosis. ROM people in Greece remain a race genetically separate from ethnic Greeks although established here many centuries ago. This population is ideal for genetically related ailments like Id. Scoliosis.
Advantages of a two-step procedure for the screening of idiopathic scoliosis

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Background: To verify if our two step modality of scoliosis screening on 8995 children (age 9–14) does diminish the radiological exposure. The result will assist in an estimated reduced rate of radiogenic fatal cancers and lower the social economic burden.

Materials and methods: Two different methodologies were used. In a first group (n = 5731: group A), the first clinical examination was performed by the school physicians. Doubtful cases were referred by the physician to the Orthopaedic specialist. In a second group (n = 3264: group B), the clinical examination was directly performed by the orthopaedists. Either for the first group or for the second, the specialist ascertained by X-rays the suspected scoliosis and deferred to a 6 month control for the still doubtful cases. To evaluate the lifetime attributable risk of cancer mortality, we have followed the ICRP 60. To calculate the social economic burden, we have assumed the present reimbursement to the Hospitals by the National Health Service which is Euro 70 for each examination.

The statistic significance of the differences was assessed by the z test for proportions.

Results: In group A, n. 86 Rx examinations were performed on 5731 children (1.5%) and in group B n. 95 on 3264 subjects (2.91%) (z = 4.452, p < 10-3). The screening of 1000 children implies a collective dose E of 0.65 + 0.98 = 1.63 Sv (boys) or 1.21 + 1.2 = 2.41 Sv (girls).

The risk of a fatal tumour for each examination in males is 4.075 (1.63 × 2.5) : 20000. A screening on 10000 children directly examined by the specialist would require 291 Rx examinations (2.91%), while by the two-step procedure they would be reduced to 150 (1.5%), with a saving of 70 × 141 = 980 Euro and of 0.283 Sv of collective dose.

The number of the Rx examinations halved (141 instead of 291) by the two-step procedure, and the number of malignant tumours due to radiations halved.

Conclusion: The comparison of the two methodologies shows that the “two steps” procedure reduces the social economical burden, but its main advantage appears on the radioprotection side, which is particularly important in children.

References
O7
Trunk asymmetry in normal juveniles
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Background: Trunk asymmetry in normal adolescents was previously reported [1]. The present study reveals, for the first time, trunk asymmetry (TA) in juveniles and provides data which describes the evolution of trunk asymmetry from early childhood to adolescence.

Materials and methods: The scoliometer readings in both standing and sitting forward bending position (FBP) of 3301 children, (1645 boys, 1656 girls) aged from 3 to 9 years old, were studied. TA was quantified by measuring angle of trunk rotation (ATR) and children were divided in two groups. In group I the ATR was 1° to 6° degrees and in group II ≥7°. STA was quantified by measuring angle of trunk rotation and children were divided in two groups. In group I the ATR was 1° to 6° degrees and in group II ≥7°. STA statistical package was used for the analysis.

Results: 71.25% of boys and 73.27% of girls (2.02% more for girls) in standing while 81.13% of boys and 80.74% of girls in sitting FBP (0.39% more for boys), were symmetric (ATR = 0°). The symmetry difference at standing minus sitting FBP for boys and girls was 9.88% and 7.43% (2.45% more for boys) respectively. Severe asymmetry of ≥7° was found 1.74% for boys and 1.75% for girls at the standing and 1.21% and 1.22% at the sitting FBP respectively. Analysing ATR by age it appears that significant TA changes take place between 8–9 years of age for boys and between 6–7 and 8–9 years for girls.

Discussion: Juveniles were found with less trunk asymmetry than adolescents. In the sitting FBP juvenile boys turn 2.45% more symmetric than juvenile girls from standing FBP, a larger percentage compared with the pertinent found for adolescents, indicating different juvenile – adolescent torso dynamics. The asymmetry of ≥7° was 1.49% less from adolescent boys and 2.17% less from adolescent girls at the standing FBP and 0.41% and 0.99% less at the sitting FBP respectively. [2].

References

O8
Measurement of the hip joint range of motion in adolescent girls with idiopathic scoliosis
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Background: Body asymmetries exist involving the pelvis and the lower limbs in patients with idiopathic scoliosis. They are suspected by some authors to have the causative role on the development of scoliosis.

Methods: Hip joint range of motion was studied in 158 adolescent girls, aged 14.2 ± 2.0 years, presenting idiopathic scoliosis of 43.0° ± 14.5° of Cobb angle and in 57 controls, sex and age matched. For the hip range of rotation the inclinometer was used in order to control the pelvis level.

Results: Compared to the controls, the patients with scoliosis revealed less frequent symmetry of the hip joint range of rotation (p = 0.0047), a significantly higher difference between the left and the right hip range of internal rotation (p = 0.0013), and a significantly greater static rotational offset of the pelvis, calculated from the mid-points of rotation, (p = 0.0092). No limitation of the hip joint range of motion was detected, but a transposition of the sector of motion, usually towards the internal rotation in one hip and the external rotation in the opposite hip. No relation between the asymmetry of the hip joint range of motion and the curve type, the Cobb angle, the angle of trunk rotation or the curve progression was demonstrated.

Conclusion: Asymmetrical range of motion of the hip joint was detected; however, most of asymmetries were expressed equally in the scoliotics and in the controls. The detected hip asymmetries were not related to the parameters describing the scoliotic deformity.

References

O9
The trunk and pelvis rotation range of motion and coupled motions in the sagittal plane in adolescent girls with idiopathic scoliosis
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Introduction: Contemporary medicine tends to analyze scoliosis in 3-D. A spine motions in one plane are coupled with motions in others planes. The purpose of this study was to analyze the trunk and pelvis rotation ROM in horizontal plane and coupled motions in sagittal plane in scoliotic girls.

Hypothesis: Scoliosis causes changes of rotation ROM according to healthy subjects. Trunk and pelvis rotation are coupled with motions in sagittal plane. Rotation ROM and coupled motions in sagittal plane depend on a type of scoliosis.

Materials and methods: Fifty nine AIS girls and 30 healthy girls at the age 10–18 participated in the study. A right thoracic curve and/or a left lumbar curve at the spine radiography were criterions for studies. Girls were assigned to four groups according to type of scoliosis. A computer-based axial rotation test assessed the trunk and the pelvis rotation ROM and coupled motions in the standing, upright position. The thoracic cage or the pelvis were fixed during tested motions. ANOVA test and T-test were used in statistic analyze.

Results: There are differences of rotation ROM in scoliotic subjects comparing to the control group. A decrease in ROM of
the trunk and pelvis rotation in double curve scoliosis girls was observed. Increasing ROM of pelvic rotation in left lumbar curves subjects was found. The right thoracic curve is correlated with decreasing ROM of left trunk rotation and the left lumbar curve is associated with increasing ROM of left pelvic rotation. Right rotation of the trunk is correlated with extension in thoracic curve subjects and right rotation of the pelvis is coupled with increasing anterior pelvic tilt in all formed groups. Increasing trunk extension was observed in scoliotic subjects comparing to the control group.

**Conclusion:** Documented relationships of the trunk and pelvic motions in horizontal and sagittal planes contribute to development of knowledge of AIS biomechanical backgrounds. This knowledge is necessary to plan the most effective way of treatment in AIS patients.

**Reference**


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**O10 First rib asymmetry and shoulder imbalance – assessment of first rib index (FRI) in thoracic X-rays of people without scoliosis**

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Scoliosis 2009, 4(Suppl 1):O10

**Background:** In a previous study we evaluated the predictive value of First Rib Asymmetry (First Rib Index (FRI)) as related to postoperative Shoulder Height Imbalance in Adolescent Idiopathic Scoliosis.

**Objective:** The present study evaluates a) if shoulder height differences exist in normal people, without scoliosis and b) if such differences are related to First Rib Asymmetry (FRI).

**Materials and methods:** We studied 73 posteroanterior routine thoracic X-rays in patients with no signs of scoliosis. The difference in shoulder height is measured as the perpendicular distance from the upper surface of the acromial end of the left clavicle and the horizontal level of the upper surface of the acromial end of the right clavicle. Shoulder asymmetry was defined as any value of this distance greater than 1 cm. First rib asymmetry was assessed by the FRI. FRI is the difference between left and right 1st rib radius, measured from the centre of the vertebral body corresponding level (usually T2) to the most distal point of the rib arch.

**Results:** We found shoulder height differences in 23 of 73 radiographs (31% of cases), 7 having the right and 16 the left shoulder higher, with a mean difference of 0.4 cm [−0.2, 0– (+) 3 cm]. The mean value of the First Rib Index (FRI) turned out to be 0.001 cm [(−)−0.4 – (+) 1.1 cm]. In 53 cases with FRI < 0.5 cm, 15 had shoulder asymmetry (28%), while in 20 cases with FRI > 0.5 cm, 8 had shoulder asymmetry (40%).

**Conclusion:** Shoulder asymmetry in Idiopathic Scoliosis is usually related to the presence of a Proximal Thoracic Curve. An interesting observation is that 31% of people without scoliosis may have shoulder asymmetry >1 cm. It appears that beside scoliosis, there may be other factors resulting in such shoulders asymmetries. This shoulder difference seems to be related to some degree to first rib asymmetry assessed by FRI, a finding also related to idiopathic scoliosis.

**References**


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**O11 Lateral spinal radiographs help create an accurate Risser sign grading**

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**Background:** The Risser sign quantifies the ossification of the iliac crest in order to assess the remaining spinal growth. The clinical value of the Risser sign has been questioned for its inaccuracy. Estimation of the Risser sign based on the lateral spinal radiograph has not been reported.

**Purpose:** To evaluate the relevance of the lateral spinal radiograph as a tool for a more accurate Risser sign grading.

**Methods:** Cross sectional analysis of spinal frontal and lateral radiographs of 201 girls with idiopathic scoliosis, aged 14.6 ± 2.2 years. The ossification of the posterior part of the iliac apophysis was quantified on the lateral spinal view at four grades: absent (A), partial (B), complete (C) or fused (D). The position of the posterior superior iliac spine was studied on both views as well as in pelvic specimens.

**Results:** The posterior one-third portion of the iliac apophysis, sagitally oriented and obscured by the sacroiliac junction, could be studied on the lateral radiograph. This revealed a modified quantification of the apophysis excursion in 58 of 201 (29%) patients. To compare the frontal view, both advanced and/or delayed ossification were assessed with the Lateral Modifiers. Twenty-five percent of the patients at Risser 0, 1 or 2 demonstrated simultaneous ossification of both anterior and posterior parts of the iliac crest.

**Conclusion:** 1. Currently used Risser sign grading does not consider the actual excursion of the iliac apophysis. Because the apophysis is posterior and medial to the sacroiliac junction, it is not observed.
2. Iliac apophysis excursion can be accurately estimated, when the lateral spinal radiograph is analyzed and Lateral Modifiers A through D are considered.

**References**


O12
A radiographic evaluation of elasticity in idiopathic scoliotic curves: are lateral bending films reliable enough to estimate curve elasticity?
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Background: Assessment of the elasticity of scoliotic curves is an important factor to plan further treatment in idiopathic scoliosis.
Purpose: To assess curve elasticity obtained from PA standing lateral bending radiographs in comparison to those taken when maximal manual supine traction is applied to the wrists and ankles in patients with idiopathic scoliosis.
Patients and methods: Evaluation of the elasticity of the scoliotic curve was done in 96 patients with idiopathic scoliosis with supine radiographs under manual traction and standing lateral bending radiographs.
Results: Measurements taken from lateral bending radiographs provided more reliable estimates of the postoperative correction compared to radiographs using manual wrist to ankle traction. Lateral bending was a more effective method to assess lumbar and thoracolumbar curves. The two tests were similar in ability to evaluate the elasticity of thoracic curves. A lack of patient cooperation in movement was attributed to inadequate assessment of curve elasticity seen in some of the lateral bending radiographs.
Conclusion: The lateral bending test usually is superior to manual traction method. Both methods for estimation of curve elasticity may be recommended because of the frequent, lack of patient cooperation in the lateral bending test. This compliance issue may result in an underestimation of the actual achieved correction.
References

O13
Curve pattern changes in idiopathic scoliosis
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Introduction: Ponseti and Friedman suggest that curve type is genetically determined and that curve types do not change throughout its course. Nowadays, we see scoliosis as a more dynamic process. Therefore we ask ourselves can the natural history of idiopathic scoliosis can change during growth when the scoliosis is not treated.
Aim: The goal of this study was to assess curve pattern changes in patients with idiopathic scoliosis who were not treated.
Materials and methods: Forty eight patients were monitored who were not treated and had an idiopathic scoliosis. Curve pattern changes were classified according the SRS.
Results: Forty eight patients (11 boys and 37 girls; 13 patients younger than 10 years and 35 patients older than 10 years) were monitored for a mean follow-up of 3 to 4 years. 8 patients (17%) showed changes in curve patterns. Six of these patients were younger than 10 years, while 2 patients were older than 10 years. There was no correlation between the curve severity and the curve pattern changes. We found no significant difference between the male and female patients. Single curves changed in double curves and vice versa during growth in 70% younger than 10 years and 18% older than 10 years.
Conclusion: In this study, changes in curve patterns suggest that idiopathic scoliosis is not a fixed deformity, but a dynamic process especially in patients younger than 10 years.
References

O14
Assessment of the ability of patients with scoliosis to actively correct the surface asymmetry of the trunk
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Background: Deformations of the torso in patients with progressive scoliosis can be precisely assessed with surface topography. Active auto-correction is one of essential exercises to be performed by patients with scoliosis.

Purpose: Evaluate what changes of surface parameters are introduced by active movements learned by patients with scoliosis from the physiotherapists.

Methods: Evaluation of the shape of the back in spontaneous position and after the active auto-correction. Fifty-eight girls, aged 14.0 +/- 1.8 years, Cobb 31.3 +/- 11.0 degrees, were educated to actively correct their posture, according to their type of scoliosis. There were 4 girls with single thoracic, 31 girls with double thoracic and lumbar and 23 girls with single thoracolumbar or lumbar scoliosis. Surface topography measures were done before and after a 12-days intensive in-patient rehabilitation program, focused on FITS physiotherapy.

Results: The POTSI index in actively corrected position after therapy was significantly lower (p < 0.05) than POTSI in spontaneous position before therapy. The control measurement, which consisted of comparing POTSI in spontaneous and in corrected position before the patients started the therapy, revealed no significant change.

Conclusion: Patients with scoliosis are able to actively change the shape of their trunk. When non-educated, they cannot effectively decrease the trunk asymmetry. After intensive in-patient physiotherapy, they achieve the ability to actively reduce the surface deformity of their back.

References

O15
The use of surface topography in the surveillance of adolescent idiopathic scoliosis: the influence of patient BMI on the reliability of curve measurement

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Scoliosis 2009, 4(Suppl 1):O15

Background: There are several methods available using surface topography to estimate the spinal curves in adolescent scoliosis patients. One new method, using the Ortelius 800 device, has been shown to be unreliable [1]. This study will analyze whether the reliability of measurements is related to the patient’s Body Mass Index (BMI).

Materials and methods: We studied the surface topography measurement in 100 in-patients with idiopathic scoliosis divided into different age-groups. First group: 7 to 12 years (n = 12), second group: 13 to 16 years (n = 51), the third 17 to 20 years (n = 15) and the fourth >21 years (n = 22) (7 males and 93 females). The thoracic Cobb angle was 26.4°, lumbar Cobb angle 25.7°. We investigated the average lateral deviation (RMS) and average surface rotation (RMS). Measurements were taken one day before the patients left the clinic, after a 3 or 4 week in-patient intensive rehabilitation program, in three different postures: Normal posture: No specific instructions: standing with feet in an standardized way. Conscious posture: The patients acquired this posture during intensive daily exercising. Corrected posture: In the most corrected posture, the patients are able to achieve this by using specific muscle tension and specific breathing techniques. We compared the results between the different postures. Then we calculated the results for the different age groups.

O16
How objective is the measurement of spinal deformity using surface topography?

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Scoliosis 2009, 4(Suppl 1):O16

Background: Claims have been made that surface topography is an objective measurement; however, there is a propensity for errors due to significant postural influences. The purpose of this study was to help estimate these influences by measuring patients with scoliosis in three standardized postural positions.

Materials and methods: We studied the surface topography measurement in 100 in-patients with idiopathic scoliosis divided into different age-groups. First group: 7 to 12 years (n = 12), second group: 13 to 16 years (n = 51), the third 17 to 20 years (n = 15) and the fourth >21 years (n = 22) (7 males and 93 females). The thoracic Cobb angle was 26.4°, lumbar Cobb angle 25.7°. We investigated the average lateral deviation (RMS) and average surface rotation (RMS). Measurements were taken one day before the patients left the clinic, after a 3 or 4 week in-patient intensive rehabilitation program, in three different postures: Normal posture: No specific instructions: standing with feet in an standardized way. Conscious posture: The patients acquired this posture during intensive daily exercising. Corrected posture: In the most corrected posture, the patients are able to achieve this by using specific muscle tension and specific breathing techniques. We compared the results between the different postures. Then we calculated the results for the different age groups.
Results: There are significant differences in both parameters tested with some more than 40% to 67% greater than the measurement error calculated. The best results were achieved in the second and the third group with the conscious posture. The adult group has the most benefit with the most corrected posture. For the youngest patients, there were no significant changes with the different postures.

Conclusion: Surface measurements can be influenced by artificial postures and therefore cannot be attributed as objective. This is why the surface measurements should be made by someone independent from the treatment process in order to exclude any bias as far as possible. Surface topography may be used for postural monitoring in the rehabilitation process of patients with scoliosis.

References

O17 Conservative treatment effects on spinal deformities revealed by surface topography – a critical review of literature
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Scoliosis 2009, 4(Suppl 1):O17

Background: Surface topography systems are on the market today promising a reduction of radiation in the management of patients with spinal deformities as well as the detection of static deviations which are supposed to cause pain.

Materials and methods: A review of literature has been undertaken to investigate the usefulness of rasterstereography applied to reveal treatment effects of conservative treatment of spinal deformities. In the video rasterstereography (Formetric® system), the whole object is illuminated by a pattern of parallel lines, recorded in a single frame and needing only a short measurement time (40 msec). The automatic image processing consists of the identification of the raster lines and automatic 3-D reconstruction of the back; shape analysis is performed by a computer. Parameters used to compare the short-term effects of the different treatment concepts described were average lateral deformation (root mean square [rms]) with a technical error of 3 mm and average surface rotation (rms) with a technical error of 1.5°.

Results: Eight reports have been found where the effects of conservative treatment were evaluated using these outcome parameters. The average changes were greater than technical error in only two of the studies, while in the others significant changes have been revealed in part.

Conclusion: Video rasterstereography seems helpful for scientific investigations. However, the margins of technical error are far too high to draw conclusions in the individual case, especially in patients with scoliosis.

References

O18 Evaluating the influence of patient positioning on the accuracy of Ortelius 800 measurements for scoliosis
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Scoliosis 2009, 4(Suppl 1):O18

Background: There are several methods available using surface topography to estimate the spinal curves in adolescent scoliosis patients. One new method, using the Ortelius 800 device, has been shown to be unreliable [1]. This study will analyze whether the reliability of measurements can be improved with simple positioning techniques.

Procedure: A volunteer patient with scoliosis had standing radiographs taken to document the actual curve dimensions. The Ortelius was used to take repeated measurements of the spine with the patient standing in the usual position. The patient was then positioned using a wide-based stance, with hands forward on the wall to brace themselves in a stable position. In addition, the spinous processes were marked to allow the examiner to more reliably find them each time. Measurements were repeated using these new methods.

Analysis: For each set of measurements, the Ortelius Cobb angles were compared to the x-ray Cobb angles. The amount of variance from x-ray was calculated for each series. The standard technique of measurement produced the most variability. Each of the two new procedures improved the measurements. However, when these procedures were used together, the smallest amount of variability was produced, making the Ortelius measurements and the x-ray measurements different by an average of only 1.5 degrees.

Conclusion: Although the reliability of the Ortelius 800 device for measurement of scoliosis was not reliable in earlier research,
these two methods to improve the stability and evaluation techniques of the patient during measurement have resulted in a marked improvement in the reliability.

References

O19 Foot loading asymmetry in patients with scoliosis
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Background: Feet contact the ground first thereby transmitting the body weight to the ground. Deformities of the trunk induced by idiopathic scoliosis can interfere with the symmetry of loading of the feet.

Purpose: To assess the influence of loading on the distribution of loading.

Methods: Twenty-three girls with idiopathic scoliosis, double thoracic (Cobb 35.9 +/- 9.7 degrees) and lumbar (Cobb 34.1 +/- 10.3 degrees), aged 13.8 +/- 1.5 years were examined with a digital platform to assess the loading of the feet. The examination was repeated after 14-days intensive in-patient rehabilitation according to FITS method, which included (apart from the correction of scoliosis) the training of the “short foot”, comprising correction of the valgus of the rear foot and a three-points foot loading.

Results: After therapy, the initial asymmetry of loading changed to the advantage of the right foot (54.7 +/- 3.7% of body weight transmitted via the right foot versus the initial value of 50.9 +/- 3.3%, p = 0.0002). The rear foot and the foot rear loading was assessed separately, the distribution of that foot revealed increased loading of the rear foot (27.5 +/- 3.9% of the total body weight versus the initial 23.4 +/- 3.6%, p = 0.00025). Also, the measurements taken with the feet actively corrected confirmed the transposition of loading to the rear foot of the right foot (29.1 +/- 4.5% versus the initial 24.9 +/- 6.7%, p = 0.0005). These results encourage a discussion of the potential influence of the soft tissue therapy by relaxation of the deep fascial line and the superficial back line.

Conclusion: Intensive in-patient FITS therapy changed the pattern of loading of the feet by increasing the loading of the forefoot of the right foot.

References

O20 Does an imbalance situation stimulate a spinal straightening reflex in patients with adolescent idiopathic scoliosis?
Michele Romano, Valentina Ziliani, Salvatore Atanasio, Fabio Zaina and Stefano Negrini
ISICO (Italian Scientific Spine Institute), Milan, Italy


Background: The correlation between balance and Adolescent Idiopathic Scoliosis (AIS) is still unclear. To help identify which exercises to recommend in the conservative treatment, evaluation of balance in AIS patients may be beneficial.

Aim: Evaluation of change of scoliosis curves in a group AIS patients while submitted to an unbalancing situation.

Design: Pre-post trial.

Population: Fourteen AIS patients (46 curves), 12 to 15 years old, with 19.3 +/- 9.9° Cobb curves.

Methods: Assessment has been made using GOALS (Global Optoelectronic Approach for Locomotion and Spine), a non-ionising instrument that allow a 3D reconstruction of the spine. We evaluated the patients twice in a standardised standing position: on the floor, and on a sway bench. For statistics we used paired T test; to consider significant a variation, due to the high precision of the instrument, we considered 1° Cobb.

Results: While on the sway bench, there was a statistically (but not clinically) significant reduction of the curves from 19.3 ± 9.9° to 18.6 ± 9.6°. This was confirmed considering the average of the curves of each patient, but not when considering the worst curve (from 26.1 ± 9.4° to 25.4 ± 10.2°), where statistical significance was not reached presumably because of the reduced sample. Looking at the curves, 13% worsened and 33% improved, versus 14% and 43% respectively looking at the patients.

Conclusion: We did not find similar reactions in all patients, even if a spinal straightening reflex while on a sway bench appeared. In any case, these variations are of low degree.

References
Scoliosis 2009, 4(Suppl 1) O21

A method for investigation of spinal kinematics in children with idiopathic scoliosis
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Scoliosis 2009, 4(Suppl 1):O21

Background: The present motion capture systems utilizing surface markers are not ideal. It is difficult to calculate the location of the particular vertebrae. To better study scoliosis, a noninvasive, tool is needed which can study spine kinematics during exercise.

Purpose: To develop and to evaluate the reliability of a novel algorithm (model). The goal is to utilize this algorithm while investigating the kinematics of idiopathic scoliosis with use of a motion capture system.

Methods: The developed model uses surface markers to determine positions and orientations of the head, C7 vertebra and the sacrum. Next, Bézier curves and the radiological data (scoliosis size and location) are configured to connect the segments (head, C7 and sacrum) and to create a model of the whole spine. Dynamic trials were performed in order to verify the algorithm. The spine kinematics of 8 juveniles suffering from idiopathic scoliosis were investigated during gait, lateral bending and twisting. Additional markers were placed on the skin over a few vertebrae in order to compare their physical locations with calculated locations.

Results: High repeatability of peak scoliosis angles and moments of its occurrences during gait cycles were observed. Even when performing complicated tasks (lateral bending or twisting), calculated position of vertebrae where in good agreement with surface markers indicating their localization.

Conclusion: The developed model has a potential to evaluate complex kinematics of a spine. However, to introduce this method in scoliosis management further improvements and investigations are necessary.

References

Scoliosis 2009, 4(Suppl 1):O22

Background: Intact posture enables postural control (PC) and balance during standing. We assumed that differences in PC would be found between patients suffering from Adolescent Idiopathic Scoliosis (AIS) and a matched control group without postural disorders.

Aim: The purpose of this study was to compare standing balance between adolescents suffering from AIS and a control group.

Methods: Twenty AIS patients, aged 10–18 from both sexes and twenty matched control group patients participated in the study. Balance in eight postural positions was measured in standing with open and closed eyes on a firm or a foam surface, standing on one foot & standing while rotating the trunk. Dependent variables were body sway and weight distribution on and between feet, in sagittal and frontal planes.

Results: Significant differences between the two groups were found in weight bearing on the foot in standing with eyes closed and on the single left foot stance. Significant differences were also demonstrated between the sexes in six testing positions. Scoliosis severity was significant in five positions, as well as the percentage of heel weight bearing in three positions. In all positions the AIS group had higher postural sway values than the control group. The latter was not found to be statistically significant. A positive correlation between scoliosis severity, body movements and heel weight distribution was found.

Conclusion: Postural control and balance in static posture positions among adolescents suffering from AIS was decreased compared to the control group. The male adolescents demonstrated inferior posture control compared to the females in the same group, and to the males in the control group. Current therapeutic methods should be analyzed, and new methods should be developed considering these aspects. Future research should include different disciplines to better assess posture control.

Reference

O23

Postural control in standing among adolescents with Idiopathic Scoliosis
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Background: Postural faults in youths is an increasing social and medical problem. The incidence of postural faults in children and youths is alarmingly high. Rapid, continuous environmental and habitual changes engrave adverse imprints in human health, including foundations for proper motor activity and general condition of a body – good posture.

Aim of the study: The aim of the study was to determine and compare posture in youths attending to sport-oriented and general-oriented schools.

Patient population: Study included 90 youths (36 M and 54 F) aged 11–14 years (mean = 11.9, SD = 0.52).
Sixty youths attended to sport-oriented schools (athletics and swimming); remaining 30 subjects attended to general-oriented schools.

**Methods:** Posture examination included visual and palpable evaluation according to modified Klapp protocol. Thoracic kyphosis and lumbar lordosis were measured by Rippstein pluriometer. In case of scoliosis, clinical rotation was measured by Bunnell scoliometer.

**Results:** Thoracic hyperkyphosis was observed in 72% of all cases (77% of non-sport-oriented vs. 70% of sport-oriented). Decreased values of thoracic kyphosis were not observed in swimmers. Lumbar hyperlordosis was observed in 43% of all cases, with prevalence of non-sport-oriented youths (67%) vs. 37% of athletes and 27% of swimmers. In coronal plane, 85% of all subjects presented at least one postural fault. The symmetry in swimmers was significantly better than in general-oriented group (p < 0.05).

**Conclusion:** 1. Postural faults are common both among youths attending to sport-oriented and general-oriented schools.
2. Swimmers present kyphotic model of posture, but nearly perfect silhouettes in coronal plane.

**References**

**O24**
The significance of postural reeducation in scoliosis
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**Objective:** To study modalities of postural therapy in scoliosis.

**Methods:** We have studied 20 patients for 8 months (aged between 13 and 20) using a monthly assessment. The evaluation was made with a digital picture under similar conditions each time, and then processed on the computer. The patients underwent a treatment that included classic rehabilitation and postural re-training to maintain a fixed posture while awake, and active exercise for postural correction using home postural training.

**Results:** Good results were seen in the limitation of the progression of the disease as well as a positive attitude among the patients about the disease. The results were more dramatic as age increased. The therapy actions are based on the active participation of the patient, and the patient’s ability to see and feel the difference between the postures. Exercises based on proprioception not visualization were more successful. The treatment had very good results for small scoliosis curves and good results for moderate scoliosis curves, which supports the efficiency of treatment.

**Conclusion:** After the treatment, the scoliotic patient was improved. The effects of the postural therapy were positive for the entire body by inducing a better locomotory function. The postural therapy can not be applied at any age because the patient must be able to understand the instructions. The mental representation of our body and of operative thoughts appears after age 13. Consequently, people older than 13 years are candidates for this therapy.

**References**

**O25**
The development of a novel biofeedback system for the evaluation, recording, control and correction of the spinal posture
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**Objective:** The goal of this study was to develop a system which controls and records the posture and the spinal curvature for both diagnostic and therapeutic use.

**Background:** The system consists of a sensor PCB (60 × 40 mm, 50 g) that is placed at the back of the patient, using an adhesive material. Biomechanical analysis (BMA) of the spine with the Spinalmouse® system was formerly used to show the abnormal levels of the spine and indicate the sensor’s placement. The practitioner sets the neutral position (or reference position) and can monitor and record the patient’s spinal posture in real time, for 12 continuous hours. The data is also stored in the sensor’s memory and can be downloaded to a PC. The flexion and extension, as well as the lateral bending limits are set and an audio signal or a low electric stimulus, (feedback) warns the patient when he/she reaches them. How many times and how long the patient remained beyond the preset limits is also recorded.

**Patient population:** To evaluate our system, 40 subjects (aged: 20 ± 5.4 y) with abnormal spine curves, participated in our study.

**Results:** The BMA of the participants, before and after a 4 hours’ session, showed a significant (p < 0.05) improvement of their posture. The participants gave 8 ± 2.3 (max: 10 scale) score in their gratification.
Conclusion: The system successfully works as an advanced biofeedback therapy method that enhances self-correction of the undesirable posture and as a diagnostic tool.

References

O26 Exercises during brace weaning can reduce loss of correction in Adolescent Idiopathic Scoliosis (AIS) patients
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Scoliosis 2009, 4(Suppl 1):O26

Background: Exercises are sometimes prescribed to avoid collateral effects of bracing and to improve brace efficacy. A loss of correction during brace weaning in AIS treatment is quite frequent, and the efficacy of exercises to prevent this loss has never been studied.

Purpose: To verify the efficacy of exercise in the reduction of correction loss during brace weaning.

Design: Retrospective control study.

Population: Sixty eight consecutive patients (8 males), age ±1 and Cobb Angle ±2° at start of brace weaning.

Methods: Patients were evaluated clinically and radiographically at start of brace weaning (defined as the first visit in which the brace was prescribed less than 18/24 h) and end of treatment. Patients were divided into 4 groups according to the exercises they performed: SEAS (14 treated according to ISICO protocol), OTH (25 treated according to other protocols), DIS (19 who didn’t exercised continuously), and CON (10 who didn’t exercised at all). The ANOVA, Wilcoxon and post hoc t tests were performed.

Results: There were no baseline as well as final differences among groups. However, during weaning Cobb angle progressed (worsened) significantly both in DIS and CON (+3.9° and +3.1°) while SEAS and OTH didn’t show any significant change. Comparing single groups, SEAS and OTH with respect to DIS had a significant difference (P < 0.05).

Conclusion: Exercises (SEAS and OTH) can help reduce correction loss experienced during weaning from the brace for AIS.

References

O27 Physical exercise and adolescent idiopathic scoliosis: results of a comprehensive systematic review of the literature
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Scoliosis 2009, 4(Suppl 1):O27

Background: A previously published systematic review (2003) documented evidence on the efficacy of specific physical exercises to reduce progression of adolescent idiopathic scoliosis.

Aim: To verify, if the indications for treatment with specific exercises for AIS, has changed in these years.

Study design: Systematic review.

Methods: A bibliographic search with strict inclusion criteria has been performed on the main electronic databases and through extensive hand search. We retrieved 19 studies: 1 randomised (RCT) and 8 controlled studies. A methodological and clinical evaluation has been performed.

Results: The 19 papers included 1654 treated patients and 688 controls. The highest quality study (RCT) compared 2 groups of 40 patients, showing an improvement of the curve in all treated patients after 6 months. We found 3 papers on Scoliosis Intensive Rehabilitation (Schroth), 5 on passive autocorrection-based methods (Schroth, side-shift), 4 on active autocorrection-based approaches (Lyon and SEAS) and 5 with no autocorrection. Apart from one, all studies confirmed the efficacy of exercise in reducing the progression rate and/or improving the Cobb angles.

Conclusion: Exercise efficacy is proven by an RCT and several controlled studies. In 5 years, 8 more papers have been published in indexed literature coming from all over the world and proving that interest on exercise does not come only from Western Europe.

References

O28 End of treatment results for SEAS exercises: a controlled retrospective study
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References

Background: The efficacy of SEAS exercises in the short term (1 year) is established in a controlled prospective study. The efficacy results at the end of treatment have not been presented.

Aim: To verify the end of treatment results of SEAS exercises.

Study design: Retrospective controlled study.

Population: One hundred and twenty two AIS patients of 13.8 ± 3.1 years at start, 15.8 ± 11.9° Cobb and 5.6 ± 3.1° Bunnell, who consecutively completed an exercise treatment (on average 2.2 ± 1.7 years), have been included. They have been divided into two groups: SEAS exercises (SE: 33) and usual physiotherapy (UP: 89).

Methods: The validated outcome criteria included Cobb and Bunnell degrees, hump, sagittal configuration and Aesthetics Index. Data was compared with similar control groups from the literature. Statistical analysis included paired t-test, ANOVA and Kruskall-Wallis tests.

Results: SE group showed a statistically significant decrease of maximal Cobb and Bunnell degrees and hump, with better sagittal profile and aesthetics. The UP group showed a slight worsening of scoliosis parameters and flattening of sagittal profile. In addition, aesthetics improved for both groups when compared to similar controls in the literature.

Conclusion: End of treatment SEAS exercises demonstrate better results than UP and controls. Improvements were seen in almost all clinically important parameters.

Reference


O29

Selectively increased trunk mobility with FITS therapy: a preparatory stage for correction of idiopathic scoliosis

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Scoliosis 2009, 4(Suppl 1):O29

Background: Reduced spine mobility inside the scoliotic curve can be an obstacle for effective correction of idiopathic scoliosis with physiotherapy or bracing.

Purpose: To assess the effect of a session of specific FITS physiotherapy on trunk mobility.

Methods: Thirteen girls aged 14.7 +/- 1.4 years, presenting single thoraco-lumbar scoliosis of 28.6 +/- 7.5 degrees of the Cobb angle, were examined. They presented coronal imbalance comprising a protruding concave hip, a deeper concave waist and the medial occipital plumb line shift of 1.5 +/- 0.5 cm to the convexity.

Trunk mobility was assessed before and after one session of FITS physiotherapy, by measuring the range of: (1) frontal trunk shift towards concavity, (2) lateral trunk inclination towards convexity, (3) trunk rotation towards correction, (4) thoracic spine length in forward flexion, (5) lumbar spine length in forward flexion. The control group consisted of the same patients who were examined once again one month later. They underwent identical measurements before and after one session of an unspecified body massage.

Results: All the parameters apart the thoracic spine flexion revealed significant increase of the range of the tested movements (p < 0.05). After one FITS session, the trunk shift, expressed as the percentage of the trunk height, increased of 3.9 ± 2.1%, from 6.7 ± 2.3%, to 10.6 ± 2.5% (p < 0.0001). However, after unspecified massage, the trunk shift increased but not significantly.

Conclusion: A specific FITS session increased trunk mobility towards the correction of scoliosis more than unspecified massage. This can increase the effectiveness of subsequent corrective patterns of movement.

References


O30

The short-term effect of therapeutic exercises (TE) in adolescent idiopathic scoliosis (AIS) evaluated by the BACES system

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Introduction: Therapeutic exercises contribute to reduce signs and symptoms of AIS, although their relevance in scoliosis management is still under debate. Scientific literature shows a wide variety of exercises.

Aim: The goal of our presentation is to illustrate the short-term effects of a few exercises for AIS and to suggest some methodological considerations.

Materials and methods: Ten female adolescents affected by AIS (moderate severity; mean age: 12.9 years) were enrolled. The short-term effects of 3 exercises (self-elongation, kyphotisation, side-shift) were evaluated, during standing and sitting, in comparison to their own spontaneous posture. Cobb angle of kyphosis and lordosis, ATR, plumb alignment were measured with the BACES system. Exercises were considered effective if the differences of the alignment of the spine were statistically significant when compared with spontaneous posture data. Distribution of frequencies was performed to show the results.

Results: The effect of therapeutic exercises is characterized by a very high variability among patients. Standing position guarantees a better correction of scoliotic deformity than sitting. Side-shift exercises improve scoliotic deformity in the major part of patients.

Discussion: It is feasible to verify the short-term efficacy of exercises with surface methods. The effect is often
unpredictable, with a lot of variability. Among our exercises, the side-shift exercise seems to be the more effective in reducing both side translation and rotation of the back, especially while standing. **Conclusion:** Considering the unpredictable effects, every exercise should be tested before being prescribed.

**References**

**O31**
**Efficacy of spinal orthosis in combination with orthopedic gymnastics in treating patients with idiopathic scoliosis**
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**Scoliosis** 2009, 4(Suppl 1):O31

**Objective:** To investigate the efficacy of spinal orthosis in combination with orthopedic gymnastics for the treatment of patients with idiopathic scoliosis.

**Methods:** To achieve the target of muscle contraction on the convex side and muscle extension on the concave side, 40 children with idiopathic scoliosis have worn the spinal orthosis for 23 hours every day. In addition, they performed orthopedic gymnastics for 30 minutes at least once or sometimes twice a day. During the treatment, X-rays were taken periodically to measure Cobb angle.

**Results:** After one year, there were 33 children who kept wearing the orthosis and doing the orthopedic gymnastics. Their Cobb angle of the thoracic and lumbar curve had been significantly reduced after the treatment ($P < 0.05$). Patients with single curve idiopathic scoliosis demonstrated more improvement than those patients with double curves ($P < 0.05$).

**Conclusion:** Orthosis in combination with orthopedic gymnastics can rectify scoliosis deformity and can be an effective treatment for patients with idiopathic scoliosis.

**References**

**O32**
**Effectiveness of Brügger-therapy in conservative treatment of children with idiopathic scoliosis**
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**Scoliosis** 2009, 4(Suppl 1):O32

**Background:** Scoliosis is the most deforming orthopedic problem confronting children. The literature regarding conservative scoliosis treatment is voluminous, but new and more effective therapeutic approaches are needed.

**Objectives:** The purpose of this study is to analyse the effectiveness of Brügger-method in the treatment of idiopathic scoliosis.

**Subjects and methods:** The study was carried out on 17 patients aged 7–18 years (9 male, 8 females) affected with adolescent idiopathic scoliosis. The primary criterion for selection was the curve in maximum 30° measured with the Cobb’s method and a history of not using bracing. Over one year, therapy according to Brügger concept was applied. After that time, the effectiveness of this therapy was evaluated. Outcome measures included clinical examination, specifically with the Moiré-technique.

**Results:** The probands were evaluated individually. The results demonstrated positives changes in all probands when comparing initial and final examinations. Evaluation of the truncal configuration by Moiré-technique documented significant changes in the sagittal, frontal and transversal planes.

**Conclusion:** Our results support the clinical effectiveness of the Brügger-concept in the treatment of idiopathic scoliosis in children. Treatment can reduce the magnitude of the thoraco-lumbar and lumbar curves. We recommend utilizing exercises according the Brügger-concept in the treatment of scoliosis patients.

The study was supported by grant from Czech Ministry of Education, Youth and Physical Education MSM 0021620864

**References**

**O33**
**Exercise is not an independent risk factor for the development of adolescent idiopathic scoliosis**
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**Scoliosis** 2009, 4(Suppl 1):O33

**Aim:** The goal of this observational study is to asses the incidence of AIS among athletes and non-athletes. This will help determine whether athletic activities play a potential role in the development of AIS.

(page number not for citation purposes)
**Methods:** This study evaluated 2387 adolescents with a mean age of 13.4 years. All patients completed a detailed questionnaire focusing on the following: personal, somatometric and secondary sex characteristics, type, duration and character of daily performed physical activities, and history of existing cases of AIS among their relatives. The patients were classified into 2 groups according to their answers: “athletes” and “non-athletes”. The 2 groups were statistically comparable as far as age, height, weight, onset of menstruation and prevalent extremity were concerned. All children underwent physical examination (“forward bending test”, observation in the standing erect position for asymmetries of the lateral contours of the trunk, shoulders and scapulae and measurement of their limb’s length) by 3 orthopedic surgeons during a school-screening program. Children considered, by all examiners, to be suspicious for suffering from scoliosis underwent further radiographic evaluation.

**Results:** One hundred and seventy seven children (66 boys and 111 girls) who were classified as suspicious. Subsequently, 99 (athletes: 48, non-athletes: 51) cases AIS were radiographically confirmed. No statistically significant difference was found between athletes and non-athletes adolescents (p = 0.927), athletes and non-athletes boys (p = 0.888) and athletes and non-athletes girls (p = 0.804), as far as the prevalence of AIS was concerned.

**Conclusion:** Systematic exercising seems not to be positively or negatively associated with a higher or lower incidence of AIS.

**References**

**Q35**

**The use of the SpineCor Dynamic Corrective Brace in Greece: a preliminary report**

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**Aim:** The purpose of this observational study was to quantify the efficacy of the SpineCor Dynamic Corrective Brace for patients who were still actively being treated in Greece. It also, evaluated the effectiveness of the Brace for adolescent idiopathic scoliosis in accordance with the new standardized criteria proposed by the Scoliosis Research Society (SRS) [1].

**Methods:** From 2003–2007, 109 patients were treated. 82 patients met the inclusion criteria proposed by the SpineCorporation [2]. 26 patients met the criteria for inclusion proposed by the SRS [1]. There were no patients with an outcome. Assessment of the brace effectiveness included (1) percentage of patients who had an initial Cobb angle reduction of 5° or greater; (2) percentage of patients who had an initial Cobb angle increase or decrease of less than 5° (3) percentage of patients who had an initial Cobb increase of 5° or greater and (4) the number of cases progressing to require surgery or undergone surgery.

**Results:** Successful treatment (correction >5°, or stabilization ± 5°) was achieved in 79 of the 82 patients and 25 of the 26 patients studied from the time of fitting of the Brace to the point which last Cobb angle was measured. This meant 96%
correction/stabilization. Two out of 82 patients (2.4%) had curve progression and 1 patient (1.2%) underwent surgery. 1 patient out of 26 (3.8%) had a curve progression and has been recommended surgery.

Conclusion: The SpineCor Brace is an effective treatment for adolescent idiopathic scoliosis.

References

O36 A prospective study on the clinical efficacy and patients’ acceptance of SpineCor and rigid spinal orthoses in treatment of AIS

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Background: Although the clinical effectiveness of rigid spinal orthosis to AIS has been demonstrated, the patient’s acceptance is always a concern. Poor compliance may affect treatment outcomes as well as a patient’s quality of life. The flexible spinal orthosis, SpineCor is a relatively new design for tackling those inevitable drawbacks inherent in the rigid spinal orthosis. However, there are few studies to compare the SpineCor system with the rigid spinal orthosis regarding their treatment efficacy and patients’ acceptance.

Aim: The objective of this study is to compare treatment efficacy and patient acceptance for the SpineCor system with the rigid spinal orthosis.

Methods: Forty-three subjects with moderate AIS were randomly assigned to the SpineCor group (S group, n = 22) and the rigid orthosis group (R group, n = 21). In this prospective study, their survival rate in the first 45 months of intervention was studied. The subjects’ acceptance to the orthoses was evaluated by a purpose-designed questionnaire which was administered in the 3rd, 9th and 18th months of intervention.

Results: The results of this study showed that there were 68% of the subjects in the S group and 95% of the subjects in the R group did not show curve progression >5°. A significant difference (p = 0.046, by Fisher exact test) in failure rate between the 2 subject groups was found. In the patient survey, the 2 subject groups had similar responses to the questionnaire.

Conclusion: This study demonstrated that the rigid spinal orthosis was more effective than the SpineCor in curve control while the patients’ acceptances to these two orthotic designs were comparable.

Reference

O37 Clinical and postural behaviour of scoliosis patients during daily brace weaning hours

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Scoliosis 2009, 4(Suppl 1):O37

Background: What happens to scoliosis when the brace is weaned is not described, even if this has a clinical impact.

Aim: To evaluate the postural and clinical changes which occur during brace weaning.

Design: Pre-post trial.

Population: Ten adolescent idiopathic scoliosis female patients 12.6 years old, with 42.8 ± 7.4° Cobb curves. Inclusion criteria: more than 30° Cobb; TLSO worn at least 20 hours/day. Patients have been divided according to the hours of brace wearing per day: group A (6 patients, 23 hours per day) and B.

Methods: We evaluated patients at brace weaning and every hour per 4 hours, clinically (Bunnell degrees, hump and plumbline distances through usual clinical instruments) and posturally, by means of GOALS (Global Optoelectronic Approach for Locomotion and Spine), a non-ionising instrument that allow a 3D reconstruction of the spine. Paired ANOVA and t-test were used for statistical analysis.

Results: Almost all clinical data showed a worsening in 4 hours: this was statistically significant in the total of data and in A, not in B; in A, Bunnell and hump were already statistically changed after 2 hours. Although not statistically significant, GOALS suggest an immediate postural collapse (1st hour), followed by a positive postural reaction (2nd–3rd hour), and a possible final decline (from the 4th hour).

Conclusion: This data demonstrates the importance of performing the clinical examination at the end of the daily brace weaning hours. Moreover, it suggests an interesting and specific postural behaviour during brace weaning.

Reference
O38
A reliable dosage meter to track brace usage
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Scoliosis 2009, 4(Suppl 1):O38

Objective: To objectively measure brace usage in terms of wear time and wear tightness during daily activities.

Study design: A reliable brace dosage monitoring system consisting of a microcomputer and a force transducer was developed. This device measures how tightly and how long the patient uses her brace per day. Five AIS subjects who met the SRS Brace Study inclusion criteria were recruited to date. All subjects were new to brace treatment and used the Boston brace. Force transducers were embedded at the major pressure pad location. The sample rate was 1 sample per minute. Each subject had an in-brace x-ray 1 month after they received their brace and returned to the scoliosis clinic approximately 4 months later.

Hypothesis: Understanding how much time per day the brace is used, how tightly the brace is worn during daily activities and correlation with treatment outcomes may improve the science behind brace treatment.

Results: The dosage meter was small (4 cm x 6 cm x 1.7 cm), light weight (25 g), had sufficient memory and power for 4 months and was low cost (CND$ 200). No subjects dropped out of the study. Three subjects’ data had been analyzed. Each data set consisted of at least 3 months data. Brace usage was typically less in the first month average 42% increasing to 62% in next 3 month.

The average time that the brace was worn above 80% of prescribed tightness level was 47%.

Conclusion: A reliable dosage meter was developed that can monitor brace usage without restricting patients’ activities and requiring their attention.

Reference

O39
Preliminary results of prediction of brace treatment outcomes by monitoring brace usage
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Objective: To determine whether brace treatment outcome can be predicted by brace usage in terms of wear time (quantity) and wear tightness (quality).

Study design: A brace compliance monitoring system consisting of a microcomputer and a force transducer was used to monitor how brace candidates used their braces during daily activities.

Twenty AIS subjects (13.4 ± 1.8 years) prescribed Boston braces with full time brace wear were monitored for 2 weeks and followed-up for 3 years. A prediction of curve progression model was developed. The prediction model was tested on a new full time brace wearer (9.2 years old, female, AIS, 39° Cobb angle, Apex T8).

Hypothesis: Brace treatment outcome may be predicted from brace usage.

Results: The curve size of the 20 subjects prior to bracing was 32 ± 8°. While in the brace, the Cobb angle improved by 9 ± 6°. At skeletal maturity, after bracing, the Cobb angle was 4 ± 9° higher than prior to bracing. The quantity and quality of brace usage was recorded. The curve progression model was:

\[
\text{Curve Progression} = 33 + 0.12\times\text{Peterson Risk}(%)-0.48\times\text{Quality} (%) - 0.52\times\text{Quantity} (%) + 0.0066\times\text{Quantity}\times\text{Quality}
\]

The new subject had a Peterson Risk 73%, Quality 80% and Quantity 70%. The in-brace Cobb angle was 29°. At the 4 month visit, the predicted curve progression was 2° and the out of brace curve was 40° (1° different).

Conclusion: The quality and quantity of brace usage plus the risk progression factor may be able to predict brace treatment outcome.

Reference

O40
A study of athletic abilities in idiopathic scoliosis patients with brace therapy
Akiko Misawa, Yoichi Shimada, Naohisa Miyakoshi, Michio Hongo, Yuji Kasukawa and Shigeru Ando
Rehabilitation Division, Akita University Hospital, Japan
Scoliosis 2009, 4(Suppl 1):O40

Background: Brace therapy for scoliosis patients may reduce the flexibility of the spine due to the correction of the trunk during the patient's high growth period. However, the influence of brace therapy on athletic ability is still unknown.

Goal: The purpose of this study is to investigate athletic abilities in scoliosis patients during partial brace therapy.

Methods: Ninety-six idiopathic scoliosis patients treated with brace therapy for more than one year were investigated. The average age was 14.3 years. The follow-up period averaged 4.5 years. There were 77 patients with an Osaka Medical College brace, 15 with a Boston brace, and 4 with other braces. All patients applied the brace only at night.

Subjective flexibility of the spine after brace therapy was evaluated. Athletic abilities, including running short and long distance, along with athletic club activities in school were also investigated.

Results: The subjective flexibility of the spine was reduced severely in 8% of the patients, and slightly in 42% of the patients. Short distance running ability was higher than “Normal” in 60% of the patients and it was also higher in 52% of the patients for long distance running before brace therapy. After brace therapy,
athletic ability was unchanged in 91.7% of the patients. Thirty-eight percents of the patients belonged to a sports club in school. While thirteen percent of patients complained of a reduction in athletic ability during brace therapy.

Conclusion: We conclude that the influence of partial brace therapy on athletic abilities in idiopathic scoliosis patients is fairly low.

O41
Brace treatment can change aesthetics in Adolescent Idiopathic Scoliosis (AIS) patients
Fabio Zaina, Stefano Negrini and Salvatore Atanasio
ISICO (Italian Scientific Spine Institute), Milan, Italy
Scoliosis 2009, 4(Suppl 1):O41

Background: Aesthetics is a main goal both of conservative and surgical treatment in AIS. Previously we developed and validated a clinical scale, the Aesthetic Index (AI), to measure aesthetic impairment and changes during treatment.

Aim: To verify the efficacy of bracing on aesthetics in AIS.

Study design: Pre-post study.

Population: Thirty four consecutive patients, age 13.2 ± 3.7, initial Cobb Angle 30 ± 12°, ATR 10 ± 4° Bunnel, 11 males.

Methods: Patients with at least 5/6 score of AI were included. All of them had a brace prescription (18 to 23 h per day). After 6 months, AI was measured again, and pre-post scores compared. The Wilcoxon test was performed. 11 of these patients already concluded treatment and definitive results are reported.

Results: At the beginning, median AI was 6 (95% IC 5–6), after 6 months of brace AI score decreased to 2 (95% IC 0–6) (p < 0.05). In the final subgroup results, the effect of the brace was the same (from 6 to 3). After 6 months, we did not find any difference in the results according to the hours of brace wearing or to the type of exercises performed.

Conclusion: Use of a brace for just 6 months, will improve aesthetics. This is evident even in high aesthetic impact scoliosis. Completing brace treatment can guarantee the maintenance of achieved results.

References

O42
Pressure measurements in a new TLSO with a dynamic thoracic brace pad for idiopathic scoliosis
Joris Hermus, P Monteban, N Guldemond, A v Ooij and L v Rhijn
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Scoliosis 2009, 4(Suppl 1):O42

Introduction: Van den Hout (2002) [1] performed pressure measurements which are practicable and of value for studies on the working mechanism of brace treatment. Therefore, we performed pressure measurements in our new TLSO with a more or less dynamic thoracic brace pad.

Materials and methods: Pressure measurements were performed in 8 patients who were treated with our new TLSO. These were done in 15 positions which can be compared with all day activity.

Results: Eight girls, with a mean age of 12.7 years were asked to participate. The mean duration of brace treatment prior to participating in the present study was 7 months. The mean primary right thoracic curve was 31° and the mean secondary curve measured 23°. The mean corrective force over the lumbar brace pad in standing position was 71 N; over the thoracic brace pad it was 107 N. Van den Hout found in the Boston brace that the mean corrective force through the lumbar brace pad was larger than the mean corrective force over the thoracic brace pad. However, we found higher corrective forces in the thoracic brace pad than in the lumbar brace pad.

Conclusion: Our new TLSO results in higher corrective force measures than in the lumbar brace pad which suggest that the thoracic brace pad is more or less dynamic.

References

O43
BRACE MAP, a proposal for a new classification of braces
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Scoliosis 2009, 4(Suppl 1):O43

Background: The existing classification of braces considers only the anatomical spinal section involved (C: cervical; T: thoracic; L: lumbar; S: sacral; Orthosis). The lack of a more detailed classification restricts the ability to distinguish between the braces and to provide a common reference between the conservative treatment experts.

Aim: To propose and to verify a new classification of braces.

Methods: Theoretical development of a classification and an application to 13 different braces (Boston, Charleston, Cheneau 2000, Lapadula, Lyonese, Magueione, Milwaukee, PASB, Providence, Sforzesco, Sibilla, SpineCor, Triac).

Classification: We considered the following items (acronym BRACE MAP): Building, Rigidity, Anatomical classification, Construction of the Envelope, Mechanism of Action, Plane of action. Each item is composed by 2 to 7 classificatory elements defined using one or maximum two letters, so that from the classification it is possible to come back to the brace characteristics (e.g. SpineCor is classified as CpETAM3, that means Custom positioning, Elastic, TLSO, Asymmetric, Movement principle, 3D correction).
Results: Out of the 13 braces considered, BRACE MAP did provide the ability to differentiate between the braces except for two types.
Conclusion: This first proposal needs to be refined through Consensus during the meeting; nevertheless, it appears to be useful in distinguishing between the existing braces.

O44 The question: to brace or not to brace?
Franz Landauer
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Scoliosis 2009, 4(Suppl 1):O44

Objective: The goal of the study is to provide a critical review of brace treatment success (Cheneau-Type) in adolescent idiopathic scoliosis.
Study: Two hundred and thirty four patients with an idiopathic scoliosis (Cobb angle 20°–50°) were evaluated. Measurements were taken on standing radiographs (ap). Groups with good and bad compliance but also good and bad initial correction were formed. Different groups up to 50° Cobb angle were established.
Results: In patients with good compliance (n=188) and good initial correction (n=136), a continuous correction of about 7° Cobb angle was evident. In patients with good compliance but bad initial correction (n=45) only a stop of progression was noted. For patients with bad compliance (n=47), a progression of curvature with high variation (32° ± 6° to 37° ± 9°) was noted. Results are highly influenced by primary correction and compliance. The result at the end of therapy depends on the Cobb angle at the beginning of therapy.
Conclusion: Results of brace therapy correlate to the Cobb angle at the beginning of therapy and to compliance. However, a higher Cobb angle at the beginning of therapy cannot be compensated by compliance. Primary correction worsens in severe cases. The criteria for bracing must be questioned. There is no doubt: “In the most cases, we are too late”. I recommend that we start treatment earlier.

O45 Vertebral deformity corrected by bracing: retrospective selected case series of 10 scoliosis patients treated with a RSC Brace
Manuel Rigo, Monica Villagrasa and Gloria Quera-Salvá
E. Salvá Institute. Barcelona, Spain
Scoliosis 2009, 4(Suppl 1):O45

Background: Bracing can prevent curve progression in Idiopathic Scoliosis. Compliance and in-brace correction predict the end result. Part time, full time or even night time bracing may result in excellent in-brace correction. This is associated with a progressive correction of the spinal and trunk deformity as well as a correction of the vertebral deformity. This 10 patient series demonstrates a clear correction of the vertebral, spinal and trunk deformity.
Materials and methods: Retrospective selected case series of 10 patients (8 F, 2 M) diagnosed with IS, with a minimum age of 5 years and a maximum of 13, all of them treated with a RSC brace. Curve pattern: 7 thoracic, 1 thoracic double major and 2 thoracolumbar. Minimum observation time was 1 year and 3 months and maximum 5 years 5 months. Mean Cobb angle was 36° (25°–47°). All the patients showed an in-brace correction in their first brace > 45%.
Results: Out of the 13 braces considered, BRACE MAP did provide the ability to differentiate between the braces except for two types.
Conclusion: This first proposal needs to be refined through Consensus during the meeting; nevertheless, it appears to be useful in distinguishing between the existing braces.

References

O46 Early night-time-bracing – an alternative in scoliosis management
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Scoliosis 2009, 4(Suppl 1):O46

Background: The application of a Full-Time-Brace in combination with physiotherapy is still the “Gold Standard” of conservative scoliosis therapy in the German speaking area. However, the step from only physiotherapy to full-time bracing (at 20–25° COBB) appears to be a far-reaching physical and psychological challenge for a child or teenager.
Aim: The goal of the investigation was to determine if early night-time bracing (16–25° COBB) can effectively stop idiopathic scoliosis progression and prevent full-time bracing successfully.
Methods: We present the results of 22 early treated scoliosis patients, treated all with a Dresdner night-time brace at one institution. The average age was 11.9 years and the average follow up was 24.9 months after brace discontinuation. Treatment was considered successful if there was improvement in the curve or up to a maximum progression of 5° and if there was no progression above an absolute value of 25° COBB.
Results: We found a primary correction of 82.2%. After 24.9 months follow up we found a success rate of 86.3% (including noncompliant patients, 79.2%). Scoliosis patients with more than a 25° initial COBB angle were not included in this investigation.
Conclusion: Early Night-Time-Bracing is an ideal controllable first step in orthotic treatment of scoliosis, and is sufficient for most patients with lower COBB angles to avoid full-time bracing. It is possible to suspend the treatment at any time if scoliosis decreases significantly (low risk of overtreatment) and it is also possible to change to full-time bracing if curve progresses. We recommend treating patients with higher initial COBB-angles with full-time bracing.
References

O47
Brace treatment with progressive lordotic forces at the thoracolumbar junction in adolescent scoliosis and hyperkyphosis
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Scoliosis 2009, 4(Suppl 1):O47

Introduction: Brace treatment options in idiopathic spinal deformities are limited. Most correctional forces are aimed at the apices of curves in scoliosis and in kyphosis. Psychological drawbacks and discomfort in stiff, unnatural designed orthoses result in unsatisfactory compliance.

Aim: To offer an alternative to present braces. To show that restoration of natural lordosis and concomitant mobility at the thoracolumbar junction by symmetrical lordotic forces, thus only in the sagittal plane, in an adjustable brace offers an interesting alternative.

Study: Retrospective case control study with radiological results and scores for overall-satisfaction.

Methods: Review of 91 children with scoliotic and kyphotic spinal deformities wearing a lordotic brace during growth for at least a full year. Measurements of Cobb angles on AP and sagittal standing X-ray’s were compared at indication time, first-in brace day and out of brace after a full year. A questionnaire was filled in with scores for satisfaction, compliance and repeated choice.

Results: Mean age of starting brace was late: 13.8 years (SD2). In kyphosis (pure or concomitant scoliosis maximum 25°, N = 79)° values for the thoracic curve (p < 0.01), the thoracolumbar curve (p < 0.01), de lumbar lordosis (p < 0.01) and the pelvic incidence (p < 0.01) changed significantly in a paired t-test at one full year brace treatment in comparison with the values at time of indication.

For scoliosis (one curve at least 25°, N = 38) the in-brace correction is significant (p < 0.01) of the Cobb angles of thoracic and thoracolumbar curves and the pelvic obliquity. In the sagittal plane even after a full year, a significant correction was seen in the thoracic and thoracolumbar curves. Satisfied and very satisfied were 84.6%. Choice for same treatment was 75.9%.

Conclusion: This study supports an alternative brace technique for treatment of scoliosis and kyphosis with pure lordosis at the thoracolumbar joint, including periodical adjustments combining passive and active components in redressing tensions. Significant reduction of scoliotic and kyphotic curves is possible during growth. By stepwise restoration of thoracolumbar lordosis and preventing overload in compression during sitting creates improved conditions. Good compliance and satisfaction seems part of the process.

References

O48
Remodeling of Cheneau’s brace during treatment
J Cheneau, D Chekryzhev, A Mesentsev and D Petrenko
9 rue des Chanterelles, 31650 Saint Orens, France
Scoliosis 2009, 4(Suppl 1):O48

Background: Remodeling of the brace is often necessary during treatment of the spinal deformity. Reasons for brace remodeling include change of the spinal shape during the treatment and rapid growth of the patient.

Summary of techniques: We developed several techniques for brace remodeling. These techniques improve patient’s quality of life without the cost of making a new brace. Remodeling may be done using warm or cold techniques.

Warm: After warming-up of the problem area, the brace may be cut out and riveted-in. The same maneuver may be applied in other zones of the brace.

Cold: Cold remodeling allows the clinician to change the length of the brace, to adjust the brace volume, and to change the position of the expansion rooms and pressure zones. For the lengthening of the brace, cross-cut and connections of the brace parts using plastic bridges should be done. L-cut must be done from the medial axillary line to anterior surface of the brace for the enlargement of the zones 7–19. This piece of plastic should be turned-up and fixed by a connective plastic plate. If pressure zone 41D is impaired, it may be cut out and riveted-in. The same maneuvers may be applied in other zones of the brace.

References
O49
Kyphosis angle evaluated by video rasterstereography – relation to X-ray measurements
Hans-Rudolf Weiss and N ElObeyed
Asklepios Katharina Schroth Spinal Deformities Rehabilitation Centre, Bad Sobernheim, Germany
Scoliosis 2009, 4(Suppl 1):O49

Background: Surface topography evaluations are prone to technical errors due to postural sway of the patients measured. The technical error of lateral deviation (rms) and surface rotation (rms) may vary between 15 and 20%, while the kyphosis angle (IP-ITL) has a technical error of only 5% (2.5°), which is comparable to the x-ray measurement. Purpose of this study was to investigate the hypothesis that video rasterstereography can be used for prognostication of a kyphosis patient.

Materials and methods: Fifty three patients (23 females, 30 males, average age 17 years with a range from 11 to 56 years) undergoing in-patient rehabilitation have been measured with the help of video rasterstereography (VRS) before starting the treatment program and the values for kyphosis angle have been correlated to the kyphosis angle measured on a lateral x-ray (XR) not longer than 6 weeks before VRS measurement. 26 had a thoracic Scheuermann, 3 a thoracolumbar, 15 an Idiopathic Kyphosis and 9 a kyphosis of other origin.

Results: Average kyphosis angle XR was 49° (SD 17) and VRS 63° (SD 13). There was a high significant Pearson correlation of 0.78 and a high significant difference of 14° in the t-test (t -9.6, p < 0.001).

Conclusion: The kyphosis angle VRS (Vertebra prominens – lower neutral zone of inclination) seems to allow a follow-up of individual kyphosis patients. The XR kyphosis angle according to Stagnara is measured from T4 to the lower end vertebra and therefore is lower than the VRS kyphosis angle measured from T1. The difference found between XR and VRS kyphosis angles may be explained by the angle between T1 (VRS) and T4 (XR) differently used as the upper end vertebra. Therefore, the prognostication of an individual patient is possible within certain limits.

References

O50
Forced lordosis on the thoracolumbar junction can correct double major scoliosis; an innovative approach on brace treatment and etiology of adolescent scoliotic and kyphotic deformities
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Dept. of Orthopaedics, Slingeland Ziekenhuis Doetinchem, The Netherlands

Scoliosis 2009, 4(Suppl 1):O50

Background context: Adolescent idiopathic scoliosis is an important spinal deformity. No etiology directed therapy is available. Correction can be achieved with limited options by bracing. The focus of bracing is in the coronal plane and with forces directed at the apices of curves. Bending radiographs in the coronal plane are used to assess flexibility and to predict treatment outcome. The corrective potential of fulcrum lordotic bending in the sagittal plane as technique in bracing has not been addressed in radiographic studies.

Purpose: To support our hypothesis that an early kyphotic deformity of the thoracolumbar junction plays a role in the development of scoliotic deformities and can be addressed to facilitate correction of scoliosis.

Study design: A prospective radiographic study was conducted.

Methods: Anterioposterior spine radiographs of patients with a double major curve pattern scoliosis were obtained in two groups of patients. In group A, radiographs in 3 positions: standing, and supine with and without radiolucent fulcrum (n = 12) were taken. In group B, radiographs in two positions (n = 28); standing, and supine with lordotic fulcrum were taken. Cobb angles of the scoliotic curves were determined and evaluated statistically. The sagittal contour of the thoracolumbar junction in standing position was measured.

Results: In group A with the patients lying supine, a significant correction of the Cobb angle was obtained at the thoracic level of 15.4% and the lumbar level of 27.5% (p < 0.001). Adding in supine position, a lordotic fulcrum on the thoracolumbar junction resulted in further correction at the thoracic level of 15.7% and lumbar 18.1% (p < 0.001).

Comparing in group A the thoracic and lumbar curvatures in standing position with that on a lordotic fulcrum in supine position revealed a total reduction of 31% and 45.6%, respectively. For the independent group B, this reduction in one step is 38% and 44.4%, respectively.

Conclusion: In this radiographic study, correction of a double major curve scoliosis in the coronal plane appeared to benefit clearly from the application of a lordotic fulcrum on the thoracolumbar junction. This innovative approach was already valuable in the application of our bracing technique and maybe in developing strategies in surgical correction of scoliosis.

References

O51
The geometry of the spine in the sagittal profile: a comparison of girls with and without scoliosis
Manuel Rigo, M Villagrasa and G Quera-Salvá
E. Salvá Institute. Barcelona, Spain
Background: Using the Formetric® system, we observed a high incidence of abnormal sagittal configurations in both scoliotic and non scoliotic patients. Those abnormal configurations could be described by using terms like Hyper- or Hypo- but not all of them. Changes in the location of the thoracic apex, lordotic apex, transitional point as well as segmental rectifications of the profile were observed with the formetric. This data is used to define a specific scale and to measure harmony of the spine (HDSS). This new, simplified scale is clinically valid and is reliable. The HDSS ranges from 0 (harmonic) to 16 (disharmonic).

Goal: The purpose of the study is to compare the sagittal configuration of scoliotic patients and normal subjects.

Materials and methods: We have studied the sagittal profile with the Formetric® system in 157 consecutive girls with non-treated IS and 39 age matched non scoliotic girls (NIS).

Results: The HDSS showed no differences in both groups (IS = 5.6; NIS = 5.4). The angle of the regional kyphosis was no different in scoliotic (43.1°) and non scoliotic (43.7°) girls. The angle of the regional lordosis was significantly lower in scoliotic girls (34.9°) compared with non scoliotic (35.4°). Harmonic/disharmonic features are similar for both scoliotic and non scoliotic girls.

Conclusion: The sagittal geometry of the spine is highly variable in both scoliotic and non scoliotic girls. The angle of thoracic kyphosis is not different between the groups. Lordosis is slightly lower in the scoliotic group.

References

O52
The clinical validation of a specific (HDSS) scale: a measurement of harmonic/disharmonic within the geometry of the spine in the sagittal plane
Manuel Rigo, Monica Villagrasa and Gloria Quera-Salvá E. Salvá Institute, Barcelona, Spain

Scoliosis 2009, 4(Suppl 1):O52

Background: Using the Formetric® system, we have observed a high incidence of abnormal sagittal configurations in scoliotic as well as in non scoliotic patients. Those abnormal configurations could be described by using terms like Hyper- or Hypo- but not all of them. Changes in the location of the thoracic apex, lordotic apex, transitional point as well as segmental rectifications of the profile were observed with the formetric. This data is used to define a specific scale to measure harmony of the spine.

Materials and methods: This scale, a simplified version of the 2007 original presented at the SOSORT meeting, uses four items: kyphosis apex, lordotic apex, transitional point and number of rectified segments. The HDSS ranges from 0 (harmonic) to 16 (disharmonic). The scale has been clinically validated in 157 scoliotic patients. These groups are divided into four groups according to their visual harmonic or disharmonic profile as determined by an expert clinician.

Results: The HDSS took a significant different value in the four groups. First the groups are divided in two main groups: those with more harmonic profiles (N = 77, HDSS = 2.9 ± 1.1) and those with more disharmonic profiles (N = 80, HDSS = 8.2 ± 2.4). The differences of the two main groups are highly significant (p > .001). The system and the scale were reliable.

Conclusion: The HDSS is a useful tool to measure how harmonic/disharmonic the geometry of the spine is in the sagittal plane.

References

O53
Values of thoracic kyphosis and lumbar lordosis in adolescents from Czestochowa
Jacek Durmala, Ewa Detko and Katarzyna Krawczyk Department of Medical Rehabilitation, Medical University of Silesia, Katowice, Poland

Scoliosis 2009, 4(Suppl 1):O53

Background: Knowledge of the normal value of sagittal curves of spine is essential during the assessment of the posture of the body.

Aim of the study: The goal of the study is to outline normal values of thoracic kyphosis and lumbar lordosis in adolescents.

Patient population: One thousand one hundred and fifty six adolescents (622 M and 534 F) aged 11–14 years from Czestochowa.

Methods: The measurement of curves in the sagittal plane were performed during clinical analysis of the body posture using plurirometer-V by Rippestein.

Results: See Table 1.

Conclusion: The applied method of the measurement is simple and useful in clinical practice.

Reference
Can radiographic measurements of degenerative lumbar scoliosis predict clinical symptoms?
Avraam Ploumis, Hong Liu, Amir Mehbod and Ensor Transfeldt
Twin Cities Spine Center, Minneapolis, MN, USA
Scoliosis 2009, 4(Suppl 1):O54

Background: Sagittal alignment is more critical than coronal curve magnitude in clinical presentation of patients with adult deformity.

Purpose: To evaluate the radiographic parameters of patients with degenerative adult scoliosis and to correlate them with functional scores.

Methods: Radiographic analysis of 56 patients with degenerative lumbar scoliosis was performed in anteroposterior and lateral 36-inch standing radiographs. Measurements included curve type, curve location, curve magnitude, coronal balance, sagittal balance, and rotatory olisthesis. Clinical functional results were measured with Oswestry disability index and SF-36 form. Correlation between clinical and radiographic results was calculated.

Results: Patients with positive sagittal imbalance and rotatory olisthesis >grade I demonstrated poorer functional results. Patients with coronal imbalance less than 4 cm did not affect their functional outcomes. Patients with lumbar major curves experienced worse symptomatology than those with thoracolumbar major curves.

Conclusion: Positive sagittal imbalance and moderate to severe rotatory olisthesis in the lumbar curves are important radiographic parameters which may correlate to degree of symptomatology in adult patients with degenerative scoliosis. Treatment of these patients should focus on improvement of aforementioned parameters.

References

SEAS exercises revert progression of adult scoliosis: a retrospective long-term study
Alessandra Negrini, Stefano Negrini, Silvana Parzini, Michele Romano, Fabio Zaina and Salvatore Atanasio ISICO (Italian Scientific Spine Institute), Milan, Italy

Background: Formal papers regarding the efficacy of exercise in adult scoliosis are few.

Aim: To verify, if the natural history of adult scoliosis can be modified by exercises.

Study design: Retrospective pre-post study.

Population: Thirty one patients (3 males) of 38 ± 11 years and 55 ± 14° Cobb scoliosis, treated for 3 (range 1–18) years.

Table 1 (abstract O53)

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because of progression subjectively perceived (17 patients), or objectively documented (14 patients: sub-group A, previous observation of 10 years, range 1–27), have been included. 6 patients (sub-group B) were observed also after stopping treatment for 6 (3–10) years.

**Methods:** Five degrees of Cobb angle was considered significant for clinical change. Statistical analysis included paired t-test, ANOVA, Kruskall-Wallis and chi-square tests.

**Results:** Exercises caused a statistically significant decrease of 3.6 ± 5° of scoliosis (= 3.2 ± 4.3° per year): 1 patient progressed, 45% improved; in sub-group A results were identical, after a previous worsening of 9.7 ± 6.8° (+ 2.1 ± 4.3° per year); in sub-group B stopping exercises caused a progression of 8.3 ± 3.8° (+ 1.4 ± 0.5° per year). The best results were observed in patients exercising since, even if some patients continued to decrease their curve during the years.

**Conclusion:** SEAS exercises revert the progression of adult scoliosis, and a prospective study is already under way. The different results according to length of treatment could be due to a plateau of correction or to an increase of quality of the protocol applied (SEAS changes continuously according to new knowledge in the literature). These results question the immediate need for surgery when facing progression of deformity in adulthood.

**References**


**O56 Adult scoliosis and the SPINECOR® dynamic brace: some early results on efficiency**

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2Ste-Justine Hospital, Montréal, Canada

**Scoliosis 2009, 4(Suppl 1):O56**

**Background:** Scoliosis offers little hope for rehabilitation in the adult population. Pain and viscerosomatic dysfunction are frequently encountered. Conventional medical care uses rigid bracing, medication and surgery for the most serious cases. The treatment of adult scoliosis with the SpineCor® Dynamic Brace deserves more attention. This brace offers a variety of combinations to improve spinal alignment depending on the type, severity and rigidity of the curve. The main therapeutic goal of this brace is to reduce the strain on the neuromusculoskeletal system. The brace acts as a dynamic support against compressive loading on the vertebral joints while creating a corrective movement in the spine.

**Methods:** Seventeen adult scoliosis patients aged between 21 and 69, whose curves had a Cobb angle 18 to 78 degrees, were fitted with a SpineCor® Dynamic Brace in a Chiropractic practice in Montréal, Canada. 13 of them were actively wearing it from 10 to 70 hrs per week.

**Results:** Thirteen of the 8 have complete resolution of their symptoms while in brace, 3 of which had a Numerical Pain Scale (NPS) over 6/10, and 2 had never experienced any pain before or after the treatment. It is important to make note that 8 of the 13 patients were concomitantly receiving CBP® Chiropractic care.

**Conclusion:** These results suggest that the SpineCor® Dynamic Brace is a potential, promising conservative method for the treatment of scoliosis in the adult population. In this study, utilization of this brace improved patient pain and sense of wellbeing.

**O57 Conservative treatment in patients with scoliosis due to Prader Willi Syndrome**

Hans-Rudolf Weiss and Silvia Bohr

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**Scoliosis 2009, 4(Suppl 1):O57**

**Background:** Patients with Prader Willi Syndrome often suffer from scoliosis of major degrees. Review of the current literature demonstrates that surgical intervention is the gold standard of treatment. Unfortunately, the rate of complications in this condition is reported to be significantly higher than in patients with Adolescent Idiopathic Scoliosis. The purpose of this study is to reveal the effects of conservative treatment in this rare patient population.

**Materials and methods:** A case series of patients with this condition has been investigated to estimate as to whether Prader Willi patients with scoliosis may benefit from conservative scoliosis management. 9 Patients with this condition have been found in our out-patient database. 5 of these are mentally retarded patients (3 girls, two boys) and are 19 years and older and therefore are without any significant residual growth. Average Cobb angle was 47 degrees (34–66 degrees), average observation time was 6.4 years.

**Results:** Two of the five patients progressed. Average Cobb angle after follow-up was 52 degrees. No progression beyond 70 degrees has been found after cessation of growth. In one patient the curve deteriorated clearly after reducing brace wearing time and therefore was due to non-compliance.

**Conclusion:** Stabilization of scoliosis due to Prader Willi Syndrome is possible by means of conservative management. To expose this patient population to surgical management seems not to be justified medically.

**References**


**O58 Spontaneous resolution of a Chiari I malformation and cervicothoracic syrinx in a 9 years old girl with a 47° scoliosis responding favourably to bracing**

Manuel Rigo1 and Luis Manuel González Martinez2

1E. Salvador Rehabilitation Institute, Barcelona, Spain
2Neurosurgeon, Zaragoza, Spain

**Scoliosis 2009, 4(Suppl 1):O58**

**Background:** Pediatric case reports support the spontaneous resolution of Chiari I and syrinx. We present a case of a 9 years
old girl with a spontaneous regression of a cervico-thoracic syrinx and a complete spontaneous resolution of the Chiari I malformation after one year of bracing to treat her scoliosis.  

Case report: An 8 years old girl was first diagnosed with JIS. She presented a right thoracic single curve (Apex at T10) of 36° Cobb and ± 10° rotation. Normal sagittal configuration. MRI demonstrated a Chiari I malformation and a cervicothoracic syrinx (C4 to T9-10). She attended our clinic later showing a rapid progression of the Cobb angle to 47° Cobb. Absent superficial abdominal reflexes was the only neurological sign. Bracing with a RSC was indicated. After one year of treatment (in brace correction 47%) the scoliometer value reduced from a total value of 9.5° to 6°. Back asymmetry has dramatically improved. A second MRI showed a reduced syrinx and no Chiari I malformation.  

Discussion and conclusion: This is a first report of a case showing a temporary improvement of a conservatively treated scoliosis coinciding with a spontaneous resolution of a Chiari I malformation and a related cervico-thoracic syrinx. The mechanism of such a resolution is not clear. However this case supports the idea that the resolution of the Chiari I and its related syrinx would improve the prognosis of the associated scoliosis.

References

O59  
Conservative treatment in patients with severe congenital scoliosis: a presentation of three cases  
Hans-Rudolf Weiss
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Background: In view of the very limited data about conservative treatment of patients with congenital scoliosis (CS), early surgery is suggested in mild cases with segmentation failures in the first three years of life. It is common sense that patients with failures of segmentation will not benefit from conservative treatment at all and the same applies to failures of formation with curves of > 50 degrees in infancy.  

Materials and methods: Two patients with rib synostosis denied surgery before entering the pubertal growth spurt. These patients have been treated conservatively with braces and Scoliosis In-Patient Rehabilitation (SIR) and now are beyond the pubertal growth spurt. One patient with a formation failure and a curve of > 50 degrees lumbar has been treated with the help of braces and physiotherapy from 1.6 years on and is still under treatment now at the age of 15 years.  

Results: Severe decompensation was prevented in the two patients with failure of segmentation, however a severe thoracic deformity is evident with underdeveloped lung function and severe restrictive ventilation disorder. The patient with failure of segmentation is well developed now without cosmetic or physical complaints although his curve progressed at the end of the growth spurt due to mal-compliance.  

Conclusion: Failures of segmentation should be advised to have surgery before entering the pubertal growth spurt. In cases in which they decline surgery, conservative treatment can at least in part be beneficial. For patients with failures of formation, conservative treatment should be suggested in the first place because long-term outcomes of early surgery beyond pubertal growth spurt are not yet revealed.

References

O60  
The treatment of the congenital scoliosis by Cheneau’s brace: summary of the first experience  
J Cheneau, D Chekryzhev, A Mesentsev and D Petrenko  
39 rue des Chanterelles, 31650 Saint Orens, France
Scoliosis 2009, 4(Suppl 1):O60

Background: Normalization of the growth balance is the primary goal of the orthopedic treatment in children. The principle postulated in Delpech’s (Hutter-Vallkmam) Law is true for the treatment of many pathological conditions such as congenital clubfoot, developmental dysplasia of hip, Blount disease, etc. Brace treatment of the spinal deformity restores normal growth of the spine. We hypothesize that the principles of active correction are efficient in the treatment of the congenital scoliosis.

Objective: To study the influence of the Cheneau’s brace on growth of the wedged vertebra in children with congenital scoliosis.  

Methods: Seven patients (2 males, 5 females) with congenital spinal deformity due to formation failure were treated by Cheneau’s brace. Mean age in this group was 5.6 years (range 2–9 years). Before the treatment, the average Cobb angle was 35.4° (range 23°–42°). The angle of the wedged vertebra was 44.8° ± 4.3°. A full-time bracing regimen was prescribed for all the patients.

Results at one year: After the beginning the treatment, the angle of the wedged vertebra was 29.3° ± 5.6° (35.4%), mean Cobb angle was 20.1° (55.1%).

(page number not for citation purposes)
Conclusion and recommendation: Patients will continue to use the Chenasu’s brace. More time is needed to reach specific conclusions based on this preliminary data. However, our initial results allow us to continue this brace study as an evaluation for its effectiveness in congenital scoliosis treatment. The application of Cheneau’s brace may change growth potential of the wedged vertebra.

References

O61 Medical and psychosocial outcome of Scoliosis In-Patient Rehabilitation (SIR)
Klaus Freidel, Franz Petermann, Dagmar Reichel, Petra Warschburger and Hans-Rudolf Weiss
Asklepios Katharina Schroth Spinal Deformities Rehabilitation Centre, Bad Sobernheim, Germany

Background: In a doctoral thesis by the first author, the medical and psychosocial outcome of Scoliosis In-Patient Rehabilitation is examined. The results of this investigation are published in German only. Therefore, a presentation of his results in English will enhance the present literature in scoliosis treatment.

Materials and methods: One hundred and forty one female patients with idiopathic scoliosis took part in this prospective study (11–16 years of age n = 85 [Group I]; 17–21 years n = 23 [Group II]; and > 21 years n = 33 [Group III]). The following HRQL/Anxiety questionnaires have been used: SF-36, BWF, CHQ, FKV and STAIAK. Pain measurement was also performed (VRS). Clinical follow-up: ATR (Scoliometer), surface topography and vital capacity (VC). Additionally the patients have been asked about their satisfaction with respect to content and outcome of SIR. The evaluation included measurements before SIR (t1), directly after SIR (t2) and two months after SIR (t3).

Results: Significant improvements have been found with respect to HRQL/anxiety and also with respect to pain (Group III; t3). Average lateral deviation, ATR and VC have also improved significantly after SIR. In addition, the patients were very satisfied with SIR contents and outcomes.

Conclusion: The results clearly demonstrate a positive influence of SIR on the patient suffering from scoliosis with respect to medical and psychosocial issues.

References

O62 Effect of conservative treatments on QoL according to the SRS-22
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Background: The SRS-22 has been developed to monitor QoL in scoliosis. Only a few studies have evaluated its effects on therapies. Consequently, doubts exist on its utility in conservative treatment.

Aim: To evaluate if SRS-22 is able to detect changes in patients treated conservatively.

Study design: Pre-post and cross-sectional study.

Population: One hundred and thirty two consecutive AIS patients at their first evaluation, age 12.8 ± 2.7, divided into 5 groups according to treatment: 30 brace for 18 hours/day, 7 for 21 h/d, 33 for 23 h/d, 48 exercises and 14 observed (controls).

Methods: All patients compiled SRS-22 before the first and at the 6 months follow-up evaluations. Statistical analysis required ANOVA and Kruskall-Wallis tests.

Results: Controls did not show changes with time, while all treated patients had increase of satisfaction with treatment. Aesthetic improvement was perceived by patients treated with exercises, while brace treated patients did show a psychological negative impact: these statistical changes were not clinically significant (0.2–0.3 points out of 5), excluding satisfaction (1.15–1.8). Between the groups, the 23 h/d showed worst start but best results in functioning, aesthetics, pain and satisfaction.

Conclusion: SRS-22 appears to detect changes in populations, but its clinical everyday use appears less reliable.

References

O63 Does bracing affect the quality life of patients with adolescent idiopathic scoliosis?
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2Dept. of Orthopaedic Surgery, Faculty of Medicine, The University of Tokyo, Japan
Scoliosis 2009, 4(Suppl 1):O63

Aim: The aim of this study is to investigate the quality of life (QOL) of the patients with idiopathic scoliosis who underwent various kinds of conservative treatment.

Methods: The responses to the Scoliosis Research Society (SRS)-22 questionnaire, Oswestry disability index (ODI), and Roland-Morris disability questionnaire (RDQ) were analyzed according to the treatment they received.

References
Results: One hundred twenty-two female patients with idiopathic scoliosis whose age was between 14 and 30 years were included in the analysis. Of 122 patients, 47 were treated with exercise only, 33 were treated with Milwaukee brace (MB), and 42 were treated with Boston type under arm brace (UAB). Most of the patients wore their brace part-time. The average age of three groups was 20.1, 19.2, and 18.3 years, and the average Cobb angle was 30.9°, 45.9°, and 38.5°, respectively. The average score for the domains of SRS-22, that is, pain, function, self image, mental health, and satisfaction was, 4.7, 4.4, 3.4, 3.9, and 3.3 in exercise group, 4.4, 4.0, 3.3, 3.6, and 3.5 in MB group, and 4.7, 4.3, 3.5, 4.2, and 3.5 in UAB group, respectively. The score for pain and function domain was significantly lower in the MB group than in the other two groups. For mental health domain, score of the MB group was lower than that of the UAB group. There was no difference among the three groups regarding ODI and RDQ score.

Conclusion: Brace type was one of the factors that affect the QoL of the patients with scoliosis.

References

O64 Psychological problems of patients with scoliosis who utilize the Cheneau’s brace

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Scoliosis 2009, 4(Suppl 1):O64

Background: An important element in treatment of scoliosis is the evaluation and correction of the patient’s psychological status. Changes in their usual lifestyle as well as the daily need to use the brace are the additional negative factors which affect a child. The psychological disorders which evolve may create limitations in personal relationships.

Methods: Clinical cases of 260 patients aged 10–16 treated by Cheneau’s brace were included.

To evaluate the psychological and emotional state the following were implemented: Lusher colour test, evaluation of light perception in dreams, psychological image test, observance of the level of neurosis, Spilberg’s questionnaire for parents and children, vegetative test by Hildenbrand and Kermo as well as an evaluation of the general somatic state.

Results: All children had problems adapting to the brace. This period was characterized by negative emotional conditions, such as dream disturbance, increased irritability, negation, anxiety, fears, and change of mood. Internal disharmony connected with a new life in the brace was seen among girls aged 13–16. Approximately 30% of the patients experienced neurosis due to personal discomfort, to process expectations and to the potential for a negative treatment result. Psychological condition of 16.2% of patients depended on their relatives’ attitude to the process and result of treatment.

Conclusion: Monitoring of the emotional response to treatment for scoliosis by the Cheneau’s brace will improve the quality of the treatment. In addition, incorporating a psychologist’s assistance in the management of these emotional responses may lead to improved quality of treatment.

Reference

O65 Quality of life for adolescents with idiopathic scoliosis in relation to the duration of application of the modified Boston brace

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Scoliosis 2009, 4(Suppl 1):O65

Aim: The aim of this comparative study was to assess the quality of life of adolescents with Idiopathic Scoliosis in relation to the duration of application of modified Boston brace, as a conservative treatment.

Methods: Ninety one adolescents, 10 to 18 years old with idiopathic scoliosis who were treated conservatively with modified Boston brace took part in this study. The mean daily time of brace application was over 12 hours. Adolescents with history of acute or chronic illness, surgical treatment, mental retardation, neuromuscular disease or other congenital anomaly were excluded from the research.

The adolescents were divided in two groups. In the first group (n = 47) were included adolescents wearing the brace for over two years (mean time of application 3.3 years) and the second group (n = 44) included adolescents, which have been treated with Boston brace for less than two years (mean time of application 1.2 years). Every child completed a detailed questionnaire (SRS-22) concerning the evaluation of function, pain, self image, mental health and satisfaction with management. Both groups were comparable according to age and degrees of scoliotic curve.

Results: There was no statistical significant difference between both groups in terms of the questionnaire. However, the mental health section results demonstrated a difference, with a favorable tendency for the second group.

Conclusion: The mental health of adolescents with Idiopathic Scoliosis who wear the modified Boston brace needs to be further investigated.

References

O66
Severity of illness, functional status, and health-related quality of life in youth with spina bifida
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Background: As youth with spina bifida age out of pediatrics, they have difficulty transferring care to adult providers. Care is fragmented with a loss of follow-up. Clinicians in adult health care are untrained in historically, pediatric conditions. Understanding health status, functional status, and health-related quality of life in spina bifida is important in a life-span approach to care.

Methods: A descriptive study of 60, 15–25 year olds with spina bifida, from the Northeastern USA examined for Health Status, Functional Status, and self-perceived HRQOL.

Results: Results indicate and describe that 28% of youth were primarily healthy, 72% reported secondary health conditions and 32% reported co-morbidity. Functional status (FIM) was high with a mean of 116.8 (SD = 7.07, range 90–126) however, areas of bowel and bladder incontinence, inability to traverse stairs, and memory deficits were limitations. Youth reported high HRQOL; mean = 200.8 (SD = 19.54, range of 155 – 232). A regression analysis with HRQOL entered as the criterion variable results were not statistically significant (r² = .02, df = 2, 57, p = .57). Main and ancillary variables show statistically significant correlations important for future research.

Conclusion: This study identifies that youth with spina bifida report a high level of HRQOL, participate in recreation, sport activities, college, adult living, and yet, experience secondary health conditions that leave them with concerns for their future.

References

O67
The best treatment for adolescent idiopathic scoliosis: what do current systematic reviews tell us?
Lori Dolan and Stuart Weinstein
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Introduction: Systematic reviews, the explicit combination of findings from multiple studies, can provide reliable and accurate conclusions about the effectiveness of interventions. This presentation summarizes six existing systematic reviews of non-operative treatments for AIS and discusses the practical implications of the findings.

Materials and methods: The Cochrane, Medline, DARE (Database of Abstracts of Reviews of Effects), and ACP Journal Club databases were searched for meta-analyses and systematic reviews of AIS treatment. The reviews were scored using the Oxman and Guyatt Overview Quality Assessment Questionnaire (OQAQ) to assess the scientific quality of the materials and methods leading to the conclusions.

Results: The search yielded six studies [1, 2, 3, 4, 5, 6, 7]. The major objectives included effectiveness of mass screening, exercises, bracing, observation and electrical stimulation. Based on the OQAQ scores, the Rowe review is extensively flawed, and its recommendations should be questioned. The Focarile and the Lenssinck reviews were the highest quality in this series, and as such, their recommendations should be considered the most valid and informative concerning treatment decisions.

Conclusion: Systematic reviews differ in quality, and all are limited by the availability and quality of published clinical evidence. Where level III and IV studies predominate, as in the case of AIS, systematic reviews may produce contradictory or inconclusive results. Such is the state of knowledge regarding bracing – the balance of published evidence neither supports nor prohibits using a brace to treat scoliosis in the growing child.

References
O68
Adolescent idiopathic scoliosis – a review
of the treatments and evidence-based practice
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Scoliosis 2009, 4(Suppl 1):O68

Background: Treatment options for Adolescent Idiopathic Scoliosis include: exercises; in-patient rehabilitation; braces and surgery. The indications for various treatment options are based on developmental and epidemiological aspects. The predicted outcomes are based on observational data and knowledge of the natural history of scoliosis. The goal of this review is to provide a synopsis of all treatments in relation to evidence-based practice.

Methods: A systematic review was performed to determine an outcome parameter for “rate of progression”. Only prospective, controlled studies that considered the treatment versus the natural history were included. The search strategy included the terms; ‘Adolescent Idiopathic Scoliosis’; ‘Idiopathic Scoliosis’; ‘natural history’; ‘observation’; ‘physiotherapy’; ‘physical therapy’; ‘rehabilitation’; ‘bracing’; ‘orthotics’ and ‘surgery’.

Results: Review of the retrospective studies support out-patient physiotherapy. One prospective controlled study supports treatment with the Scoliosis In-patient Rehabilitation (SIR). One prospective multi-centre study, one long-term prospective controlled study, and one meta-analysis study support bracing. One prospective controlled study supported surgery.

Conclusion: There is evidence supporting the conservative treatment for Adolescent Idiopathic Scoliosis, but it is weak. No substantial evidence is found to support surgical intervention. In order to develop substantial evidence-based recommendations for the use of any interventions, more controlled studies are necessary. This need is especially true for recommendations for invasive surgery.

Reference

O69
Evaluation of pulmonary function before and after vertebral arthrodesis in idiopathic scoliosis
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3Department of Physical Medicine and Rehabilitation, A. Gemelli University Hospital, Rome, Italy
Scoliosis 2009, 4(Suppl 1):O69

Introduction: Severe adolescent idiopathic scoliosis (AIS) may produce a pulmonary restrictive dysfunction, as well as aesthetic and functional modifications of the spine. The deformation of the thorax (“oblique oval-shape chest”), determines the change of insertional geometry of respiratory muscles and the decrease of contractile efficacy of the diaphragm on the concave side of the scoliotic curve.

Materials and methods: A total of 45 patients affected by thoracic AIS with mean Cobb angle of 66° underwent surgery. All the patients were evaluated for spine deformity (lateral deviation and rotation of the vertebral column) and pulmonary function (vital capacity, total lung capacity, forced expiratory volume in one second, thoracic gas volume), before surgery and 1, 2, 4 years after surgery.

Results: In the analysis of reciprocal relationships among lateral deviation and rotation of vertebrae and lung volumes and capacities, we observed an optimal correction of the curve for its lateral deviation, a slight improvement for vertebral rotation and only a maintenance of pulmonary function.

Conclusion: A strong correlation exists between vertebral rotation, pulmonary function and deformity as well as decreased elasticity of rib chest. Vertebral arthrodesis poorly influences these elements. In order to prevent or treat pulmonary dysfunction of scoliotic patients, we should also modify vertebral rotation and rib chest shape. This is confirmed by results of our studies on evolution of pulmonary ventilation and diaphragmatic movement in idiopathic scoliosis using radioaerosol ventilation scintigraphy.

References

O70
Background summary: a new brace for the treatment of camptocormia
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Scoliosis 2009, 4(Suppl 1):O70

Background: Camptocormia or bent spine syndrome is an acquired postural disease leading to lumbar kyphosis observed when the patient stands up, walks or sits. Classic body jackets provide little correction and are often poorly tolerated.

Objective: To study the effectiveness and the tolerance of a new brace in the treatment of camptocormia.

Methods: Fifteen patients were consecutively included in the study. We excluded patients who refused to be equipped with a body jacket at the first consultation and who had lumbar pain when they were straightened up. Patients equipped with the brace were hospitalized for 5 days in order to learn a self-rehabilitation program. Evaluation at each visit included patient self-assessments, and physical and radiographic examinations.

Results: Five men and 10 women 71.4 ± 7.3 years old were included. In comparison to day 0 (without brace), the average increase in lumbar lordosis with the brace was 10.1 ± 9.9° at day 30 (p < 0.05) and 12.5 ± 9.7° at day 90 (p < 0.05). The average increase in thoracic kyphosis between day 0 and day 90 was 7 ± 10° (p < 0.05). Average pain values showed significant differences between day 0 (without brace) and days 30 and 90 (with brace), corresponding to a rate of pain reduction of
69 ± 36% and 70 ± 35%, respectively. The average increase in quality of life was 87% and 92% at days 30 and 90, respectively. **Conclusion**: These results demonstrate that camptocormia can be efficiently corrected.

**References**


**O71**

**The development of a spinal algorhythmic for evaluation of scoliosis**

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Scoliosis 2009, 4(Suppl 1):O71

**Objective**: The conservative management of scoliosis and related spinal deformities must be precise. A prompt evaluation of various somatic-radiological parameters and an accurate record of the spinal data are required during treatment.

**Study design**: Seven types of parameters are considered:
1) growth (height, seated height, weight, lower extremity length inequality etc.),
2) clinical frontal plane (rib hump height, Bunnel, pelvic balance etc.),
3) radiological frontal plane (Cobb-Perdriolle degrees, Risser, etc.),
4) clinical sagittal plane (sagittal distances from the plumb line, pelvic balance, etc.),
5) radiological sagittal plane (angle of kyphosis, lordosis, sacrum, etc.),
6) muscular-neuromotor integration (pectoral, psoas muscles retraction etc.),
7) unstable equilibrium (Romberg, knee-vestibular test, Fukuda-Unterberger, etc.).

**Results**: This spinal algorhythmic allowed us to obtain early and accurate identification of progressive deformities. In addition, we were able to facilitate the treatment of spinal diseases for all of the patients.

**Conclusion**: During growth, we believe that the various types of spinal deformities require prompt, careful and appropriate treatment recommendations.

This spinal algorhythmic is proposed to aid in the immediate evaluation of a deformity. The goals are to define the categories of scoliosis, kyphosis, spondiolysis and to quantize the magnitude of the spinal deformities. This criteria easily recognizes all of the patient categories, identifies progressive deformities, and describes indications for their treatment.

**Poster Presentations**

**P1**

**Clinical detectable tension in the growing body: new and revisited aspects in (de-)formation of the growing spine. Can lordotic bracing technique be seen as neuromuscular tension regulation in stead of osseous correction?**

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Scoliosis 2009, 4(Suppl 1):P1

**Background**: The unclear etiologies for scoliotic and kyphotic deformities of the spine are responsible for uncertainty in treatment options. A constant reference to what normal growth and to what the optimal construction of the entire spine should be at the end of growth is lacking.

Newly developed examination of sitting children with testing of muscular tightness is helpful. This examination highlights the different disturbances of growth that keep the spine from developing optimal configuration and thereby optimal function. Prolonged sitting of children exists only 130 years or less.

**Goal**: To improve the understanding of the role and characteristics of the central nervous system, especially the cord and roots in proper and improper growth of the human spine. To clarify that preservation of lordosis and good function at the thoracolumbar junction at the end of growth can be a condition sine qua non for normal configuration and function of the spine in adult life.

**Methods**: Present important and consistent clinical observations in children in sitting and supine position with early and advanced adolescent deformities, both kyphotic and scoliotic by photographic studies and video fragments.

Disclosure of for the greater part unknown, experimental work on growth and deformation of the spine by Milan Roth (Brno) in German and Czech literature to propose a tension-based balancing system between central cord and the osseous and discoligamentary spine (uncoupled neuro-osseous growth).

Relate these clinical and experimental findings to common knowledge about adolescent spinal deformities and mechanical laws on tensile and compressive forces in structures.
Results: Overview of relevant clinical tests in the growing child presented with deformities shown to correlate with the proposed internal balancing problem (uncoupled neuro-oseeous growth) researched by Roth. Possible pathognomonic MRI signs are shown.

Discussion: By looking for scientific support for these phenomena in (bio-)mechanical literature, the work of Milan Roth was disclosed in his complete width. His embryologic studies, (neuro-) anatomical and radiological findings with their explanations, alongside interesting cadaver-, mechanical- and neuroanatomical experiments and models can bring his concept of neuro-spinal relationship in growth and misgrowth back to orthopedic daylight. Even Nicoladoni saw a century ago that a cascade of structural alterations takes place around the “core”-unit of the spine: the boundaries of the central canal let it stay in its place and in the shortest configuration possible in scoliosis, by suspected tensile and compressive forces. Anatomical and biomechanical consequences of keeping the spine upright in standing but more important in the sitting positions seems to fit. Children do sit for prolonged periods only in the last one or two centuries! It can be shown that the presence of these tension related clinical signs are easily leading to high compressive forces with deformation of the ventral parts in the TL-junction while sitting In literature, evidence of torsion facilitating anatomical with deformation of the ventral parts in the TL-junction while sitting. It can be shown that the presence of these tension based system, the adaptations made and subsequent phenomena in (bio-)mechanical literature, the work of Milan Roth was disclosed in his complete width. His embryologic growth) researched by Roth. Possible pathognomonic MRI signs are shown.

Conclusion: By recognizing positive effects of creating lordosis at the thoracolumbar junction of the spine and by the consistent clinical findings in early deformations scientific data from Roth, the etiology of spine deformities is better understood. With the central nervous system’s leading role in the growth of the spine of standing and sitting vertebrates as well as the role to steer a tension based system, the adaptations made and subsequent deformities are better understood. This tension regulating system is widely available in nature, and researched in trees. Additional research in this area for preventive measures and for therapeutic strategies in deformities seems inevitable.

References

P2
Using mixed methods in clients with spinal cord injury to promote a smooth transition from hospital to society
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Purpose: To discover the features needed to progress and to identify which factors promote a smooth transition from hospital to society.

Methods: A mixed method design was used, which combined qualitative (Parse research method) and quantitative research strategies. Phase 1, the parse research method was used on 15 participants with spinal cord injuries. The central finding of this phase was the following: the experience of moving forward is a triumph over handicaps. This occurs due to a transition of thoughts amid an open mind and due to a confirmation of self-worth emerging from faith. Phase 2, the purpose of this phase was to gain an understanding of how smooth transition clients function with their spinal cord injury. This was accomplished through data collection and analysis. The conceptual framework was build up through the result of phase 1 and literature review. The questionnaire was designed sequentially within the qualitative research, including demographic data, characteristics of the spinal cord injury, clients’ self-perception, self-efficacy scale and social support. Four targets local Spinal Injury Association were drawn on the basis of cluster random sampling from the total of 23 Taiwan Spinal Injury Association. The participants were selected from each association through convenience sampling. The total number of participants is 210.

Results: The results show that 164 participants (80%) have moved forward already, and the others have not. There were significant correlations between moving forward and clients’ self-perception, and self-efficacy. The findings are stronger when you combine a system of hospital and society to promote clients smooth transition. Finally, the continuing care and long-term service system is established. The nursing philosophy is extended from client-family centered care to the whole society.

References

P3
Multiple anomalies with scoliosis – a case study
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History: A 25-year-old woman presents with severe neck and back pain. The pain was most severe in the cervical area. PMH: She has iron deficiency anemia. She had a vaginal birth with normal gestation. Social: She graduated from high school and she is a housewife in social anamnesis.

Physical examination: Right eye: Limited to lateral vision, neurologic consultation confirmed loss of right eye vision.
Spine: Scoliosis at the dorsal and lumbar region. After radiologic imaging of full spine, several deformities were found in the all parts of spinal column. The cervical magnetic resonance imaging (MRI) confirmed herniation from foramen magnum with cervical scoliosis.
Neuropsychological testing was consistent with attention deficit and very mild cognitive impairment. Language and praxis functions seemed to be preserved.

Brain: Cranial computed tomography and MRI revealed a severe ventriculomegaly compressing the brain cortex but sparing the cerebellum and the brainstem. Ventriculoperitoneal shunting was recommended by neurosurgery.

Discussion: Long-standing overt ventriculomegaly in adults is a clinical entity characterized by chronic hydrocephalus. The onset of this condition occurs in infancy with a slow evolution and onset of clinical symptoms during adulthood. Limited case reports exists which describe this condition of severe hydrocephalus with the relatively spared neurological functioning and cognitive aspects. This case report demonstrates in vivo the level of adaptation to which human brain can reach under chronic mechanic stress conditions. Scoliosis may present with other anomalies.

P4
The lived experience of moving forward after spinal cord injury: a study using Parse research method
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Aim: The purpose of this study is to discover the structure of the (“lived”) real life experience of moving forward after sustaining a spinal cord injury using the Parse research method. Another goal is to better understand the impact of the Taiwanese culture on this experience. The overall goal is to improve the quality of life for patients with spinal cord injury.

Methods: This study was conducted in a Rehabilitation Hospital and Spinal Injury Association in the middle of Taiwan. Participants were 15 clients with spinal cord injury. The Parse research method was used to answer the research question: what is the structure of the lived experience of moving forward? The Parse research method illuminates the structure of lived experiences of health, such as moving forward, through the processes of dialogical engagement, extraction-synthesis and heuristic interpretation.

Results: The central finding of this study is the following structure: the lived experience of moving forward is a triumphing over handicaps, an ability to transition thoughts with an open mind, an emergence of self-worth based on one’s faith.

Discussion: The findings are discussed in relation to human becoming, related literature and future research. The concept of client-centered care is discussed.

References

P5
The lived experience of family resilience after a spinal cord injury: a study using the Parse research method
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Background: Spinal cord injury is one of the most disastrous injuries a person may experience. Although one family member experiences the injury, the entire family is affected.

Aim: The purpose of this study is to explore the universal real life experience of this tragedy and to develop an insight into the subsequent family resilience.

Methods: The Parse’ Research Methodology was used. Data was collected from July/2006 to Jan./2007 through tape-recorded dialogical engagement and then analyzed by extraction-synthesis and heuristic interpretation. Participants were 7 clients (spinal cord injury patients) and their respective family caregiver.

Results: The findings show that the universal real life (“lived”) experience of family resilience for the family caregivers are as follows: to sacrifice wholeheartedly, to fortify the sense of being in this adversity with triumph, to offer restraint and optimism, to construct a “reachable” dream.

Discussion: The findings are discussed in relation to human becoming, related literature and future research.

References

P6
Living with spinal deformities: the Indian experience
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India has the largest number of cases of spinal deformities in the world. The major causes of such deformities are malnutrition, water impurities, post-polio complications, calcium deficiency, congenital conditions, social violence and accidents. In India, there are very few medical centers which can perform corrective surgery and even fewer capable of rehabilitation. Community based rehabilitation projects also lack the infra-structure and expertise to deal with spinal deformity cases. Individuals with spinal deformities are marginalized, stigmatized and discriminated in the society. Folklores and religious scripture reinforce the prejudices against individuals with a hunchback or crooked spine. Some charitable and religious institutions do cater to the basic needs of these individuals; however, their meaningful participation in social life and in proper employment remain distant goals.
P7
Why are the extension/strengthening exercises wrong in the treatment of idiopathic scoliosis?
New conservative treatment plan based on types of scoliosis (new classification 2001–2007)
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Introduction: Until the determination of etiology for “so-called” idiopathic scoliosis (Karski 1995–2006 [1, 2, 3, 4, 5, 6]), rehabilitation treatments were mostly unsuccessful. New treatments are designed for specific “group/type of scoliosis”. Utilization of the new, Lublin classification may be assist in the appropriate recommendation for new rehabilitation exercises. In addition, previous strengthening exercises have been proven harmful.

New rehabilitation exercises:
* Exercises to remove contractures of right hip.
* Flexion-extension (two phases) asymmetric exercises for spine.
* Active sport practice in schools – stretching exercises like Karate, Aikido etc.
* Special sleep positions – fetus position.
* "At ease" – standing position only on left leg.

The lecture will give all details of new exercises.


1. To understand rules of new treatment and of prophylaxis recommendations, this lecture will present the new Lublin classification of “so-called” idiopathic scoliosis based on biomechanical etiology. For details see lectures in: http://www.ortopedia.karski.lublin.pl

Results: Results of new treatment will be presented in tables. Most cases showed correction of axis of spine or stopping of deformity. In I-st epg we observed progression only at 13% of children and in II-nd epg only at 3%. The number of children who needed operative procedures in Poland decreased!

Conclusion: 1. Old “strengthening exercises” are wrong. They only cause larger iatrogenic deformity.

2. New asymmetric flexion-rotation exercises are correct and effective in beginning stages of scoliosis. Subsequently, they constitute good, new prophylactics.

3. The Lublin experience confirms that we can introduce rules of “neo-prophylaxis” in our orthopedic management of “so-called” idiopathic scoliosis in all countries.

References