Presented by SOSORT
(Society on Scoliosis Orthopaedic and Rehabilitation Treatment)

ABSTRACTS
**Abstract**

**Background**
Orthotic treatment of children with AIS is a generally accepted treatment option. Failure of bracing to halt curve progression has been reported in 20% or more of patients and it is known that some curves in children with AIS will not progress even if untreated. Success and failure rates of brace treatment vary considerably.

**Purpose**
We reviewed the response to brace treatment in patients who were also analyzed with a DNA-based adolescent idiopathic scoliosis progression test (AIS-PT) and compared this with the natural history of adolescent idiopathic scoliosis without treatment. Our purpose was to document the influence of orthotic care on the outcome at skeletal maturity.

**Methods**
Medical records and x-rays were reviewed and DNA was collected with a saliva sample in two cohorts of Caucasian female AIS patients. A risk of progression score was calculated using 53 genetic markers with utility for calculating the risk of AIS curve progression from <25° to >40° before skeletal maturity or >50° at maturity (1-200). Group A (2442 females) had no brace treatment and their outcome at maturity or surgery was known. Group B (308 females) were brace compliant for more than one year and their curve severity at maturity or surgery was known.

**Results**
There was little statistical difference in the curves representing risk of progression versus curve severity when the two groups were compared. Graph 1

**Conclusions**
In this retrospective study of US Caucasian females, there was no statistically significant alteration in the natural history of adolescent idiopathic scoliosis. At best, there was only a modest brace effect. Prospective trials with genotype homogeneity are needed to validate current assumptions on the efficacy of orthotic types and treatment regimens when bracing adolescent idiopathic scoliosis.

---

1 – How to explain that monozygotic twins with same DNA, same environment, and same treatment do not have same evolutivity?

Your two questions are very important. Monozygotic twins are a "birth defect" occurring in the first two weeks of gestation. Depending on the age of the embryo at cleavage, allocation of blastomeres, availability of cytoplasmic components, reorientation of one twins' three major axes and subsequent timing differences in establishment of the other two axes and vagaries of placental circulation, when considering midline disorders such as scoliosis, monozygotic twins are an uncertain
research model. AIS is a disorder with strong genetic determinants including the ability to predict curve progression which occurs outside of the intra-uterine environment.

2 - If the rigid brace do not seem to modify the natural history of the idiopathic scoliosis, why to have given up the plaster casts which make it possible to improve the results (11% of progression higher than 5°).

Our study involves subjects from major spine centers across the US. The routines used in the US may be related to the modest ability to influence the natural history of AIS. The most important point of the paper is that clinical research on AIS bracing must be properly designed. Small series, anecdotal reports or study cohorts that contain patients with different risks of curve progression do not meet the threshold for scientific inquiry. It is clear that brace methods vary widely and to document the efficacy of any particular method requires genotype homogeneity in the study cohort. SOSORT has the potential to educate the rest of the world about successful bracing in AIS and well designed studies will advance that process.

Affiliation  2749 E Parleys Way suite 200 - UT 84109 - Salt Lake City - USA
**Objective:** A portable posture monitoring and training system has been developed for tracking daily posture information and posture improvement.

**Background:** Spinal deviations usually refer to abnormal lateral or sagittal curvature that could be the cause or effect of some spinal diseases. The conventional orthotic intervention is to apply passive forces to patients body via an orthosis for supporting / controlling the trunk alignments. However, once the orthosis is removed, such functions cannot be maintained. Therefore, an active posture training approach is postulated in suitable clinical cases as it can keep the trunk in appropriate posture via using the patients own back muscles and a long-lasting effect is anticipated.

**Method:** A portable posture monitoring system has been developed, which consists of 3 inertial sensor modules, a data logging and feedback system, an integrated garment, and software for posture analysis and training. The sensor modules are used for tracking posture change at the thoracic and lumbar regions on the sagittal and coronal planes relative to a neutral position, in terms of curvature alteration measured between adjacent sensor modules. An auto-reset algorithm has been designed for minimizing the error due to the inherent limitations of the inertial sensors. An opto-electronic motion analysis system was used for accuracy comparisons.

**Results:** The results showed that inertial sensor modules could provide trunk posture information and its measurements were found to be comparable to those of the motion analysis system (averaged RMS differences <4.3o for the sagittal plane and <3.6o for the coronal plane, correlation coefficient >0.829 in domain planes of movements during flexion and lateral bending). The system has been used to monitor posture changes of 5 healthy human subjects during daily activity over a period of 4 days with different thresholds set for providing audio-biofeedback signal.

**Conclusion:** The findings demonstrated the potential of this system in facilitating posture training. It is worthy for further developments and the ultimate goals are towards the applications in occupational health promotion as a prophylactic measure for those jobs with high risk of back problems as well as a treatment option for the patients with posture deformities or spinal diseases.

**Affiliation**
Department of Health Technology and Informatics, The Hong Kong Polytechnic University, Hung Hom, Hong Kong.
The randomized controlled trial has emerged as the gold standard for all clinical research. The combination of randomized assignment to groups, use of strict inclusion and exclusion criteria, standardized protocols and ad hoc power analysis serve to rule out many threats to the internal validity of research results. Thus, it is the most powerful methodology available to researchers investigating the relative effectiveness of treatments. To date, there has been only 2 randomized studies examining the effectiveness of bracing for adolescent idiopathic scoliosis.

The purpose of this presentation is to discuss the planning and the current status of the Bracing in Adolescent Scoliosis Trial (BrAIST). This five-year, >$5 million project includes 27 healthcare centers, and is funded by the United States National Institutes of Health, the Canadian Institute of Health Research, and the Shriners Hospitals. Additionally, 3 institutions, including the Chinese University of Hong Kong, are participating using internal funding. The protocol randomizes children with AIS who are at high risk for curve progression to treatment with a thoracolumbosacral orthosis or to clinical monitoring. The study is currently in its second year of recruitment. BrAIST incorporates several innovations never used in a single study to date:

1) randomization,
2) objective brace dose monitoring,
3) standardized, objective radiographic measurement,
4) comprehensive radiographic, clinical, and psychosocial testing,
5) diversity of participating sites and
6) ad hoc determination of effect size, based on the risk/benefit considerations of potential patients.

Issues to be discussed include:

- Ethics – rationale for the ethics of an observation arm
- Protocol development and implementation – endpoints, measures, quality assurance
- Recruitment and randomization – expectations and actuality
- Bracing quality control – independent review of in-brace films
- Patient/family decision-making – impact of information and being offered a choice
- Brace compliance monitoring – reliability/validity of temperature as proxy for dose

**Affiliation**

*University of Iowa Healthcare Department of Orthopaedics 200 Hawkins Dr. Iowa City, IA 52242 United States*
The use of axial loaded MRI in place of radiographs for surveillance of Adolescent Idiopathic Scoliosis: One practice’s experience and recommendations.

There have been several recent research studies published suggesting that MRI scans may prove to be a viable alternative to radiographs in the surveillance of curves for patients with AIS. This orthopaedic practice began a prospective study of whether these scans provided reliable curve measurements when compared to traditional radiographs. While enrolling patients in this study and obtaining axial loaded MRI’s during regular clinic hours, we were able to gain experience in how to schedule patients, obtain scans efficiently, provide axial loading to simulate gravity during the scan, use MRI images to obtain Cobb angles, and incorporate this all into our regular patient care routine. This presentation will be used to share our experiences and give recommendations to physicians interested in incorporating these techniques into their scoliosis clinics.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Evaluation (Scoliosis &amp; Kyphosis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>The influence of examiner experience on the reliability of surface topography measurements in patients with AIS.</td>
</tr>
<tr>
<td>Authors</td>
<td>Knott Patrick, Mardjetko Steven, Lamborne Drew, Stemer Jordan, Strasburg Annalyse</td>
</tr>
<tr>
<td>Abstract</td>
<td>The Ortelius 800 is a device for measuring scoliosis curves in AIS using surface topography. Initial experience with this machine was found to be unreliable, but more recent techniques have been shown to greatly enhance the reliability and reproducibility of Cobb angle measurements. If this machine can be used to obtain consistent measurements, then in addition to its use by spinal deformity specialists, it could be employed as a screening device by school personnel or by general pediatricians. But, more widespread distribution of the Ortelius 800 would mean that less experienced examiners would be using the machine. This study looked at the relationship between the experience of the examiner and the reliability of the Cobb angle measurements. If only very experienced examiners can obtain reliable measurements, then distribution of this tool should be more limited. In this study, volunteer patients were measured by a clinician with more than 20 years experience, and then again by health science students with less than one year of physical examination experience. Measurements were compared to see the influence that experience had on the reliability of this screening tool.</td>
</tr>
<tr>
<td>Affiliation</td>
<td>Rosalind Franklin University of Medicine and Science 3333 Green Bay Road, North Chicago, IL 60064 USA Illinois Bone and Joint Institute, Morton Grove, IL USA 3T Imaging, Morton Grove, IL USA</td>
</tr>
</tbody>
</table>
**Topic**: Etiology (Scoliosis & Kyphosis)

**Title**: A comprehensive model of idiopathic scoliosis (IS) progression, based on the patho-biomechanics of the deforming “three joint complex”.

**Authors**: Theodoros B. Grivas¹, Elias S. Vasiadis², Georgios Triantafyllopoulos¹, Angelos Kaspiris²

**Abstract**

**Introduction**: It was previously postulated that the IV disc wedging is a significant progressive factor for mild IS curves. The present report introduces an innovative comprehensive model of IS curves progression based on intervertebral disc (IV) diurnal variation and the subsequent patho-biomechanics of the deforming “three joint complex”.

**Methods**: Throughout day and night, due to sustained loading and unloading, the scoliotic wedged IV disc expels fluid and imbibes it more convex-wise. The convex side of the IV sustains a greater amount of cyclic expansion than the concave side.

**Results**: Consequently the imposed, convex-wise, asymmetrical concentrated cyclical loads to the adjacent immature vertebral end plates and posterior elements of the spine lead to symmetrical vertebral growth. More specifically the loading on the two facet-joins asymmetrically increases during the day, as the wedged IV space narrows due to expelled water and it asymmetrically decreases during the night, as the IV space swells due to imbibed water.

**Discussion**: This 24 hour period cyclic asymmetric loading leads both to asymmetric growth of the end plates and wedging of the vertebral bodies, and to similarly asymmetric growth of the pedicles and arches posteriorly as an effect of Hüeter-Volkmann law. It is well described that the pedicle in the convex side is more elongated than in the concave side and the facet joint larger respectively.

**Significance**: The proposed model may help to explain the beneficial effects of exercises, night time bracing in idiopathic scoliosis and of fusionless surgery with staples for progressive IS.

**Affiliation**

1. Department of Trauma and Orthopaedics, "Tzania" General Hospital - NHS, Tzani and Afendouli, 18536, Piraeus, Greece, grivastb@vodafone.net.gr.
2. Department of Trauma and Orthopaedics, "Thriasio" General Hospital - NHS, Gennimata Av, 19600, Magoula, Attica, Greece

D. Bernardou 31 str. Brilissia, 15235 Attica, Greece - 15235 - Greece
A simple functional classification for unspecific chronic low back pain with special respect to the sagittal plane.

**Authors** Weiss H.R., Werkmann M., Bohr S.

**Abstract**

Up to now, chronic low back pains without radicular symptoms are not classified and attributed in international literature as being “unspecific”. For specific bracing of this group of patients suffering from low back pain we use simple physical tests to predict the brace type the patient might benefit from. Based on these physical tests we have developed a simple functional classification of “unspecific” low back pain in patients with spinal deformities.

**Material and Methods:** Between January 2006 and July 2007 we have tested 133 patients (116 females and 14 males) with spinal deformities (average age 45 years, ranging from 14 years to 69) and chronic unspecific low back pain (pain for > 24 months). We applied the “sagittal realignment test” (SRT), a lumbar hyperextension test, and the “sagittal delordosation test” (SDT).

**Results:** 117 Patients reported significant pain release in the SRT and 13 in the SDT (>/= 2 steps in the Roland & Morris VRS). 3 Patients had no significant pain release in both of the tests (< 2 steps in the Roland & Morris VRS). Pain intensity was high (3,29) before performing the physical tests (VRS-scale 0-5) and low (1,37) while performing the physical test for the whole sample of patients. The differences where highly significant in the Wilcoxon test (z = – 3,79; p < 0,0001).

**Discussion:** With the exception of three patients (2,3%) a clear distribution to one of the two classes has been possible. 117 Patients were supplied successfully with a sagittal realignment brace (physio-logic brace™) and 13 with a sagittal delordosation brace (spondylogic® brace). Therefore a clear distribution of the patients from this sample to either chronic postural or chronic instability back pain was possible. In 2,3% a combined chronic low back pain from the findings obtained seems reasonable to assume.

**Conclusions:** Chronic unspecific low back pain is possible to clearly be classified physically. This functional classification is necessary to decide on which specific conservative approach (physical therapy, braces) should be used. Other factors than spinal deformities contribute to chronic low back pain.

**Affiliation** Orthopedic Rehabilitation Services Alzeyer Str. 23 D-55457 Gengingen, Germany
**Topic**  Bracing for Kyphosis  
**Title**  The sagittal re-alignment brace in the treatment of chronic low back pain in patients with lumbar kyphosis.  
**Authors**  Weiss H.R., Werkmann M., Bohr S.  
**Abstract**  For adult scoliosis patients with chronic low back pain bracing is initially indicated before spinal surgery is considered. Until recently the effect upon pain reductions in the mid or long-term has not been reported upon. Promising results have been documented in short-term for the application of a sagittal re-alignment brace in patients with spinal deformities and suffering from pain; however mid-term or long-term results are not yet available.  
The **purpose** of this study is to investigate the mid-term effects of this brace with respect to pain control.  
**Material and Methods:** 65 patients (56 females and 9 males) with chronic low back pain (> 24 months) and the diagnosis of scoliosis or kyphosis were treated with a sagittal realignment brace (physio-logic brace™) between January 2006 and July 2007. All patients had a lumbar kyphosis. The indication for this kind of brace treatment was derived from a positive sagittal re-alignment test (SRT) and the restriction of no successful conservative treatment during the last 24 months. The aim of this intervention was to avoid surgery for chronic low back pain.  
**Results:**  The average pain intensity on the Roland and Morris VRS (5 steps) before treatment was 3.3 (t1), at the time of brace adjustment 2.7 (t2) and after an average observation time of 18 months 2.0 (t3). The differences were highly significant in the Wilcoxon test.  
**Discussion:**  Mid-term measurements showed that a significant pain reduction is possible in chronic postural low back pain using a sagittal realignment brace inducing lumbar re-lordosation.  
**Conclusions:**  The brace action of the sagittal re-alignment brace leads to promising mid-term improvements in patients with chronic low back pain and spinal deformities. Contrary to unspecific orthoses, which after a short period are worn no longer, the sagittal re-alignment brace (physio-logic™ brace) leads to an effective reduction of pain intensity in mid-term even in patients who have stopped brace treatment after the initial 6 months of treatment. Therefore in conservative treatment of chronic low back pain specific approaches such as the sagittal re-alignment brace should be applied first, before a risky operation is performed.  
**Affiliation**  Orthopedic Rehabilitation Services Alzeyer Str. 23 D-55457 Gensingen, Germany
Bracing for Kyphosis

Title
In-brace corrections in patients with kyphosis using the kyphologic® brace.

Authors
Weiss H.R., Werkmann M., Bohr S.

Abstract
Little is known about the in-brace correction effects of braces used for the treatment of kyphosis. While Bradford et al. have found their attempts effective, treating Scheuermann's kyphosis with Milwaukee braces, they did not report on in-brace corrections. According to White and Panjabi, it seems the appropriate approach to try to correct a curvature of >50° with the help of distraction forces, however, patient comfort is largely reduced in the Milwaukee brace. Therefore, in Germany braces generally prescribed for kyphosis treatment are using transverse correction forces only. Our efforts to reduce brace material have resulted in a special bracing design called kyphologic® brace.

Aim of this presentation is to study possible in-brace corrections which have been achieved with this brace.

Materials and methods: 56 adolescents with the diagnosis of a thoracic Scheuermann kyphosis or a thoracic idiopathic kyphosis (22 girls and 34 boys) and an average age of 14 years (12-17yrs.) have been treated with the kyphologic® brace between 5/07 and 10/08. Average Stagnara angle was 55,6° (43-80). In-brace correction was recorded and compared to the initial angle with the help of the t-test.

Results: Average Stagnara angle in the brace was 39°. The average in-brace correction was 16,5° (1-40°). Average in-brace correction in % of the initial value was 36%. The differences were significant in the t-test (t = 5,31, p < 0,001). There was no correlation between the in-brace correction in % and the age of the patient, but a high significant correlation between in-brace correction in % and initial Stagnara angle.

Discussion: If we assume that outcome of brace treatment positively correlates with in-brace correction the treatment should start before the curvature angle exceeds 55°. In scoliosis bracing an average in-brace correction of >15° predicts an end result correction. At average with this brace we have achieved >15° also in kyphosis treatment. Therefore we estimate to achieve a favourable outcome using this brace type when compliance can be gained.

Conclusions: An average in-brace correction of >15° as achieved with the help of the kyphologic® brace seems to predict a favourable outcome.

Affiliation
Orthopedic Rehabilitation Services Alzeyer Str. 23 D-55457 Ginsingen, Germany
Introduction: Recent findings link BMI in girls with thoracic adolescent idiopathic scoliosis (AIS) to skeletal asymmetries of spine and upper arm. The aim of the present study in healthy adolescents is to evaluate an association between BMI and back shape asymmetry, termed here TA.

Methods: 5953 adolescents age 11-17 years (boys 2939, girls 3014) were examined in a school screening program in two standard positions, standing forward bending (FB) and sitting FB. TA was measured in both positions using a Pruijs scoliometer as angle of trunk inclinations (ATIs) across the back at each of three regions, thoracic, thoracolumbar and lumbar. Abnormality of ATIs was defined as being outside, or beyond, 2 standard deviations for region, age, gender and position, termed severe TA. Each child was assigned to a relatively lower or relatively higher BMI group using a median value of BMI by age and sex. The sitting FB position is thought to express intrinsic TA free from extrinsically-induced effects of any leg-length inequality. Results In the sitting FB position after correcting for age, relatively lower BMIs, are associated with a greater number of severe TAs than with relatively higher BMIs in both boys (thoracolumbar and lumbar regions) and girls (thoracolumbar region).

Conclusions: It appears that body fat, BMI, menarche and TA have mechanisms common to them all in development. BMI is a surrogate measure for body fat and circulating leptin levels. We suggest, analogously to a recently suggested hypothesis for AIS pathogenesis, that severe TA is caused by a genetically-determined selectively increased hypothalamic sensitivity to leptin mediated via the sympathetic NS as an adverse response, exacerbated by lower circulating leptin levels probably associated with relatively lower BMIs. This hypothalamic functional asymmetry is expressed phenotypically via the sympathetic NS acting bilaterally to produce left-right asymmetry in ribs and/or vertebrae leading to severe TA when beyond the capacity of postural mechanisms of the somatic NS to control the shape distortion of the trunk. A test of the hypothesis involving skin sympathetic responses is suggested.

Affiliation

1. Department of Trauma and Orthopaedics, "Tzanio" General Hospital - NHS, Tzani and Afendoul, 18536, Piraeus, Greece, grivastb@vodafone.net.gr.
2. Department of Trauma and Orthopaedics, "Thriasio" General Hospital - NHS, G, Gennimata Av, 19600, Magoula, Attica, Greece 3. The Centre for Spinal Studies & Surgery, Nottingham University Hospitals Trust, Queen’s Medical Centre Campus, Nottingham NG7 2UH, UK
Etiology (Scoliosis & Kyphosis)

Title
Age variations of melatonin level and its hormesis; implications for AIS and osteoporosis.

Authors
Theodoros B. Grivas1, Elias S. Vasilias2, Georgios Triantafyllopoulos1, Angelos Kaspiris2, R Geoffrey Burwell3

Abstract

Introduction: Melatonin, the “light of night”, is very important hormone for the functions of human organism. Its secretion increases in early childhood. In adolescence there is a decrease of the hormone concentration. The levels continued to decline gradually during middle age. In old population the levels of melatonin in serum are very low. Among a lot of other functions of this hormone, melatonin is involved to human sexual maturation and decline through its action to menses and in osteogenesis.

Methods: Menses therefore could suitably be explored for hormesis (hormesis: responses of cells or organisms to an exogenous (eg drug or toxin) or intrinsic factor (eg hormone) in which the factor induces stimulatory or beneficial effects at low doses and inhibitory or adverse effects at high doses [bimodal dose-response] or vice versa).

Results: On the topic of the menses, at around 10 years, age at which AIS appears, the circulating melatonin level is about 120 pg/ml - positive hormesis for menses - and menarche appears, figure 1. If there is a circulating melatonin defect, then a delay at the age at menarche, compared with the normal peers, is expected and subsequently the female is susceptible to scoliosis. In these terms melatonin could be certainly involved in the Scoliosis pathogenesis [1]. Around the age of 45 years when the circulating melatonin levels are about 20 pg/ml - negative hormesis for menses - figure 1, the menopause starts. As a result the problems of osteoporosis and fractures start [2,3,4,5].

Discussion: It is documented the bone-protecting effect of melatonin in ovariectomized rats which can depend in part on the free radical scavenging properties of melatonin. Additionally, melatonin may impair development of osteopenia associated with senescence by improving non-rapid eye movement sleep and restoring GH secretion. Whether modulation of melatonin blood levels can be used as a novel mode of therapy for scoliosis and augmenting bone mass in diseases deserves to be studied [3].

1. Grivas et all. Association between adolescent idiopathic scoliosis prevalence and age at menarche in different geographic latitudes. Scoliosis, 2006

Affiliation
1. Department of Trauma and Orthopaedics, “Tzanio” General Hospital - NHS, Tzani and Afendouli, 18536, Piraeus, Greece, grivastb@vodafone.net.gr
2. Department of Trauma and Orthopaedics, “Thriasio” General Hospital - NHS, Gennimata Av, 19600, Magoula, Attica, Greece
3. The Centre for Spinal Studies & Surgery, Nottingham University Hospitals Trust, Queen’s Medical Centre Campus, Nottingham NG7 2UH, UK

D. Bernardou 31 Brilissia, Attica - 15235 - Greece
Age variations of melatonin levels. The hormone secretion increases in early childhood. In adolescence there is a decrease in the hormone concentration. The levels continue to decline gradually during middle age. In old population the levels of melatonin in serum are very low.
Muscle assessment in healthy teenagers. Comparison with teenagers with low back pain.

Authors: Bernard J.C., Bard R., Pujol A., Combey A., Boussard D., Begue C., Salghetti A.M.

Abstract: Objectives: To describe muscle parameters in healthy teenagers and compare them to teenagers with chronic low back pain (CLBP).

Methods: A comparative study of 276 control teenagers and 51 teenagers with CLBP, benefiting from a specific treatment, 14.5 years average age. The control group is made up of teenagers without back pain and teenagers who reported some back pain when we asked them, but without specific treatment. The results to four static tests assessing trunk flexors, trunk extensors, hip extensors and quadriceps endurance are statistically compared. In the control group, associations between different clinical measures and possible back pain are looked for.

Results: The two groups are homogeneous, concerning age, weight, standing height, sitting height and BMI (p>0.05). Low back pain is more common in girls, either in the control group (69% of girls) or in the group with CLBP (78%). CLBP is associated with a poor endurance strength of the trunk extensors (151 s in the control group to 105 s in the CLBP), with hip extensors weakness (140 s in the control group to 1 min 24 s in the CLBP), and with quadriceps weakness (159 s in the control group to 140 s in the CLBP), (p=0.000). No significant difference was found between trunk flexors endurance in the two groups (131 s in the control group to 133 s in the CLBP). In the control group, 48 teenagers reported back pain “often”, “very often” or “all the time”; no links were found between pain and muscle flexibility, measured with finger-floor distance, heel-cheek distance, and popliteal angle. Only the sitting height was found statistically higher (p=0.003) in the control teenagers who reported back pain (87 cm) related to the ones who have no pain (85 cm). Sport influences global strength in lower limbs and changes the ratio of quadriceps to hip extensors, in favor of quadriceps. Neither pain nor the ratio of trunk flexors to trunk extensors are modified by sport. Trunk extensors, hip extensors and quadriceps endurance is lower in the CLBP group.

Affiliation: Service enfants-adolescents, centre médico-chirurgical de réadaptation des Massues, 92 rue Edmond Locard 69322 Lyon cedex 05, France
### Title
Is Scoliosis In-patient rehabilitation clinically effective? A systematic PubMed review.

### Authors
Weiss H.R.*, Goodall D*

### Abstract
In-patient scoliosis rehabilitation has been assessed in a prospective controlled study. This study is out-of-date as it was performed 1991 and when the program lasted 6 weeks on average, but more recently rehabilitation length has been significantly reduced. The results of postural changes are not significant at this stage and the improvement of vital capacity is far from the values obtained in 1991. Meanwhile there is evidence that improvements of health related measures can be achieved on an out-patient basis and that these more modern programs have similar rates of surgery when compared to the in-patient approach described in the literature. The aim of this study is to find evidence for the application of in-patient rehabilitation programs.

**Types of studies** included: clinical evaluations of in-patient rehabilitation (prospective controlled or randomised controlled trials). Meta analyses, due to their recognised good standard have also been included. To attempt to detect the true effects of the treatment, the control group inclusion criteria consisted of patient groups with observation as the only intervention. Only studies better than level III have been taken into account, as these have been shown to be a good standard in health care research.

Search strategy for identification of the studies; Pub Med; Medline; Key words: "in-patient rehabilitation","prospective controlled study" / "in-patient rehabilitation","randomized controlled study"

Results. Two papers were found when searching for prospective controlled studies, none were found searching for a RCT. The two papers found were reviews citing the prospective controlled study on scoliosis rehabilitation mentioned above.

**Discussion:** There is no evidence that in-patient scoliosis rehabilitation with reduced rehabilitation times (3-4 weeks) is superior to out-patient rehabilitation. Without doubt within scoliosis rehabilitation the psychological effect of in-patient rehabilitation may be an advantage over the outpatient approach, but there is no evidence that with respect to health related issues in-patient rehabilitation is superior to out-patient based concepts.

**Conclusions:** There is no evidence for in-patient rehabilitation in terms of health related issues. To gain the psychological benefits a two weeks program can be considered as being sufficient. There are obvious cost effective advantages of an out-patient program compared to an in-patient program.

### Affiliation
1. Orthopedic Rehabilitation Services Alzeyer Str. 23 D-55457 Gensingen, Germany
2. 163 Sandringham Road, WD24 7bh Watford,77 - London, UK
Establishing a Normative Database for the Sagittal configuration of the Back using an objective three dimensional measurement tool (the MIDAS System).

Bettany-Saltikov J.A., Warren J.G.

Objective: The primary objective of this study was to produce a database of normative back sagittal values in young adult subjects, against which the backs of patients with different spinal dysfunctions could be compared.

Background: Assessment and retraining of posture is a traditionally integral physiotherapeutic intervention in the treatment of back pain with the benefit of postural correction exercises for the relief of back pain being well documented. This lack of objective measures for assessing posture does not agree with standards set out by governing bodies in the United Kingdom, which stipulate that treatments should be based on objective markers and evidence-based practice. Previous studies with physiotherapists concluded that there was a need for an assessment system to provide objective, accurate results, displayed quantitatively and visually for Evidence Based Practice.

Methods: Subjects: 100 healthy subjects aged 20-40 years old were recruited. Ethical approval was granted by the Health and Social Care Ethics committee.

Instrumentation: A relatively low-cost, portable system, known as the MIDAS system (Middlesbrough Integrated Digital Assessment System) was used with software specifically designed for the assessment of back posture.

Procedure: Data collection involved one tester touching the MIDAS stylus tip to each of the marked spinal points in a standardized order and pressing the foot pedal of the MIDAS to store the position on the computer.

Results: The overall mean thoracic Sagittal value was 49.2 (SD 10.55) degrees and the overall mean lumbar value was -44.93 (SD 15.57) degrees. The overall sagittal profile of the back demonstrated that overall the left shoulder, scapula and pelvis were rotated forward by a mean of 8.04mm, 5.9mm and 0.15mm respectively over the right side of the back.

Conclusions: Our results should provide a normative database for clinicians (physiotherapists, chiropractors, spinal surgeon) who routinely assess back posture. The method we have devised will also provide an evidenced based objective alternative to just “eyeballing “back posture during clinical evaluation. It is hoped that the MIDAS system can be implemented as a means of quantifying posture in physiotherapy departments in the near future.

Affiliation: University of Teesside School of Health and Social Care Borough Road Middlesbrough TS1 3BA UK
**Title**: Effectiveness of the SpineCor brace based on the standardized criteria proposed by the S.R.S. for adolescent idiopathic scoliosis – up to date results.

**Authors**: Coillard C., Circo A.B., Rivard C.H.

**Abstract**: Objective: To verify the effectiveness of the Dynamic SpineCor brace for adolescent idiopathic scoliosis and to confirm the stability of the results two years after the end of the treatment.

**Study design**: From 1993 to 2009, 840 patients were treated using the SpineCor brace. 413 patients fitted the criteria for inclusion recommended by the SRS committee and 159 patients were still actively being treated. After all, 254 patients have a definitive outcome. Assessment of brace effectiveness included; 1) percentage of patients who have 5° or less curve progression and the percentage of patients who have 6° or more progression, 2) percentage of patients who have been recommended/undergone surgery before skeletal maturity, 3) percentage of patients with curves exceeding 45° at maturity (end of treatment) and 4) 2-years follow-up beyond maturity to determine the percentage of patients who subsequently underwent surgery.

**Results**: Successful treatment (correction >5° or stabilization ±5°) was achieved in 165 patients of the 254 patients (64.9 %) from the time of the fitting of the SpineCor brace to the point in which it was discontinued. 46 immature patients (18.1 %) required surgical fusion whilst receiving treatment. Two patients out of 254 (0.7 %) had curves exceeding 45° at maturity.

**Conclusions**: The SpineCor brace is effective for the treatment of adolescent idiopathic scoliosis. Positive outcomes are maintained after the weaning of the brace since 99 patients out of 106 (93.3%) stabilized or corrected their Cobb angle. Moreover, out of the 93.3%, 12.3 % of the patients still corrected their Cobb angle 2 years after the end of the treatment.

**Affiliation**: Research Center, Sainte-Justine Hospital, & University of Montreal, 3175 ch. Côte Ste-Catherine, Montréal, Québec, H3T 1C5 Canada
Bracing for Scoliosis

Title: An Early Stage Brace Wear Pattern during Daily Activities for AIS.

Authors: Lou E, Hill D, Raso, J, Moreau M, MAhood J, Hedden D.

Abstract: Objective: To evaluate changes of compliance including both wear tightness and wear time during early brace treatment for AIS.

Background: The efficacy of brace treatment for children with AIS has been hampered by the lack of comprehensive information about wear characteristics. Our group developed a reliable brace compliance monitoring system to measure and record the temporal profile of the loads on the pressure pad imposed on the trunk during daily living.

Method: The brace compliance monitoring system was used to monitor how new brace subjects used their braces during first 4 months. Six AIS subjects (5F, 1M), age between 10 and 13 years old (12.3 ± 1.0 years), prescribed TLSO with full time wear (22 hours per day) were monitored starting at the beginning of their brace treatment. The Cobb angles were measured at the initial visit, 4 weeks after the final brace fitting (in-brace) and the first follow-up visit (out-of-brace) approximately 4 months after initiation. The force average relative to the prescribed tightness level (set as 1.0) and the monthly force comparison were reported. The average wear time and monthly wearing pattern were calculated.

Results: The brace monitor logged the data for 4 months without any data loss. The initial, the in-brace and the follow-up Cobb angles were 33±4, 21±3, and 35±5 degrees, respectively. During this study period, the daily force average relative to the prescribed level was 0.97±0.20. The average force from month 1 to 4 was 1.12±0.23, 1.02±0.20, 0.92±0.18, 0.83±0.19, respectively. The average wear time relative to the prescribed time was 56±15%. The monthly wear time from month 1 to 4 were 52±8.6, 54±13, 59±16, 59±21%, respectively. All subjects are still on their brace treatment.

Conclusion: During the first 4 months of brace use, the wear time improves but brace tightness is lower.

Affiliation: Department of Rehabilitation Technology, Glenrose Rehabilitation Hospital - Edmonton, AB Canada 2 Department of Surgery, University of Alberta, Edmonton, AB, Canada
**Topic**
Bracing for Scoliosis

**Title**
Prediction of Curve Progression For AIS Patients treated with a TLSO Brace.

**Authors**
Lou E., Hill D., Parent E., Raso J., Moreau M., MAhood J., Hedden D.

**Abstract**

**Objective:** To develop a curve progression model for patients with AIS receiving brace treatment by considering compliance measures and in-brace correction factor.

**Background:** Bracing is the most commonly used non-surgical treatment for adolescent idiopathic scoliosis (AIS). Prediction of brace treatment outcomes has not been well documented.

**Method:** Twenty subjects, (17F;3M), age 13.4 ± 1.8 years, prescribed a full-time TLSO (22hr/day) were monitored and followed for 3 years. All subjects met the SRS Brace Study inclusion criteria. The brace usage in terms of quantity (% of wear time relative to the prescribed wear) and quality (% of wear tightness relative to the prescribed tightness level) was logged with a compliance monitoring system. The Peterson’s risk of progression at the time when the brace was prescribed was calculated based on 4 variables: Risser sign, apex of the curve, age and imbalance. In-brace curve correction (flexibility) was calculated as: (Initial Cobb – in-brace Cobb)/Initial Cobb. A predictive model for curve progression using regression was developed based on the Peterson’s risk of progression, quantity, quality and the percentage of in-brace correction. Data from six new subjects who used a monitoring system and followed for 2 years after bracing were used to assess the validity of the model.

**Results:** The Cobb angles of the 9, 8 and 23 subjects pre-brace, in-brace and 3 years after weaning were 32 ± 7 degrees, respectively. The individual parameter: Peterson’s risk of progression, flexibility, quality, quantity, quality*quantity, contributed to the curve progression model was 8%, 19%, 15%, 8% and 14%, respectively. Combining all variables, 56% of the variance in curve progression can be predicted. The curve progression model was: Curve Progression (in degrees) = 33 + 0.11*Peterson Risk (%) – 0.07 in-brace correction (%) - 0.45*Quality (%) - 0.48*Quantity (%) + 0.62*Quantity*Quality. The results from the 6 new subjects are in table I. The largest prediction error of the prediction model was 3 degrees.

**Conclusion:** It is possible to predict the curve progression for AIS patients who have brace treatment.

**Affiliation**
Department of Rehabilitation Technology, Glenrose Rehabilitation Hospital - Edmonton, AB Canada 2 Department of Surgery, University of Alberta, Edmonton, AB, Canada
Title: Does bracing affect the quality of life of the patients with idiopathic scoliosis? Re-analysis of Cobb angle-matched subjects.

Authors: Maruyama T., Takeshita K., Kitagawa T., Nakao Y.

Abstract: Background: We reported that quality of life (QOL) of the patients treated with Milwaukee brace (MB) was lower than that of the patients treated with under arm brace (UAB) or exercise at the 2008 SOSORT meeting in Athens. However, in that study, Cobb angles of the patients were not matching and there were significant differences in the Cobb angle among the treatment groups.

Objectives: The aim of this study is to re-analyze the QOL of the patients with idiopathic scoliosis who underwent conservative treatment by comparing Cobb angle-matched treatment groups.

Methods: Female patients with idiopathic scoliosis who underwent conservative treatment for at least one year, whose age was between 14 and 29 years and whose Cobb angle was between 25 and 50 degrees were included in the study. 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.

Results: Eighty-four patients were included in the analysis. Of 84 patients, 19 were treated with MB, 37 were treated with Boston type UAB, and 28 were treated with exercise only. Most of the patients wore their brace for part-time. The average age of three groups was 17.9, 18.3, and 21.5 years, and the average Cobb angle was 38.8, 37.8, and 36.0 degrees, respectively. The average score for the domains of SRS-22, that is, pain, function, self image, mental health, and satisfaction was, 4.5, 4.0, 3.5, 3.9, and 3.4 in MB group, 4.7, 4.2, 3.5, 4.1, and 3.4 in UAB group, and 4.6, 4.4, 3.2, 3.8, and 3.6 in exercise group, respectively. The score for function domain was significantly lower in the MB group than in the other two groups. There was no difference among the three groups regarding other domains of SRS-22, ODI and RDQ score.

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

Affiliation: Dept of Orthopaedic Surgery, Saitama Medical Center, Saitama Medical University 1981 Kamoda, Kawagoe, Saitama, 350-8550 Japan
Correlation between the Sagittal Plane in adults and the automatic postural system. Longitudinal study, follow up 24 month period.

Objectives: The Sagittal Plane is governed by the correct balance of the pelvis. The muscle chains are governed by the exoreceptors. Therefore new corrected exoreceptor information bring about a subsequent realignment of the muscular skeletal axis.

Background: Since the early 1980 a cybernetic concept of governing balance was introduced; in 2005 J. C. De Mauroy, introduces the existence of a strange attractor; in 2008 A. Fimiani hypothesized the role of the pelvis as the strange attractor of the postural system.

Method and Results: The group was made up of 68 adults aged between 18 and 70; of which 48 were female and 20 males. The patients underwent only receptor treatment, following the techniques by B. Bricot and by Bourdiol. All patients were checked with x-rays and photographic evidence, measured on the dynamometric platform, and tested with the S. F. McGill Questionnaire. The time of observation was over a 24 month period.

Outcome: Comparing photographs of the patient’s spines showed that after 24 months all the patients adopted a new posture. From the x-rays it was possible to note only lumbar and dorsal curvature. Two subgroups of patients were individuated characterized by age. Group A consisted of 22 people aged between 40 to 70; group B consisted of 30 people aged between 18 to 30. In group A, both the lumbar curvature, \( p = 0.38 \), and dorsal curvature, \( p = 0.067 \), do not show any significant variation in statistics; whereas group B, both lumbar curvature, \( p = 0.0349 \), and dorsal curvature, \( p = 0.0484 \), show significant variation. Valuation of lumbar pain demonstrated a significant statistical improvement, \( p = < 0.000001 \).

Conclusions: The fundamental problems for the patient are represented by pain and aesthetic deformity. In both cases observation shows that patients experienced and obtained a significant improvement. Analysis of the x-rays points out that if the skeleton isn’t compromised in any way, it modifies itself following the new muscular equilibrium even in adults. So we can conclude that correct external stimulation of the automatic postural system influences the position of the body in relation to its surrounding space.

Affiliation: via Dello Stadio 79 Ischia (NA) - 80077 - Italy
**Topic**  
Prevention-Screening

**Title**  

**Authors**  
Kaced H., Belabassi H.

**Abstract**  
**Objectives:** The main aim of this study was to estimate the prevalence of Idiopathic Scoliosis among Algiers school population. However, the analysis of the results also enabled us to sketch the profile of the Algerian scoliotic child.

**Background:** The epidemiological profile of this disease was scarcely studied in our country. In fact, management of Spinal Deformities was only effective in a few specialized services in Algiers City, and thus all the scoliotic patients who are diagnosed in countryside had to move to the capital for treatment. Considering the frequency of severe deformities we had been receiving all this time, we deemed it important and urgent to focus our efforts on the timely detection of curvatures before it is too late for the conservative treatment.

**Method and Results:** A screening Survey for scoliosis was conducted on a sample of Algiers school population in 1995 – 1996. Our methodological steps corresponded to a prospective evaluation. It was based on a cross-sectional survey that had been executed in a restricted period and on a defined population where the information had been collected only once on each individual. In fact, 19,529 boys and girls, aged between 5 and 16 years, were examined and 9.6% of them were referred to the specialized center. Criteria for positive rulings were mainly gibbosity, or other signs indicating scoliosis. Structural scoliosis was diagnosed in 25.35%. The prevalence of Idiopathic Scoliosis, of 5° and more was 2.38% with a female predominance; and that of the overall one was 2.43%.

**Outcome:** The Algerian Population has recently reached 33.8 millions, with nearly 50% aged under 15. The considerable rate of youth in the Algerian population, along with the insufficiency of both specialized structures and qualified teams in management of spinal deformities, induces us to emphasize the need of an early detection of scoliosis at school. We thought that the obtained epidemiologic data would show us the magnitude of the problem and oblige our ministry to orientate the public health policy, according to the conclusions of our study. We expected it to apply some recommendations as to improve the training of school doctors and the specialists who are in charge of the orthopaedic pathology, to identify services and equip them for that, and to develop the culture of multidisciplinary practice.

**Conclusion:** The recommendations which resulted from this work were not considered until last year. At last, the program of school screening for scoliosis has become mandatory as was detection of defective vision, hearing problems or cardiac diseases...etc. Currently, we are trying to organize some seminars about spinal deformities and their treatment. To manage all the students who will be detected is another problem.

**Affiliation**  
Service de Médecine Physique et Réadaptation Hopital de Douéra . Faculté de Médecine de Blida  
Bracing for Scoliosis

SpineCor treatment for adolescent idiopathic scoliosis — 5 years follow-up after weaning of the brace.

Circo A.B., Coillard C., Rivard C.H.

Objective: Knowing that any apparent correction of the curve that occurs during a rigid brace treatment can be expected to be lost over time the purpose of this prospective interventional study was to evaluate the stability of the spine 5 years after the weaning point of the SpineCor brace.

Study design: From 1993 to 2009, 840 patients were treated using the SpineCor brace. 495 fitted patients have a definitive outcome and 405 patients finished the treatment with the SpineCor brace. 94 patients had at least 5 years of follow-up. Assessment of brace effectiveness included; 1) percentage of patients who have 5º or less curve progression and the percentage of patients who have 6º or more progression, 2) percentage of patients who have been recommended/undergone surgery before skeletal maturity, 3) percentage of patients with curves exceeding 45º at maturity (end of treatment) and 4) 2-years follow-up beyond maturity to determine the percentage of patients who subsequently underwent surgery. 5) percentage of patients that corrected or stabilized their Cobb angle 5 years after the weaning point.

Results: Looking at the stability of the curves after the end of the treatment, 29% of the patients still continued their correction after the weaning point and 63.5% remained stable and only 7.5% progressed with more than 5º (4.3% of them had surgery recommendation after the weaning point).

Conclusions: The SpineCor brace is effective for the treatment of adolescent idiopathic scoliosis. Positive outcomes are maintained after 5 years after the weaning of the brace. Moreover, one third of the patients still corrected their Cobb angle in the five years period after the end of the treatment.

Research Center, Sainte-Justine Hospital, & University of Montreal, 3175 ch. Côte Ste-Catherine, Montréal, Québec, H3T 1C5 Canada
Topic: Bracing for Scoliosis

Title: Long-term outcome after Boston brace treatment in adolescent idiopathic scoliosis.

Authors: Lange JE, Steen H, Brox JI.

Abstract:

**Objectives:** To evaluate the long-term outcome in adolescent idiopathic scoliosis (AIS) 12 years or more after treatment with Boston brace.

**Background:** Few studies have evaluated long-term outcome after bracing using validated quality of life outcome measures.

**Material:** 110 (78 %) of 140 (7 men) patients with AIS treated with Boston brace 12-28 years previously responded to a long-term follow-up examination.

**Method:** Patients were evaluated either by clinical and radiological examination (n=66), postal questionnaire or telephone interview. All patients answered a standardised questionnaire including demographics, work status, treatment, Oswestry Disability Index (ODI) (100-worst possible), General Function Score (GFS) (100- worst possible), EuroQol (EQ-5D (1 – best possible), EQ-VAS (100- best possible)) and Scoliosis Research Society -22 (SRS-22) (5 - best possible).

**Results:** The magnitude of the primary prebrace major curve was in average 33.2 (range 20 – 52) degrees (n=110). At weaning after 2.9 (0.5 – 9.3) years of treatment and at the last follow-up 19.8 (12 - 28) years after weaning the corresponding values were 28.5º (9 -56) (n=110), and 34.0º (8 – 87) (n=66), respectively. Even if the average progression of the major curve after weaning was 5.5º (-7 – 44), the long time follow-up compared with the prebrace value was -0.6º (-21 – 36) (n=66).

The mean age at follow-up was 36 (29 - 46) years. Work status: Full time (80%), on sick-leave (3%), on rehabilitation (4%), disability pension (4%), homemaker (7%), students (2%), changed job because of back pain (7%). Educated at the University level (58%), married/living together (77%), having children (88%), pain in pregnancy (55%).

28 % had taken physiotherapy for back pain the last year, and 12 % had visited a doctor. Global back status was excellent or good in 81 %. Mean ODI 6.4 (SD 9.8), mean GFS 5.4 (10.5), mean EQ-5D 0.84 (0.2), SRS-pain 4.2 (0.8), SRS-mental health 4.2 (0.7), SRS-self-image 3.9 (0.7), SRS-function 4.1 (0.6), SRS-satisfaction with treatment 3.7 (1.0).

**Conclusion:** Long-term results were satisfactory in most patients with AIS treated with Boston brace.

Affiliation: Orthopaedic Dept. Rikshospitalet University Hospital, N-0027 Oslo, Norway
### Abstract

**Objectives:** To evaluate the repeatability, reliability, internal consistency, and concurrent validity of an adapted Norwegian version of the Scoliosis Research Society 22 questionnaire (SRS-22) and the generic health-related quality of life instrument EuroQol (EQ-5D and EQ-VAS).

**Background:** SRS-22 is widely used for evaluation of health-related quality of life in AIS. Its repeatability which is essential for use in follow-up studies, and concurrent validity with EuroQol, which can be used for cost-utility analysis, has not yet been assessed.

**Methods:** The forward-backwards translation of the English version of the SRS-22 was performed according to guidelines for cross-cultural adaptation of outcome questionnaires. Fifty-seven patients with AIS of various ages and severity of deformity filled in a questionnaire including SRS-22, EQ-5D, and EQ-VAS twice with two weeks interval. The study was approved by the Regional Ethics Committee for Medical Research in Norway.

**Results:** There were no floor or ceiling effects on the score distributions. The study demonstrated moderate to internal consistency and high reliability of SRS-22 questionnaire with Chronbach alpha and ICC ranging from 0.76 to 0.93 for the 5 domains. Repeatability was excellent for all domains of SRS-22 with repeatability coefficients <1. Concurrent validity with EQ-5D was poor to moderate with Pearsons r ranging from 0.01 to 0.58. However, total scores of the two instruments showed satisfactory agreement.

**Conclusion:** The SRS-22 outcome instrument has satisfactory repeatability, but concurrent validity with EQ-5D suggests that the disease specific and the generic questionnaire measure different constructs.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Bracing for Scoliosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Evaluation of conservative scoliosis treatment compliance</td>
</tr>
<tr>
<td>Authors</td>
<td>Aulisa A.G., Guzzanti V., Perisano C., Falciglia F., Aulisa L.</td>
</tr>
</tbody>
</table>
| Abstract      | **Background:** The main purpose of this study is the evaluation of the orthoses treatment compliance of patients affected by adolescent idiopathic scoliosis.  
**Methods:** We have examined 106 patients (96 females, 10 males) affected by idiopathic scoliosis. The patients were treated with different types of orthoses (Lionese, Milwaukee, P.A.S.B., Lionese+P.A.S.B., Milwaukee+P.A.S.B., Milwaukee+Lionese). In order to evaluate the compliance and the final results related to the patient’s behaviour, we have considered: - the patient’s commitment related to the type of brace, sex and spine curve trend - evaluate abandon considering age, scoliosis degree and duration of treatment.  
**Results:** Our study highlighted that steadfast patients (66) are more than the inconstant (40). Inside the inconstant group, 52.5% have not worn the brace for long time (more than 3 months), the others only in the summer or at school. Inside the inconstant group, 50% have been treated with Milwaukee brace. It was also noticed that, in mixed brace type treatments, the Milwaukee brace raised the percentage of abandon. Inside the steadfast group, 47% have been treated only with P.A.S.B. brace and 6% with a mixed type including P.A.S.B.. 28.3% of the patients has abandoned the treatment before the scheduled date. Patients who terminated the treatment at more than 17 have had a higher degree of improvement (10.81%) compared with an age lower than 17 (9.38° cobb). When the abandon occurred, patients who didn’t complete the treatment (more than 50% wore P.A.S.B.) showed a slightly higher improvement degree than who completed the treatment.  
**Conclusions:** The analysis highlighted that the brace type, the patient commitment and completion of the treatment until a complete maturity of the skeleton are very important for the improvement of the scoliosis. The patient commitment depends on the orthoses type and not on the sex. The compliance of Milwaukee type is lower than the P.A.S.B. one, because the Milwaukee is more visible and has the chin support while the P.A.S.B. fit better and is less visible. Treatment abandon depends on several factors including psychological elements, low compliance and an improvement of the spine curve (showed by x-ray) that misleads patient to believe in a complete recovery.  
| Affiliation    | Orthopaedics and Traumatology Department Bambino Gesù Children’s Hospital, Rome Institute of Scientific Research Orthopaedics and Traumatology Department Catholic University, P.zza s. Onofrio 4 - 00165 Rome - Italy |
# Bracing for Scoliosis

## Correlation between hump dimensions and side deviation in idiopathic scoliosis before and after a conservative treatment.

### Authors

Aulisa A.G., Guzzanti V., Perisano C., Giordano M., Ricciarini M.E., Aulisa L.

### Abstract

**Background:** The purposes of our study are two: - verify a potential correlation between the hump dimensions and the scoliosis curve severity - evaluate how the treatment can influence the main characteristic parameters.

**Methods:** 134 patients (13 males and 121 females) with an average age of 12.83 ± 1.93 ranging between 6 and 18) affected by adolescent idiopathic scoliosis have been treated with brace until the complete skeleton maturity (72 Lionese, 41 P.A.S.B., 4 Milwaukee -13 mixed treatment P.A.S.B. + lionese, 3 Milwaukee+Lionese,1 P.A.S.B.+Milwaukee). To evaluate the treatment progress have been taken into account two parameters: the hump (clinically measured with humpmeter) and the Cobb angle (measured by x-rays of whole spine under load).

Measurements have been taken at the beginning and the end of the treatment. Statistical analysis has been performed using non parametrical tests to compare averages and make linear regressions between parameters. Same evaluations have been made later dividing the whole group in 4 sub-groups: patients with lumbar curves (66), thoracic curves (68), patients with age over 14 (45) and under 13 (89).

**Results:** Results showed that a real correlation between hump and curve severity, in Cobb degree, exists (significativity was lower than 0.001 at the beginning and end of the treatment): higher curve severity corresponds to an higher hump dimension. Furthermore the effectiveness of the orthoses treatment to correct the curve severity and remodel the hump was highlighted. Treatment starts with a Cobb angle of 29,41 ± 8,53 and ends at 19,29 ± 9,84. Hump begins with a value of 11,61 mm ± 5,59 mm and finish at 6,19mm ± 4,61mm. It was also noticed that the hump correction is higher than the correction of the curve registered in Cobb degrees. In particular, this is more noticeable: • in thoracic curves • in patients with less than 13 years of age

**Conclusions:** The hump is the effect of the rotation of the scoliosis curve. At thoracic level hump is averaged by ribs and, for this reason, there is a less important correlation with the increase of spine deformity. Orthoses treatment of idiopathic scoliosis fixes the spine deformity and, also, is very effective to remodel the hump. This phenomenon is more noticeable at backbone level where the main action is performed to the rib cage.

### Affiliation

Orthopaedics and Traumatology Department Bambino Gesù Children’s Hospital, Rome Institute of Scientific Research Orthopaedics and Traumatology Department Catholic University, P.zza s. Onofrio 4 - 00165 Rome - Italy
A study of vertebral geometry before and after conservative treatment in thoracic Scheuermann disease.

Aulis A.G., Guzzanti V., Perisano C.1, Mastantuoni G., Aulisa L.1

Background: The study of the vertebral changes in Scheuermann disease during conservative treatment is generally based upon the magnitude of the curve according to the Cobb method and the magnitude of the vertebral deformation in the sagittal plane. In the present study an X-ray analysis of vertebral changes before and after bracing has been performed to assess whether additional radiographic parameters may aid in assessing the impact of the disease and the response to the conservative treatment.

Methods: There were 16 patients with thoracic Scheuermann disease undergoing treatment with an antigravitary brace. Mean age at the onset of treatment was 13 years and patients had a mean curve value of 54,4° Cobb at the beginning of treatment. The following parameters were analysed on a standard LL X-ray film taken before and at the end of treatment: cuneization angle (ALFA), anterior wall tilt (AANT), posterior wall tilt (APOS). Each value was determined by two independent observers. Vertebrae were subdivided into three sectors: apical vertebra (sector 4), those above the apical vertebra (sector 3), those below the apical vertebra (sector 5) and the marginal vertebrae (sector 2 and sector 6). The L1 vertebra was used as control (sector 1). Values variations were analysed by means of the t-test for paired data. Significance was set at P <0.05.

Results. Whole iperkyphotic curve. Parameters in all the kyphotic curve vertebrae shows a significant reduction in the wedging angle ALFA (P<0.01) and in the posterior wall inclination APOS (P<0.0002). There was no significant variation in the anterior wall inclination.

Sector 2. The posterior wall inclination decreased by about 50% in value (P<0.02).

Sector 3. Value variation was not significant.

Sector 4. At the apex vertebra level, body wedging, decreased by 50% in value after treatment (P<0.004).

Sector 5. The posterior wall inclination decreased (P<0.009).

Sector 6. The posterior wall inclination recorded a significant decrease of about 2° (P<0.001).

Conclusions. The analysis of results shows that additional parameters, particularly the anterior and posterior wall tilt that express the magnitude of trapezoidal deformation, may account for the response of vertebral geometry to conservative treatment in thoracic Scheuermann kyphosis. Radiographic assessment of treatment outcome should therefore encompass both the traditional measures of curve and cuneization magnitude and the anterior and posterior vertebral wall tilt variations.

Affiliation Orthopaedics and Traumatology Department Bambino Gesù Children’s Hospital, Rome Institute of Scientific Research Orthopaedics and Traumatology Department Catholic University, P.zza s. Onofrio 4 - 00165 Rome - Italy
<table>
<thead>
<tr>
<th><strong>Topic</strong></th>
<th>Bracing for Scoliosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
<td>Efficacy of bracing in worst cases (over 45°): end-growth results of a retrospective case series.</td>
</tr>
<tr>
<td><strong>Authors</strong></td>
<td>Negrini S, Atanasio S, Fusco C, Zaina F.</td>
</tr>
</tbody>
</table>
| **Abstract** | **Objectives**: verifying the efficacy of bracing for adolescent idiopathic scoliosis (AIS) in worst cases (over 45°) refusing surgery.  
**Background**: 45°-50° curves are considered surgical, but not all patients want to face surgery and a treatment should be warranted to try help them avoiding fusion; the efficacy of bracing in this curves is generally considered scanty, but our experience seems to drive to different conclusions, that need verification.  
**Methods. Study Design**: retrospective study. Population: all AIS patients with at least one 45° degree curve at first evaluation that reached the end of treatment since our database start in 2003; we had 14 females and 2 males; 6 had a previous, failed brace treatment; at start: age 14.1±1.7, Cobb degrees 49.4±4.3 (range 45°-58°).  
**Methods**: full time treatment (23 or 24 hours per day) for one year with Risser cast (11) or Sforzesco brace (5) respecting SOSORT criteria, plus specific exercises. Outcome criteria: SRS (unchanged; worsened over 6°; over 45° at the end of treatment; surgically treated; 2 years follow-up); clinical (ATR, hump, Aesthetic Index, plumbline distances); radiographic (Cobb degrees); and ISICO (optimum; minimum). Statistics: ANOVA and chi-test.  
**Results**: reported compliance in the 4.5±1.6 treatment years was 90.5±15.5%. At the end 5 patients (31%) were still over 45° (range 32°-50°), no one was fused and this remained true at the 2 years follow-up for the 50% that reached it. Improvements have been found in 69% and 56% of worst and average curves, and in 56% and 80% of Thoracic and Lumbar curves respectively. We found highly statistically significant reductions of maximal (-8.6°), average (-4.8°), Thoracic (-6.0°) and Lumbar (-10.2°) curves. Statistically significant improvements have been found for Aesthetic Index and Thoracic ATR, with a decrease of plumbline distances. According to ISICO criteria 75% of patients had minimum and 63% optimal results.  
**Conclusion**: Curves over 45° represent a challenge for physicians and patients that can be faced with high efficacy braces, good methodology (SOSORT criteria), dedication and compliance (high motivation that can come from decision/hope to avoid surgery). In these optimal situations, according to this retrospective study, surgery can be avoided in some cases. |
| **Affiliation** | ISICO (Italian Scientific Spine Institute), Via Roberto Bellarmino 13/1, 20141 Milan, Italy |
Objective: verifying the efficacy of bracing for adolescent idiopathic scoliosis (AIS) after the end of growth (Risser 4 and 5, until 20 years of age).

Background: it is widely thought that bracing after skeletal maturity is useless; even if some results we previously published drive to different hypothesis. According to our experience and some old masters proposals (Stagnara, Sibilla), in these cases we propose bracing for aesthetic reasons and/or in worst cases for a possible curve reduction.

Methods: Lyon or SPoRT braces 18 to 24 hours per day plus specific exercises, respecting SOSORT criteria, with a rapid weaning (2-3 hours every 6 months). Outcome criteria: SRS (unchanged; worsened over 6°; over 45° at the end of treatment; surgically treated; 2 years follow-up); clinical (ATR, hump, Aesthetic Index, plumbline distances); radiographic (Cobb degrees); and ISICO (optimum; minimum).

Results: reported compliance during the 2.6±0.6 treatment years was 95.1±7.8%, while residual growth was 0.9±1.1 cm.. No patients progressed over 45°, no one was fused and this remained true at the 2 years follow-up for the 25% that reached it. Improvements have been found in 48% and 36% of worst and average curves, and in 45%, 58% and 36% of Thoracic, Thoracolumbar and Lumbar curves respectively. We found highly statistically significant reductions of maximal (-4.4°), average (-4.2°), Thoracic (-6.0°) and Thoracolumbar (-6.6°) curves. Statistically significant improvements have been found for Aesthetic Index, but not for ATR or plumbline distances. Clinically, 30% of patients improved over the measurement error for Aesthetic Index. According to ISICO criteria 50% of patients had minimum and 35% optimal results.

Conclusion: Before 20 years of age, even in skeletal mature patients, it is possible to reach radiographic and aesthetic improvements, although not as good as during growth. Correction is based on bone growth, but also ligaments and neuromuscular control of posture can be involved.
Efficacy of conservative treatment of adolescent idiopathic scoliosis: end-growth results respecting SRS and SOSORT criteria.

Objectives: verifying the efficacy of a complete conservative treatment of adolescent idiopathic scoliosis (AIS) according to the best methodological criteria defined in the literature.

Background: the SRS criteria give the methodological reference frame to present results of bracing. SOSORT criteria give the clinical reference frame for an appropriate bracing treatment. The combination of the two has never been presented in a study until now.

Methods: retrospective study. Population: we included all AIS patients respecting the SRS inclusion criteria (age 10 years or older; Risser test 0-2; Cobb degrees 25-40°; no prior treatment; less than 1 year post menarche) that reached the end of treatment since our database start in 2003; we had 44 females and 4 males, age at start 12.8±1.6. Methods: according to individual needs, 2 patients have been treated with Risser casts followed by Lyon brace, 40 with Lyon or SPoRT braces (14 for 23 hours per day, 23 for 21 h/d, and 7 for 18 h/d), and 2 with exercises only. Outcome criteria: SRS (unchanged; worsened over 6°; over 45° at the end of treatment; surgically treated; 2 years follow-up); clinical (ATR, hump, Aesthetic Index, plumbline distances); radiographic (Cobb degrees); and ISICO (optimum; minimum). Statistics: ANOVA and chi-test.

Results: reported compliance during the 4.2±1.4 treatment years was 90.9±17.6%. No patients progressed over 45°, no one was fused and this remained true at the 2 years follow-up for the 50% that reached it; worst and average curves progressed in 4%, while 8%, 11% and 6% progressed in Thoracic. Thoracolumbar and Lumbar curves respectively. We found highly statistically significant reductions of maximal (-7.0°), average (-5.6°), thoracic (-4.2°) and lumbar (-6.7°) curves. Statistically significant improvements have been found also for Aesthetics and ATR, but plumbline distances diminished. Clinically, less than 10% of patients worsened for all parameters (exceptions: lumbar ATR and hump), while improvements were very common. According to ISICO criteria 88% of patients had minimum and 65% optimal results.

Conclusion: respecting SOSORT criteria, results of conservative treatment is much better than what previously reported in the literature using the SRS criteria.

ISICO (Italian Scientific Spine Institute), Via Roberto Bellarmino 13/1, 20141 Milan, Italy
Static pelvic obliquity can influence clinical assessment of trunk rotation in idiopathic scoliosis.

Kotwicki T., Kubiak A., Szulc A.

Background: The Bunnell scoliometer is widely used for scoliosis screening; however the cut off value of the angle of trunk rotation is still debated. It is not clear whether and how much the scoliometer measurements are sensitive to a non-level pelvis.

The aim of the study was to verify whether the angle of trunk rotation depends on the functional pelvic obliquity. To answer this question, we measured the angle of trunk rotation (ATR) in the classical forward bending position while the pelvis was raised with a shoe lift.

Material: The ATR was measured in 25 girls with idiopathic scoliosis (study group), aged 13 to 19 years (mean 15,6 ± 1,8 years) and in 25 healthy girls (control group), aged 12 to 16 years (mean 14,2 ± 0,9 years). In the study group the Cobb angle revealed the value of 35,0° to 92,0° (mean 54,4° ± 18,0°) in the lumbar curvature and of 38,0° to 93,0° (mean 60,7° ± 17,3°) in the thoracic curvature.

Methods: Bunnell scoliometer was used in two positions: sitting and standing, both forward bending positions. The scoliometer readings were noted at four levels of the spine: high thoracic, main thoracic, lumbar and sacral. Then the measurements were repeated in the same subjects and at the same four levels of the spine, while levelling the left or the right side of the pelvis using a shoe lift 1cm or 2cm thick.

Results: Comparing to classical forward bending position, the ATRs changed significantly while the shoe lifts were applied. Typical patterns of alternatively raised and lowered ATRs within adjacent spinal levels were identified. The difference depended on the shoe lift height and on the spinal level: it was of 1,5°-4,5° of rotation within the lumbar spine; 1,2° - 3,8° of rotation within the thoracolumbar spine, and 0,7° to 2,4° of rotation within the high thoracic spine.

Conclusion: The measurement of the ATR with the Bunnell scoliometer is sensitive to a non-level pelvis, especially within the lumbar spine. This should be taken into consideration when using the scoliometer in school screening.
**Topic**  Bracing for Kyphosis

**Title**  Lumbar Scheuermann conservative treatment allows a proper vertebral body growth and spinal configuration: a case series.

**Authors**  Fusco C, Atanasio S, Zaina F, Negrini S.

**Abstract**

**Objectives**: verifying the efficacy of brace treatment of lumbar Scheuermann disease on radiographic parameters.

**Background**: Lumbar Scheuermann (LS) is an atypical localization of Scheuermann disease; it has been little studied and, above all, very few is known about its conservative treatment.

**Methods**: We observed retrospectively 13 patients with diagnosis of LS, 7 of them needed bracing because of lumbar kyphosis, while the others were treated with physical exercises only to control pain and prevent deformity. All patients treated with brace (3 males and 4 females, average age 13.5 years) presented at first observation back pain, a lumbar kyphosis and a radiographic image of lumbar bone damage typical of Scheuermann disease. 5 of them started treatment with 23 or 20 hours/day of brace and reached the end of treatment after on average 2.5 years through a period of progressive brace weaning, while 2 are still in treatment.

**Results**: The two treatment groups were significantly different at start. Both treatments allow a fast disappearance of pain; with bracing a progressive achievement of a proper sagittal outline is achieved, with a good radiographic reconstruction of lumbar vertebral bodies. Distances from plumbline improved, showing a gradual increase of lumbar lordosis. 2 patients are still in treatment, they are now pain free and clinical and radiographic data suggest an improvement of lumbar kyphosis.

**Conclusion**: These observations show that brace can correct effectively LS allowing a proper lumbar vertebral body growth, while exercises can control pain and a possible worsening.

**Affiliation**  ISICO (Italian Scientific Spine Institute), Via Roberto Bellarmino 13/1, 20141 Milan, Italy
### Abstract

**Objectives:** verify relationship among LBP and posture in adolescent soccer players.

**Background.** Both in adults and children a U correlation has been proven between sport activities and low back pain (LBP). A long discussion exists about the possible influence of sport activities on spinal growth. Soccer is widely practiced by pupils in many different countries.

**Methods.** We clinically evaluated 102 males practicing agonistic soccer two to three times per week in the age range 11-16, and compared them to a normal sample of 180 schoolboys of the same age range. We also proposed a validated questionnaire on LBP prevalence and clinical characteristics that was compared to a normal sample of 668 schoolboys. The collected validated measurements were plumbline distances from kyphosis apex (C7, T12 and L3) and ATR according to Bunnell. We calculated the Sagittal Index (SI: sum of the distances of C7 and L3), and the Sagittal Ratio (SR: C7/L3 - relationship between kyphosis and lordosis). According to previous studies, we considered these normal references: 5° (ATR), and cm 1.5-5.5 (C7), 2.8-7.0 (L3) 5.5-11.0 (SI) 0.37-1.31 (SR). We used normality tests, ANOVA and chi-square; the Kruskall Wallis test for non parametric data was also applied.

**Results.** We found statistically significant increases of the plumbline distances from kyphosis apex in C7 (36.6±1.0 vs 33.6±0.7) and T12 (23.0±0.6 vs 21.3±0.8) as well as an increase of SR (0.80±0.03 vs 0.73±0.02). We did not find more pathological cases in soccer pupils than in normals for any of the considered parameters. When compared to normals, soccer players had a statistically significant reduction of most of the LBP parameters. Among LBP sufferers, intensity of LBP was similar in the two populations.

**Conclusion.** Apparently soccer adolescent players have less LBP than controls, while they have a group a tendency to the increase of kyphosis, with an unbalance between the two sagittal curves in favour of kyphosis (increase of the Sagittal Ratio). Even if these changes were statistically significant, they were not clinically significant. We did not find an increase of pathological cases (spinal deformities), but this population was small to detect these variations.

### Affiliation

**ISICO (Italian Scientific Spine Institute), Via Roberto Bellarmino 13/1, 20141 Milan, Italy**
### Abstract

**Objectives:** verifying how changing the posture of the arms, as must be done during standard radiographs to allow visualization of the spine, can change the spinal sagittal angles.

**Background:** x-rays are the gold standard evaluation of scoliosis, and this is considered true also for sagittal plane deformities. While it is very well known that posture drive to changes of scoliosis curves, this has never been verified for sagittal plane; in this case it is even more important because, to see the spine, there is the need to move the arms from the resting physiological position, so changing spinal posture. Today it does not exist a universally accepted standard for arm positioning during radiographs, nor it is known how it influences measurements. Surface devices on one side give possibly more reliable instruments because they allow to maintain the physiological position, on another side consent to verify how changing arms position influences spine configuration. Such a study could not be made with x-rays for safety and technical reasons.

**Methods. Study Design:** transversal study. Population: 85 subjects (50 hyperkyphosis, 33 scoliosis, 2 normals). Hardware: 4-D Formetric. Methods: each subject has been consecutively evaluated in normal standing, then with progressive extension of the shoulders with extended arms (45°, 90°, 135°, 180°), then with arm crossing on the chest (CROSS) and with flexion of the shoulders and elbow to let the hands rest on the shoulders (REST). All sagittal parameters given by Formetric have been considered. Statistics: ANOVA for total and sub-groups.

**Results:** The absolute differences from the standing position of kyphosis angles ranged 4.8-13.3° and were statistically significantly different with rare exceptions. For lordosis the differences were always statistically significant and ranged 4.6-10.4°. The biggest differences have been found with REST and 180°, the lowest with 45°, and CROSS in some cases. Variation of angles depended on changes of spinal configuration, with displacements of the spine both in the sagittal and horizontal axis.

**Conclusion:** According to these results, x-rays are determinant to see bone deformities and for diagnosis, while monitoring outcome can be more reliably and safely done using non-invasive, surface measurements.

### Affiliation

**ISICO (Italian Scientific Spine Institute), Via Roberto Bellarmino 13/1, 20141 Milan, Italy**
### Abstract

**Background.** Muscles shortening within the lower limbs can be observed in adolescents with either structural or non-structural spinal deformities. Whether it is related to the spinal deformity, remains unclear.

The **aim of the study** was to evaluate the lower limbs muscles shortening in a group of adolescents with structural spinal deformity (idiopathic scoliosis, Scheuermann juvenile kyphosis) comparing with adolescents with non-structural postural trunk asymmetries. The hypothesis was that structural spinal deformities are related to a specific pattern of muscle shortening.

**Material.** Sixty-one adolescents, aged 10 to 17 years, were divided into four groups according to the diagnosis: nineteen idiopathic scoliosis having the Cobb angle from 25° to 60°, seventeen idiopathic scoliosis having the Cobb angle from 10° to 25°, eight Scheuermann juvenile kyphosis, and seventeen non-structural postural trunk asymmetries having the Bunnell angle of trunk rotation inferior to 3° (neither scoliotic nor kyphotic structural deformity was present in the last group).

**Methods.** All children were examined by the same observer (first author), using clinical tests to detect muscle shortening within the lower limbs and additionally within the pectoralis major, latissimus dorsi and quadratus lumborum muscles. The results were estimated as 0 (no shortening) or 1 (presence of muscle shortening).

**Results** showed a broad spectrum of muscle shortening in each of the four groups. The muscles the most often shortened comprised: hamstrings, gastrocnemius, soleus, rectus femoris, and hip adductors, while the non-shortened groups concerned pectoralis major, latissimus dorsi, piriformis and quadratus lumborum. No relationship was found between the etiology and the shortening of any examined muscle, however, the limited number of patients prevented the observed tendency to reach statistical significance.

**Conclusions:** Lower limbs muscles shortening seem to be very common both in structural spinal deformities and in non-structural trunk asymmetries (so called faulty posture). The initial hypothesis could not be confirmed; no relationship between spinal and limb pathology could be put into evidence. Larger study groups are needed to explore the question why some lower limbs muscles undergo shortening in patients with structural spinal deformities and whether this shortening presents a separate therapeutic problem.
### Topic
Miscellaneous

### Title
The study on the relationship between functional foot architecture and postural stability in adolescents with scoliosis.

### Authors
Wiernicka M., Kaczmarek D., Łochnińska D., Kamińska E., Cywińska – Wasilewska G., Lewandowski J.

### Abstract
**Objectives:** The aim of the study was to determine the relationship between the functional transformation of foot architecture from unloaded to loaded position and the static and dynamic postural stability in scoliotic children.

**Background:** Decline in postural stability has been reported in scoliotic patients. Foot cavus has been shown to frequently coexist with scoliosis. However, there are no reports whether there is any relationship between foot architecture and balance control in scoliotic patients.

**Material and Methods:** 51 children with idiopathic scoliosis aged 11-18 years were examined. Unloading (sitting) and loading with body mass (standing) plantar photographs were taken. Feet were classified into three architectural types: cavus, rectus or planus, separately in unloaded and loaded position. Then, according to the functional response to loading, the feet were classified as: (1) efficient (cavus or rectus when both unloaded and loaded), (2) feet with reduced efficiency (pes rectus when unloaded transformed into pes planus when loaded), or (3) inefficient (cavus when unloaded but planus when loaded). The patients performed a 30s trial of a double leg stance on a stable platform with eyes open (EO) or closed (EC), then a trial on an unstable platform with EO. The following parameters were measured to assess postural stability: the sway pathway (mm), area (mm²) of the centre of pressure (COP) excursion, mean platform (frontal, FS) and trunk (biplanar - frontal and sagittal, BPS) sway (deg).

**Results:** There were no differences between the groups of the feet with respect to sway pathway and area of COP in both EO or EC trials and platform FS and trunk BPS. However, during balance testing in static conditions with EC the measured parameters were significantly higher in comparison to EO trial in reduced efficient and inefficient groups of feet. Outcome Control of postural stability in patients with idiopathic scoliosis having feet with reduced efficiency or inefficient was more relied on vision than in patients with efficient feet.

**Conclusion:** In adolescents with idiopathic scoliosis no evident relationship was found between foot efficiency (ability to maintain the foot arch under loading) and the parameters describing postural stability.

### Affiliation
University School of Physical Education, Department of Kinesitherapy, Poznan, Poland Stanislaw Staszic State Higher Vocational School in Pila, Poland University School of Physical Education ul. Królowej Jadwigi 27/39 61-871 Poznań Poland - 61 871 - Poland
Bracing for Scoliosis

Treatment of the congenital scoliosis by Cheneau brace: 2 years follow-up.

Cheneau J., Chekrizhev D., Mezentsev A., Petrenko D.

Background: Congenital spinal deformities treatment is a real challenge. Modern standard of the treatment includes surgical interventions intended to correct or fuse spine. In some cases such approach is impossible because of severe comorbidities. We hypothesized that Cheneau brace might be effective in young patients with congenital spinal deformity. This paper is the continuation of our previous study.

Object of the investigation. To study Cheneau brace treatment results in patients with congenital spinal deformities during 2-years follow-up.

Material and methods. We investigated 7 patients with congenital formation failure. 2 patients have wedge vertebra, 5 patients have hemivertebra. They were treated by Cheneau brace from 2007 to 2009. Mean age at the treatment beginning was 5.6 years (range 2-9 years). Full-time regimen was prescribed for all the patients.

Outcome. We observed a significant improvement of Cobb angle, wedge angle and Cheneau index after 1 year treatment. After 2 years radiographic data did not change dramatically, but slightly improved (Table 1).

We conclude that Cheneau active correction principles allow to correct and to control congenital spinal deformities.

<table>
<thead>
<tr>
<th>X-ray data</th>
<th>Cobb angle</th>
<th>Cheneau index</th>
<th>Wedge angle</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before treatment</td>
<td>1 year</td>
<td>2 year</td>
</tr>
<tr>
<td>1. WV</td>
<td>30</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>2. WV</td>
<td>24</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>3. WHV</td>
<td>20</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>4 WHV</td>
<td>23</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>5 WHV</td>
<td>15</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>6 WHV</td>
<td>69</td>
<td>54</td>
<td>54</td>
</tr>
<tr>
<td>7 MSA Thoracic /Lumbar</td>
<td>18/19</td>
<td>22/12</td>
<td>24/7</td>
</tr>
</tbody>
</table>

WV- wedge vertebra; WHV- wedge hemivertebra; MSA-mixed spinal anomaly
<table>
<thead>
<tr>
<th>Topic</th>
<th>Evaluation (Scoliosis &amp; Kyphosis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Prediction of the scoliotic deformity correction in brace.</td>
</tr>
<tr>
<td>Authors</td>
<td>Chekryzhev D., Mezentsev A., Petrenko D., Levytskyi A.</td>
</tr>
<tr>
<td>Abstract</td>
<td><strong>Background.</strong> Prediction of the scoliosis correction is a disputable question. Using traditional radiological methods leads to oncological diseases risk due to radiation overdose. Diagnostic device “Spinal Mouse” is widely used as the tool for the investigation in patients with scoliosis. This diagnostic method may be used for the prediction of the scoliosis correction in a brace. <strong>Object of the investigation:</strong> To study correlation between spinal mobility measured with “Spinal Mouse” and spine correction in the brace. <strong>Materials and methods:</strong> 43 scoliotic patients (12 males, 31 females) were investigated. Mean age was 10.3 years (range 6-15). Mean Cobb angle before treatment was 37.2°. All the patients were investigated before bracing with “Spinal Mouse” in convex side bending position. After three month bracing we assessed Cobb angle and defined a correlation between the spinal correction in the brace and the results of the “Spinal Mouse” test. <strong>Outcome:</strong> Mean deformity angle for “Spinal Mouse” investigation was 17.5°. Mean Cobb angle after bracing was 15°. Correlation coefficient between these data was 0.68. <strong>Conclusion:</strong> “Spinal Mouse” device allows to perform non-invasive spinal mobility investigation and may be used as the method for prediction of the scoliotic deformity correction during the brace treatment.</td>
</tr>
<tr>
<td>Affiliation</td>
<td>Chekryzhev D.-“Orthospine” Kharkiv, Ukraine Mezentsev A., Petrenko D. Sytenko Institute of Spine and Joint Pathology Kharkiv Ukraine Levytskyi A. National Medical Academy Kyiv Ukraine 80 Pushkinskaya street - 61024 - Ukraine</td>
</tr>
</tbody>
</table>
**Topic**  
Evaluation (Scoliosis & Kyphosis)

**Title**  
Psycho emotional disturbances treatment in scoliotic patients treated by brace.

**Authors**  
Levitskyi A., Yaroslavska S., Chekryzhev D., Ryhlevskiy K., Meshkova E, Bebeshko A, Plyatsek V, Velikiy A.

**Abstract**  

**Background.** In spite of positive psychological humour for the brace treatment some patients have psychological stress during initial bracing phase. Even so good correction patient may have bad clinical outcome because of the severe psychological discomfort. This situation results in the psychosomatic disease.

**Object of the investigation:** to study psycho emotional disturbances in the scoliotic patients during the brace treatment.

**Material and Methods.** We studied clinical outcomes in 380 consecutive scoliotic patients (aged from 10 to 18 years old) treated by Cheneau brace. Psychological, psychosomatic and psycho physiological symptoms were analyzed. Psychological therapy included cognitive and expositional therapy, art-therapy and group therapy. For the psychological assessment questionnaires before and after treatment were used.

**Outcome.** Psychological symptoms were revealed in 79,3% patients, psychosomatic symptoms were in 34,1% patients and 45,5% patients had psycho physiological symptoms. Psychological therapy reduced this symptoms in 73,5% patients.

**Conclusion.** Psycho emotional disturbances may impact clinical outcome in patients treated by corrective brace. Appropriate treatment of these disturbance allows to reduce symptoms, to improve quality of life and treatment outcomes.

**Affiliation**  
Levitskyi A., Yaroslavska S National Medical University Chekryzhev D. "Orthospine" Kharkiv Ukraine Ryhlevskiy K. "Oerthotech Service GBMH" Kyiv Ukraine
Meshkova E, Bebeshko A, Plyatsek V, Velikiy A. Central Ukraininan Pediatric Hospital
17 Dragomanova street, apt.171 - 02068 - Ukraine


**Topic**
Bracing for Scoliosis

**Title**
Our Lyon brace with removable neck ring. (preliminary study).

**Authors**
Biagio Iemolo

**Abstract**

**Objectives**: the purpose is to present a spinal orthosis to treat High Apex Thoraco-Lumbar Scoliosis (HA-TLS), according to biomechanical criteria. Our orthosis is a Lyon brace modified by a removable elongation neck ring (easy usable only by night-time), to maximize compliance, in full-time brace treatment, with a brace not visible daytime.

**Background**: HA-TLS is very difficult to correct using other brace except Milwaukee brace (MB). Since the introduction of the MB has been a problem (bad compliance due to cosmetically unacceptable brace). The forces applied to the spine by the MB are well illustrated by White-Panjabi (1). The knowledge of circadian biological rhythm: sleeping, during R.E.M. phase, muscular tone decrease and the gravitational force is not important. Common sense tell us to strike scoliosis night-time with two combined forces: detorsional forces expressed by Lyon brace plus very important elongation forces by neck ring.

**Method and Results**: Inclusion criteria were as follows: girls, idiopathic scoliosis with apex curves cephalic to T8, growing age (10–14 years), Cobb angle of minimum 25° and maximum 45°. Risser sign value was less than 3. The group consisted of 32 girls wearing our brace for more than 3 months with a minimum time of wearing of 21 hours per day and using neck ring night-time. The braces were all made in the same workshop and the treatment was managed by the same physician (2).

**Outcome**: The authors' follow-up is too small (interim results). However Rx control in brace after 3 months (usually required in our protocol) demonstrated excellent initial correction of HA-TLS in all patients. The average initial in-brace correction was 45% for major curves of 35 degrees and 65% for minor curves.

**Conclusions**: HA-TLS represent a very challenge for physician. Neck ring makes the MB brace cosmetically unacceptable to many patients. Bracing is useless without compliance (3). During growth, we believe that the psychological factor is very important, obtaining early improvement of compliance and a positive body image in all patients. Our orthosis has a very low effect on the quality of life and represent an alternative brace to treat HA-TLS in adolescent.

**Affiliation**
Institution: I.S.C. (Italian Spine Center) Via dei Mille n. 238 Vittoria 97019 (Rg) -Italy-
<table>
<thead>
<tr>
<th>Topic</th>
<th>Evaluation (Scoliosis &amp; Kyphosis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Validity of distances from the plumbline in sagittal plane deformities: repeatability, correlation with kyphosis angles and normative values.</td>
</tr>
<tr>
<td>Authors</td>
<td>Zaina F., Negrini A., Atanasio S., Fusco C., Pizzetti P., Saveri F., Ziliani V., Negrini S.</td>
</tr>
</tbody>
</table>
| Abstract    | **Objectives:** Assessing the repeatability of different methods to collect in everyday clinics the sagittal profile of patients with spinal deformities to identify the best one to be used  
**Background:** The sagittal plane measures have a relevant role both in Idiopathic Scoliosis and in Hyperkyphosis management. Nevertheless, clinical tools for everyday use are scarce and not adequately studied. In a previous study we evaluated the intra and inter-rater repeatability and the measure error of the plumbline distance in AIS.  
**Methods:** We performed 4 different studies in 4 different populations of adolescent idiopathic scoliotic and Hyperkyphotic patients. In the first study we report the normative data of the plumbline measures in a general population of 180 adolescents. In the second one we compared the sagittal distances from the plumbline of C7, T12 and L3 with the measures of the Video Rasterstereography at the same levels and the angles of Kyphosis and Lordosis in 100 AIS patients. In the third one we evaluated the intra and inter-rater repeatability and the measure error of kyphosis and lordosis angles measured with the Inclimed in 100 AIS patients. These data have been compared with the plumbline measures. In the last study we evaluated the repeatability of the sagittal distances from the plumbline by using a 1 mm change instead of 5 mm in a population of 40 patients. Statistical analysis: Repeatability has been evaluated according to Bland and Altman, so to identify the limits of variation clinically significant.  
**Results:** Study 1: the normative data were 34±11mm for C7 and 34±15mm for L3 for females and 34±10mm for C7 and 48±10mm for males. Study 2: a coefficient of correlation was calculated, in order to compare measures. Study 3: the k value for Inclimed varied from fair to good. Study 4: the repeatability was fair for this measure.  
**Conclusion:** Some clinical instruments are now available for sagittal plane assessment in AIS and Hyperkyphosis. The results of the present study give the limits during measurements in a clinical setting of parameter that are routinely collected by some clinicians. |
| Affiliation  | ISICO (Italian Scientific Spine Institute) - Via Roberto Bellarmino 13/1 Milan - 20141 - Italy |
Efficacy of specific SEAS exercises for hyperkyphosis: end-growth results of a controlled prospective study.

Authors: Romano M, Negrini S, Parzini S, Atanasio S, Fusco C, Zaina F, Negrini S.

Abstract: Objective: The aim of this prospective controlled study is to present end-growth results of different exercise for Hyperkyphosis.

Background: In scientific literature there are not available papers on exercise in the treatment of adolescent hyperkyphosis. It’s possible to find only papers on exercise to avoid progression of kyphosis and risk of fall in elderly age. Nevertheless, this is a diffuse approach to this pathology especially in Europe and Japan.

Methods: Study design Controlled prospective study Population 40 adolescent outpatient (19 male, 21 female) with hyperkyphosis were divided into 2 exercise groups and treated with exercise until end-growth. SEAS Groups (18 subjects) treated with specific SEAS exercises at our centres. CONTROL Group (22 subjects) treated with “classical” exercise at different facilities.

Outcome criteria - Difference in the number of braces prescribed. - Mean plumbline distances at C7 and L3. - Number of patients clinically changed. According to a previous study we consider clinically significant a change of at least 10 mm. Statistics Anova, t-test, Chi square

Results: Three patients in the control group had a brace prescription versus none in the SEAS. No significant statistical differences between pre treatment values in two groups. No significant statistical differences between post treatment values in two groups. Statistically significant Improvement of plumbline distance measures after treatment in both groups. The number of improved patients was significantly higher in the SEAS Group (p<0.05) while the number of worsened patients significantly higher in Controls.

Conclusion: Physical exercises to improve hyperkyphosis in adolescents are effective. The quality of exercises seems to be relevant to reduce brace prescription and to achieve a better result.

Affiliation: ISICO (Italian Scientific Spine Institute) - Via Roberto Bellarmino 13/1 Milan - 20141 - Italy

<table>
<thead>
<tr>
<th></th>
<th>C7</th>
<th>L3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre treatment</td>
<td>Post treatment</td>
</tr>
<tr>
<td>SEAS</td>
<td>61 (12)</td>
<td>39 (11)</td>
</tr>
<tr>
<td>CONTROL</td>
<td>54 (12)</td>
<td>41 (12)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre treatment</td>
<td>Post treatment</td>
</tr>
<tr>
<td></td>
<td>47 (11)</td>
<td>41 (13)</td>
</tr>
<tr>
<td></td>
<td>46 (14)</td>
<td>42 (12)</td>
</tr>
</tbody>
</table>

Modification of C7

<table>
<thead>
<tr>
<th></th>
<th>% IMPROVED</th>
<th>% STABLE</th>
<th>% WORSENED</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEAS</td>
<td>77.78</td>
<td>22.22</td>
<td>0</td>
</tr>
<tr>
<td>CONTROL</td>
<td>36.36</td>
<td>50</td>
<td>13.64</td>
</tr>
</tbody>
</table>

Number of patient

|       | 22          | 15       | 3          |

Modification of L12

<table>
<thead>
<tr>
<th></th>
<th>% IMPROVED</th>
<th>% STABLE</th>
<th>% WORSENED</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEAS</td>
<td>33.33</td>
<td>55.56</td>
<td>11.11</td>
</tr>
<tr>
<td>CONTROL</td>
<td>27.27</td>
<td>38.63</td>
<td>36.36</td>
</tr>
</tbody>
</table>

Number of patient

|       | 12          | 19       | 10         |
**Topic**  Bracing for Scoliosis

**Title**  New results for 495 patients with adolescent idiopathic scoliosis treated with the SpineCor brace.

**Authors**  Circo A.B., Coillard C., Rivard C.H.

**Abstract**

**Objective**: The purpose of this prospective interventional study was to confirm the effectiveness of the SpineCor treatment for patients with adolescent idiopathic scoliosis and to demonstrate the stability of the spine after the end of the brace treatment.

**Study design**: From 1993 to 2009, 840 AIS patients were treated using the SpineCor brace. 495 fitted patients have a definitive outcome and 405 patients finished the treatment with the SpineCor brace. 225 patients have a follow-up period of at least 2 years and 94 patients had 5 years or more of follow-up. Assessment of brace effectiveness included:

1) percentage of patients who have 5º or less curve progression and the percentage of patients who have 6º or more progression,

2) percentage of patients who have been recommended/undergone surgery before skeletal maturity,

3) percentage of patients with curves exceeding 45º at maturity (end of treatment) and

4) 2-years follow-up beyond maturity to determine the percentage of patients who subsequently underwent surgery.

5) percentage of patients that corrected or stabilized their Cobb angle 5 years after the weaning point.

**Results**: As demonstrated before the SpineCor brace does alter the natural history of the adolescent idiopathic scoliosis. This study showed that 71.2 % of patients (353 out of 495) corrected or stabilized their initial Cobb angle, and only 52 patients (10.5 %) had 6º or more progression of their initial Cobb angle without an indication for surgery. 74 immature patients out of 495 (14.9 %) required surgical fusion while receiving treatment. Only 16 patients (3.2%) withdrawn from the treatment.

**Conclusions**: The SpineCor brace is effective for the treatment of adolescent idiopathic scoliosis. The positive outcomes are maintained even after the weaning of the brace. Moreover, one third of the patients still corrected their Cobb angle in the five years period after the end of the treatment.

**Affiliation**  Research Center, Sainte-Justine Hospital, & University of Montreal, 3175 ch. Côte Ste-Catherine, Montréal, Québec, H3T 1C5 Canada
Bracing different types of adolescent hyperkyphosis: end-growth results of a controlled retrospective study.

Fusco C., Atanasio S., Zaina F., Negrini S.

Objectives: To verify the efficacy of brace treatment of adolescent hyperkyphosis, idiopathic and due to Scheuermann Disease (SD), on clinical parameters.

Background: Adolescent hyperkyphosis, both idiopathic and due to SD is frequently treated with brace, nevertheless results are scarce and, especially there are few studies about the use of TLSO.

Study Design: retrospective controlled study. Population: 15 patients with diagnosis of hyperkyphosis (10 male and 5 female, average age at diagnosis 13.8) that arrived at the end of treatment since our database start in 2003. Patients with idiopathic hyperkyphosis were 5 (2 females and 3 males) and 2 of them presented back pain at the start of treatment. In the group with SD there were 2 females and 8 males and 5 patients were painful.

Methods: For all patients were prescribed a brace after first visit (Maguelone brace for 23 or 21 hours per day). Mean duration of treatment was 2,65 years. Outcome criteria: Mean C7 and L3 plumbline distance change and number of patients for which there was a significant change for C7 and L3 according to a previous study, where we considered clinically significant a change of at least 10 mm; disappearance of back pain. Statistics: ANOVA and chi-square.

Results: Pre treatment C7 distances from plumbline in SD group was 73.5± 7.5mm and post treatment was 60±15.1 while L3 distance changed from 70,5± 9.6mm to 39±8,4mm; about idiopathic hyperkyphosis patients we observed for C7 distance a change from 71± 4.1 mm to 41.0±7.4mm. These changes were statistically significant in both groups but not among groups. About clinical significant changes 70% of patients improved and 30% unchanged in SD vs 100% improved in idiopathic for C7; for L3, 40%improved and 60%unchanged in SD vs 90% improved and 10% unchanged in idiopathic one. Back pain disappeared within the first 6 months of therapy in all patients.

Conclusion: Brace can correct effectively adolescent hyperkyphosis both idiopathic and due to SD allowing a progressive reconstruction of sagittal outline. Even if results are better in idiopathic group, however brace shows to improve also SD by ensuring also a proper vertebral body growth.
Clinical measurements, radiological and cosmetic improvements in a adolescent idiopathic scoliotic girl treated with Schroth rehabilitation program; A single case study.

Orna Herling1, Masharawi Youssef2 (BPT, MSc, PhD)

Summary of background: The Scoliosis Intensive Rehabilitation (SIR) program is commonly used as a conservative three dimensional treatment. SIR consists of individualized correction of scoliotic posture and breathing pattern with the help of proprioceptive stimulation and physiotherapeutic methods. Adolescent idiopathic scoliosis (A.I.S.) is a three dimensional deformity of the spine defined as a series of vertebral segments placed in extension, which deflect and axially rotate towards the same side. It represents the combination of torsional regions joined by junctional zones. Established biological risk factors of A.I.S. are growth velocity and potential residual spinal growth assessed by maturity indicators. The following four factors were established as progressive factors that are related to the “vicious cycle concept”: a) asymmetrical loading of the spine; b) vertebral growth modulation; c) spine slenderness; d) growth potential.

The aim of the current single case study was to demonstrate the significant improvement of Cobb angle, clinical measurements and cosmesis using the SIR treatment.

Methods: A 15 years old girl (menarche age 13.3 years with Tanner 5) was referred to me for an intensive scoliosis rehabilitation after her refusal for a surgical intervention. The following spinal parameters were indicated at a day of her appearance: Thoracic Cobb angle = 520; Risser Sign = 4; angle of trunk rotation (ATR) = 140; angle of axial rotation=220 (Perdriolle); Lumbar lordosis = 240; thoracic kyphosis = 17 0 (inclinometer). Using the SIR, the treatment’s goal was to facilitate correction of the asymmetric posture and to teach the patient maintain the corrected posture during her ADL.

Results: After 6 months of individual SIR treatment, the above measured parameters indicated the following: the thoracic Cobb angle decreased to 420; ATR decreased to 100; angle of axial rotation decreased to 15 0 ; lumbar lordosis and Thoracic kyphosis remained almost the same ( 230 and 160, respectively). The patient felt comfortable with cosmetic results.

Conclusions: This single case study indicates that SIR can improve Cobb angle, clinical measurements and cosmetic appearance avoiding an operation of a young girl with a Cobb angle of above 500 degrees and Risser sign of 4. Further studies are surely required for validating this conclusion.
**Title**  
Compliance and satisfaction of TLI-bracing in kyphotic and scoliotic deformities in relation with intrinsic dynamic aspects.

**Authors**  
Van Loon P.J.M., Thunnissen F.B., Roukens M, Munneke J.

**Abstract**  
**Objective:** To show good compliance and satisfaction in wearing a corrective brace with TLI = Thoracolumbar Lordotic Intervention technique and stress on the important dynamic parts in this type of treatment.

**Background:** Former rigid non-dynamic TLSO braces are known for their troublesome compliance and patient satisfaction. Dynamic braces can have good compliance but do not easily reach evident corrections. A solution was found in a short rigid brace with evident dynamic aspects by concentrating forces in a symmetric natural way at the Thoracolumbar joint.

**Method and Results:** In a group of 91 adolescent kyphotic and scoliotic deformities with earlier presented results in radiologic correction a questionnaire was done after at least one year (mean 1,6) wearing the brace. Also a registration was performed on the times the brace could be adapted towards more corrective lordosis and extension.

**OUTCOME:** Compliance was estimated by physician and parents and scored bad in 5,5%, fair in 30,8% and good in 61%. Unknown 2%. Progressive alterations in shape by adding pads to increase lordosis at the TL joint and bending the sternal support backward was done in mean 5,1 times by the orthotist. No skin sores were reported. Satisfied or very satisfied on the whole of treatment was 58,2% resp. 26,4% of ten children. Easiness of brace wearing scored very good in 11%, good in 46,2% and fair in 25,3%. Satisfaction on perceived results scores satisfied in 45,1%, very satisfied in 34,1%, neutral in 9,9% and unsatisfied in 6,6%. Different subgroups were studied and will be presented.

**Conclusions:** TLI braces are accepted very well by children with spinal deformities. Not the radiograph was leading for them, but the fact that good compliance was rewarded with gradually improved posture with regained mobility by the dynamic philosophy behind the technique.

**Affiliation**  
Slingeland Ziekenhuis Doetinchem, Postbus 169 7000 AD Doetinchem The Netherlands
<table>
<thead>
<tr>
<th>Topic</th>
<th>Physiotherapy for Scoliosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Stabilization of progressive thoracic adolescent idiopathic scoliosis under brace treatment and DoboMed physiotherapy.</td>
</tr>
<tr>
<td>Authors</td>
<td>Durmala J., Kotwicki T., Piotrowski J.</td>
</tr>
</tbody>
</table>
| Abstract    | **Background:** Conservative management of progressive idiopathic scoliosis, consisting of bracing and physiotherapy, aims to stabilize the curvature in the period of rapid adolescent growth. Prospective study using predefined inclusion criteria is a method of objective verification of the treatment.  

The **aim of the study** was to prospectively evaluate the patients with progressive idiopathic scoliosis managed with Cheneau brace and DoboMed physiotherapy.  

**Material:** Twenty-eight consecutive pre-menarchial girls aged 10 to 14 years (mean 12.6 ± 1.1 years) started the treatment for thoracic idiopathic scoliosis, having radiological proof of progression. Eighteen of them had an additional structural lumbar curvature. The Cobb angle revealed the value of 21.0° to 40.0° (mean 30.8° ± 5.5°) in the thoracic curvature and 17.0° to 40.0° (mean 29.1° ± 8.2°) in the lumbar curvature. The Perdriolle angle of axial rotation of the apical vertebra was 2.0° to 28.0° (mean 8.7° ± 5.6°) in the thoracic curvature and 4.0° to 30.0° (mean 11.9° ± 8.8°) in the lumbar curvature.  

**Methods:** Cheneau brace was ordered for full time wearing, accompanied with DoboMed daily physiotherapy. The initiation of the treatment took place during a 2 week in-patient stay at the rehabilitation department in order to adjust the brace and teach the patients and the parents the technique of exercises. The Cobb angle was controlled once a year with an out-of-brace standing radiograph. The duration of therapy is now 30 to 68 months, mean 43 ± 9 months. Eleven patients completed therapy.  

**Results:** The effective time of daily brace wearing was from 8 to 23 hours, mean 12.9 ± 5.0 hours. In the last control the thoracic Cobb angle was 17.0° to 53.0°, mean 34.0° ± 9.2°, the lumbar Cobb angle was 15.0° to 51.0°, mean 29.2° ± 10.4°. Three patients (11%) exceeded the value of 50° of Cobb, considered to be surgical indication: two in the thoracic and one in the lumbar curvature. Stabilization of the Perdriolle angle of axial rotation was noted: 0.0° to 28.0° (mean 10.5° ± 7.0°) in the thoracic curvature and 2.0° to 33.0° (mean 13.4° ± 9.2°) in the lumbar curvature.  

**Conclusion:** Stabilization of progressive thoracic scoliosis during the period of rapid adolescent growth was achieved in 89% of girls using the brace and specific physiotherapy. |

| Affiliation | Department of Rehabilitation University Hospital Medical Center of Silesia Ziolowa Str. 45/47 40-635 Katowice Poland |
**Can Back Shape Screening be used to Predict the Risk of Falls in the Elderly?**

An Exploratory Study Investigating the Relationship between Spinal Curvature and Postural Sway in Healthy Subjects.

**Authors**


**Abstract**

**Objectives**: The primary objective of this study was to evaluate the relationship between spinal curvature and postural sway in the frontal and sagittal planes in asymptomatic young adults. A secondary objective was to look at this relationship over a time period of 15 minutes.

**Background**: 1 in 3 people over the age of 65 years experiences a fall every year in the UK. A significant factor contributing to the higher risk of falling in the elderly is attributed to an increase in postural sway which is a good indicator of static standing balance. Alterations in back shape with age have also been linked to an increase in postural sway. There is however a scarcity of research that has investigated this relationship. It may be possible to predict those at risk of falling through back shape screening, thereby preventing accidents before they occur.

**Methods**: Twenty five healthy young adults, aged 20-32 years volunteered to take part in this study. Approval was gained from the University of Teesside, Ethics committee. A Microscribe 3DX Digitiser was used to measure spinal curvature and a Kistler Force Plate calculated postural sway values. Each participant stood on the force plate for a period of 15 minutes. Back shape measurements and a 30 second force plate reading were taken simultaneously at the start and again at 15 minutes.

**Results**: A significant positive correlation was found between Lumbar Lordosis and Anteroposterior Sway measured at the start (r = 0.398, p<0.05). The change in Mediolateral sway over 15 minutes was also significantly different (p<0.05). Further, general trends demonstrated that increasing spinal angles in the sagittal plane correlated with increasing anteroposterior sway whilst increasing spinal angles in the frontal plane correlated with increasing mediolateral sway.

**Conclusions**: The research demonstrated the possibility of identifying those at risk of falling, from back shape and postural sway values. Those at risk could then be referred to essential ‘balance and falls’ rehabilitation classes. The authors acknowledge the limitations within this study, that was conducted on normal healthy young subjects. A larger sample on elderly patients is required to further evaluate these preliminary results.

**Affiliation**

University of Teesside School of Health and Social Care Borough Road Middlesbrough TS1 3BA UK
**Topic**: Physiotherapy for Kyphosis

**Title**: A Comparative Study Of The Stability Ball Vs. The Desk Chair in Healthy Young Adults: Sagittal Curvature, Sitting Duration and Usability.

**Authors**: Jonathan Robinson, Josette Bettany-Saltikov, Julian Warren

**Abstract**

**Objectives**: The purpose of this study was to evaluate the effect of seating type on sitting posture through comparison of a modified desk chair and a stability ball in the sagittal plane over duration of 30 minutes. The usability of the stability ball was assessed through the completion of a purposely designed questionnaire.

**Background**: Lower back pain affects a significant number of people throughout working life, meaning treatment and prevention are key topics in back care. In recent years the stability ball has increased in popularity as a common tool used in physiotherapy practice. However its uses have been taken out of the gym and into the workplace as an alternative to the traditional desk chair in an attempt to combat back pain through the belief of encouraging a better sitting position.

**Method**: Twenty eight subjects partook in the study, sourced from the student population of the University of Teesside. Postural information was collected using the Microscribe 3DX Digitiser from Immersion Corp Ltd. (California). A desk chair with the back rest removed was used and categorised as a stable seating type, allowing comparison to the unstable stability ball. Spinal curvature was recorded at the point of initial sitting, and through 10 minute intervals for a total of 30 minutes on each of the seating types. A usability questionnaire was completed by each subject following each sitting trial.

**Results**: The results showed no significant difference with regards to spinal curvatures between seating types (p>0.05). Initial sitting curvature was found to increase significantly over 30 minutes in both the desk chair and stability ball (p<0.05). In addition the results of the usability questionnaire showed a significant difference in 3 of the 8 questions (p<0.05), in favour of the desk chair.

**Conclusions**: No benefits were found through sitting on a stability ball over that of a desk chair in prolonged sitting as both seating types were found to replicate a poor sitting position through a kyphosed and slumped posture. The clinical implications of this study serve to benefit any healthcare professional considering use of the stability ball as a replacement desk chair.

**Affiliation**: University of Teesside School of Health and Social Care Borough Road Middlesbrough TS1 3BA UK
Sagittal spinal profile changes in scoliotic children during the brace treatment

Chekryzhev D., Mezentsev A., Petrenko D.

Background: Correction of the sagittal spinal profile is important in scoliosis brace treatment. There are few papers about the sagittal spine evolution during the brace treatment. We suggest that the brace treatment reduces thoracic kyphosis and lumbar lordosis to normal values.

Object of the investigation: To study sagittal spinal profile evolution in the scoliotic patients during the brace treatment. Material and methods. 44 scoliotic patients (10 boys, 34 girls) treated with Cheneau brace were investigated. Age ranged 9-16 years old. Major curve Cobb angle ranged from 22º to 56º. Sagittal spine profile was investigated with diagnostic tool “Spinal Mouse” before and during the brace treatment.

Outcome: We find the perfect correlation between radiographic sagittal spine profile and sagittal spinal profile measured with “Spinal Mouse” (correlation coefficient was 0,97). After three month we revealed thoracic kyphosis and lumbar lordosis decreasing in both groups. Investigation showed an increased sagittal range of motion in the thoracic spine and a restricted range of motion in the lumbar spine (Table 1).

Conclusion: In our investigation we observed the flattening of the sagittal spine profile during the brace treatment. Posterior expansion room forming at the thoracic spine and pressure zones forming at the lumbar spine is not enough for good control of the sagittal spine profile in Cheneau brace.

Table 1. Evolution of the sagittal profile in scoliotic patients during the brace treatment

<table>
<thead>
<tr>
<th></th>
<th>Kyphosis</th>
<th>Lordosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>standing</td>
<td>Bending forward</td>
</tr>
<tr>
<td>Before treatment</td>
<td>19,04</td>
<td>52,6</td>
</tr>
<tr>
<td>After 3-4 month</td>
<td>14,13</td>
<td>50,1</td>
</tr>
</tbody>
</table>

Chekryzhev D.-"Orthospine" Kharkiv, Ukraine Mezentsev A., Petrenko D. Sytenko Institute of Spine and Joint Pathology Kharkiv Ukraine Levytskyi A. National Medical Academy Kyiv Ukraine 80 Pushkinskaya street - 61024 - Ukraine
**Topic** Biomechanics

**Title** Developing a new brace with pressure measurements.

**Authors** Hermus J., Hulsbosch M., Guldemond N., Rhijn L. v.

**Abstract**

**Introduction:** Pressure measurements are being used to understand the brace working mechanism, because the forces exerted by a brace cause correction of the scoliotic curve. The **aim of the study** was to understand the mechanism and effectiveness of adjustments in a new developed brace by using pressure measurements.

**Material and Methods:** Adjustments of a new developed were performed on a silicon doll and on one person. The effectiveness of the adjustments was checked by pressure measurements.

**Results:** 8 adjustments were performed on the thoracal pelotte of a new developed brace. One of the adjustments gave the maximum pressure of 41,3 kPa at the apex of the thoracal curve. The total pressure of the thoracal pelotte was 253,6 kPa. We assume that this adjustment would improve more the acceptance and comfort of the brace. And therefore could improve the compliance.

**Conclusion:** We advise to perform adjustments on a brace or developing a new brace under the control of pressure measurements.

**Affiliation** Department of Orthopaedic Surgery University Hospital Maastricht P.O. Box 5800 6202 AZ Maastricht the Netherlands
Effectiveness and quality of life of the brace 2000 compared with the Boston brace.

Hermus J., Hulsbosch M., Guldemond N., Rhijn L. v.

Introduction: Nowadays the effectiveness of brace treatment is being questioned by the lack of compliance. Therefore the brace 2000 is developed to improve the comfort and acceptance for the individual patient.

Material and Methods: Pressure measurements were performed in 15 patients wearing the golden standard/Boston brace and in 10 patients wearing the brace2000 to understand the efficacy between the two braces. The quality of life was being measured by using the SRS 22 and Brace Questionnaire.

Results: The mean duration of brace treatment prior to participating the present study was 25.5 months for the Boston brace and 13.9 months for the Brace 2000. In the Boston brace group the mean primary right thoracic curve was 35.8°; the mean secondary curve measured 24.1°. The mean corrective force over the lumbar brace pad in standing position was 394 N; over the thoracic brace pad it was 453 N. In the Brace 2000 group the mean primary right thoracic curve was 30.9°; the mean secondary curve measured 16.0°. The mean corrective force over the lumbar brace pad in standing position was 404 N; over the thoracic brace pad it was 567 N.

Conclusion: There is a tendency that the Brace 2000 give the same or even a bit higher pressure but with a higher quality of life comparing to the classic Boston brace.
Bracing for Kyphosis

**Title**: Supine fulcrum bending test and in-cast correction of Scheuermann thoracic kyphosis.

**Authors**: Kotwicki T., Ostiak W., Janusz P., Szulc A.

**Abstract**

**Background**: Patients with Scheuermann juvenile kyphosis often require conservative management with a series of corrective casts, followed by anti-kyphotic brace. Flexibility of the kyphosis can be assessed during supine fulcrum bending test. The aim of the study was to analyze the radiological flexibility of kyphosis and immediate in-cast correction in a series of patients conservatively treated at our department.

**Material**: From 2001 to 2007 eighty-six adolescents were conservatively treated for Scheuermann juvenile kyphosis of thoracic location. Charts of 55 patients: 39 boys and 16 girls were accessible. The age was from 11 to 18, mean 14,6 ± 1,6 years. The location of hyperkyphosis was middle thoracic in most cases apart from five patients with thoraco-lumbar location. In 18 patients a mild non-progressive scoliotic curvature was present, it did not exceed 25° of Cobb; a clinically visible scoliosis concerned 50% of girls and 20% of boys. The scoliosis pattern did not follow any currently used scoliosis classification; the curvature was not harmonious.

**Methods**: On the lateral full cassette standing radiograph the angle of thoracic kyphosis Th4-Th12, and lumbar lordosis Th12-S1 were measured. On the frontal radiograph the angle of scoliosis was assessed. The flexibility of kyphosis was assessed on supine fulcrum bending lateral radiograph. The in-cast kyphosis angle was measured on standing lateral radiograph.

**Results**: The initial kyphosis angle ranged from 40° to 80°, mean 59,2° ± 9,3°. The lordosis angle ranged from 53° to 96°, mean 76,3° ± 9,3°. The kyphosis angle on supine fulcrum bending test ranged from 13° to 55°, mean 30,4° ± 9,7°. The kyphosis angle in the reclining cast ranged from 22° to 74°, mean 44,3° ± 12,5°. There was no correlation between the age and the supine bending correction. There was a correlation between the correction obtained with the supine bending test and the immediate correction in the cast (r=0,64, p=0,0012).

**Conclusion**: The reduction of the kyphosis Cobb angle by supine fulcrum bending was 50% on the average, while in the cast in standing position half of this correction only was maintained.

**Affiliation**: Department of Pediatric Orthopedics and Traumatology University of Medical Sciences, Poznan, Poland - ul. 28 Czerwca 1956 roku nr 135 61-545 Poznan - 61 545 - Poland
**Title**  
A specific scoliosis classification correlating with brace treatment: description and reliability.

**Authors**  
Rigo M, Villagrasa M, Gallo D.

**Abstract**  
The purpose of the study: to show the intra- and inter observer reliability of a scoliosis classification system correlating with brace treatment.

**Background:** Different classifications have been used mainly correlating with surgical treatment but not with brace principles and design.

**Methods:** A new classification was developed in order to define specific principles of correction with a brace. The classification includes clinical as well as radiological criteria. The radiological system differentiates five basic types called: imbalanced thoracic (or three curves pattern), true double double (or four curve pattern), balanced thoracic and false double (non 3 non 4), single lumbar and single thoracolumbar. The main criteria are the curve pattern according to SRS terminology, the balance/imbalance at the transitional point and the L4-5 counter-tilting. To test the intra- and inter-observer reliability of the classification three observers (1 MD, 1 PT and 1 CPO) have measured (and one of them, the MD, re-measured) 51 AP radiographs including all the types.

**Results:** The intra-observer Kappa value was 0.87 (acceptance >0.70). The inter-observer Kappa values fluctuated from 0.61 to 0.71 with an average of 0.71 (acceptance > 0.70).

**Conclusions:** A specific scoliosis classification which correlates with brace treatment has been proposed with an acceptable intra- and inter-observer reliability.

**Affiliation**  
Institut E. Salvá. Via Augusta 185. 08021 Barcelona, Spain
Test-retest standard error of measurements for full-torso surface topography parameters in healthy teenagers.

Watkins E.M., Parent E., Emrani M., Hill D.

Objectives: To assess the test-retest standard error of measurement (SEM) of full-torso surface topography (ST) parameters in adolescents without spinal deformities.

Background: ST is used to quantify the external deformity of the torso due to scoliosis. A normative ST database is being developed to help interpret the ST parameters used to describe scoliosis. Test-retest SEM has not been estimated for most parameters in this population.

Methods: Twenty-two healthy volunteers between 10-17 years old, with a body mass index of 19.1±3.3 kg/m², scoliometer measure of 3.6°±2.5°, and without pain were included. Four Minolta 910 Laser Scanners and a standard positioning frame were used to record ST scans. One evaluator positioned all subjects, marked 11 reference points, and scanned. Immediately after, reference points were erased, landmarking and scanning repeated. ST parameters were extracted with custom designed software in Matlab by one evaluator digitizing reference points. Nineteen previously published and 7 newly proposed ST parameters were extracted. Test-retest standard error of measurement was calculated for each parameter. SEM was estimated for the minimum, maximum and the range of within-subject values for parameters extracted. SEM <4mm, <5° or <0.2 for a ratio were considered adequate based on values in patients with scoliosis.

Conclusions: Test-retest SEM of 15 of 26 ST parameters in healthy adolescents were found adequate for developing a normative database. Six of the 7 newly developed parameters had adequate SEM.

Affiliation

University of Alberta 3-48 Corbett Hall Edmonton, AB. T6G 2G4 - T6G 2G4 - Canada
For each cross-section, the position of the Centroid (1), Humps (2 and 3), PAX and BSR axes are estimated.
**Abstract**

The **purpose of the study**: To compare two different scoliosis brace designs for a particular curve pattern.

**Background**: The Chêneau brace is considered one of the standards in the treatment of juvenile and adolescent idiopathic scoliosis. The RSC brace, a Chêneau derivative, uses a specific clinical and radiological classification in order to define the most effective principles of correction.

**Methods**: **Case control study.** Eleven patients with long thoracic curves (imbalance three-curve pattern or A1 from the Rigo classification) treated with a specifically designed RSC called ‘three curves brace with open pelvis’ were compared to a control group of 10 patients with the same age and curve magnitude, treated with a classical RSC brace for three-curve scoliosis pattern. Patients with a combined upper thoracic structural curve were not included in any of the groups. Mean age = 10.5 years, mean Cobb angle = 29.5°, mean axial rotation = 15°. The compared values were the in-brace correction of the Cobb angle and the axial rotation.

**Results**: The in-brace correction of the Cobb angle was 76.7% in the study group compared to 43.3% in the control group (p<.005). The in-brace correction of the axial rotation was 55.9% in the study group compared to 29.9% in the control group.

**Conclusions**: In-brace correction of the Cobb angle and axial rotation can be improved in patients with long thoracic curves treated with a recently described brace design (three-curve-scoliosis brace with pelvis open) in comparison with the classic RSC model for this curve pattern.
Quality of life of patients with juvenile idiopathic scoliosis undergoing conservative treatment.

Kolebacz M., Durmala J., Czemicki K.

Background: One of main purposes of treatment is improvement of a quality of patient’s life in biological and, what is no less important, social and psychological aspect. Pain, limitations of movement, medical recommendations and methods of rehabilitation affect this indicator. The aim of the study was an assessment of the quality of life in group of adolescents with idiopathic scoliosis. We got knowledge about their main problems in social, emotional and personal aspects of life with consideration of a scoliosis and method of conservative treatment.

Material: 69 adolescent, aged 10 to 18, were classified into two groups according to method of treatment. Thirty nine patients underwent Cheneau bracing and physiotherapy by DoboMed program and thirty were treated by physiotherapy only.

Methods: All children were asked about their social, emotional and biological problems related to their illness and method of treatment. Group wearing brace answered 24 points questionnaire, the non-braced group answered 21 points one. Each question had answer scale from 1 (never) to 5 (always) points.

Results: The Cheneau brace affected negatively adolescent quality of life in social and biological aspects. Most of researched persons declared feeling ashamed in a school environment and experience of an uncomfortable sense of heat and pressure. Patients treated by physiotherapy only did not experienced negative consequences of their illness and applied treating methods.

Conclusions: Application of Cheneau brace with physiotherapy negatively affects the quality of life of teenage patients, whilst patients treated only with the use of physiotherapy do not feel ill. The main problem of patients using braces is feeling ashamed and physically discomforted, as well as other minor factors decreasing a quality of life.

Department of Rehabilitation University Hospital Medical Center of Silesia Ziolowa Str. 45/47 40-635 Katowice Poland - 40635 - Poland
**Abstract**

**Objective:** The aim of this paper is the evaluation of end-growth results in three groups of adolescent patients with mild scoliosis treated only with exercises.

**Background:** Systematic reviews on conservative treatment based on physical exercise to contrast scoliosis progression have proved efficacy of this approach. It’s still unclear which kinds of exercises are more effective; indeed we already showed the higher short term efficacy of SEAS.02 approach.

**Methods Study design:** Prospective controlled study Population 38 adolescent idiopathic scoliosis patients (6 male; 32 female, 13.5+/- 3.5 age range, Risser 0-3 C°>10, B°>5) whom were prescribed only exercises to avoid progression at first evaluation: all patients were enrolled consecutively. Patient were divided into three groups: SEAS group treated with specific SEAS exercise, CONTROL group patients with no treatment and OTHER treated with different protocol. Outcome criteria Percentage (%) of patients who needed bracing; % patients improved, stable or worsened according to SRS criteria (change >5° Cobb and >3° Bunnell); worst curve mean PRE/POST treatment Cobb degrees (C°); worst curve mean PRE/POST treatment ATR (Bunnell degrees - B°). Statistics ANOVA and chi-square are performed

<table>
<thead>
<tr>
<th>BRACED</th>
<th>% IMPROVED PATIENTS B°/C°</th>
<th>% STABLE PATIENTS B°/C°</th>
<th>% WORSENED PATIENTS B°/C°</th>
<th>PRE C°</th>
<th>POST C°</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEAS</td>
<td>8% (*)</td>
<td>8% - 16%</td>
<td>76% - 54%</td>
<td>16% - 30%</td>
<td>14°±4°</td>
</tr>
<tr>
<td>CONTROL</td>
<td>55% (*)</td>
<td>9% - 9%</td>
<td>36% - 36%</td>
<td>55% - 55%</td>
<td>13°±6°</td>
</tr>
<tr>
<td>OTHER</td>
<td>29% (*)</td>
<td>6% - 7%</td>
<td>65% - 50%</td>
<td>29% - 43%</td>
<td>16°±2°</td>
</tr>
</tbody>
</table>

**Conclusion:** Not all exercises for scoliosis have the same efficacy: this study proves again the efficacy of SEAS.02 when compared to usual care. In an age at risk, the group with the qualitatively better treatment (SEAS) has demonstrated an improvement of median values, but also the less effective treatment has allowed a higher stabilization if compared to natural history. In our view, the most important difference is the one in terms of bracing, because when scoliosis is of low degree, the aim of treatment is mainly avoiding more aggressive treatments, with higher impact on patient’s quality of life.

**Affiliation**

ISICO (Italian Scientific Spine Institute), Via Roberto Bellarmino 13/1, 20141 Milan, Italy
**Abstract**

**Objective:** The purpose of this study was to examine effects of hyperkyphosis on static and dynamic balance control of schoolgirls.

**Background:** Biomechanical factors such as spinal deformities can result in balance control disorders. Many studies showed balance control disorders in scoliotic subjects.

**Materials and methods:** In a comparative study, a Bertec force platform was used to record center of pressure (COP) data. Ten female adolescents with hyperkyphosis (mean age: 13.9 years, mean Cobb angle 52) were compared to 14 age-matched control schoolgirls (average age 14.8 years) in static and dynamic balance tests. In static tests, we used two visual conditions (eyes open and closed) and the subjects were asked to perform the tests on their dominant limbs and on both limbs. Dynamic tests included forward, right and left reach, using a standard reach device.

**Results:** Statistical analysis showed no significant difference in static balance tests. But in dynamic tests, significant differences were seen between the normal and hyperkyphotic subjects, in a way that the mean value of parameters were higher in normal subjects in right and left reach tests, performed with right and left hand respectively (p < 0.05).

**Conclusion:** The present results reveal that hyperkyphotic subjects might have less range of motion in lateral trunk movements and hence less limit of stability than normal subjects, since they probably showed poorer performance than normal controls in order not to lose their balance.

**Affiliation**

*Faculty of Rehabilitation, Iran University of Medical Sciences; General Rehabilitation Center of Iranian red crescent society, Shahid Yasemi St, Vali-E-Asr St, Post box 15584, Tehran, Iran*
Physiotherapy for Scoliosis

Title

Authors
Wnuk B., Durmala J., Dzierzega J., Piotrowski J., Walusiak M.

Abstract
Aim of the study: The assessment of influence joint physiotherapy (DoboMed and OTM Kaltenboru - Evjenth) to the function of the respiratory system and the morphology of the ribcage in short-term intensive physiotherapy in the Department of Rehabilitation.

Material and methods: Thirty girls with AIS (mean age – 14.5y.; Cobb angle – range 12-40 degree) were examined. The group was divided into two randomized subgroups. DoboMed was applied in group “D” only. DoboMed and manual therapy was applied in the group “DK”. The physiotherapy was been continued for 3 weeks. The spirometry, the strength of respiratory muscles (maximal inspiratory and expiratory pressures - MIP, MEP), kyphosis (plurimeter-V) and the angle of trunk rotation (ATR) in thoracic part (Bunnell scoliometer) were estimated twice – before and after therapy.

Results: Values of MIP and MEP (p<0.01) were been significantly increased in both groups (before and after therapy). In the group “DK” - compared with group “D”- were observed significant increasing of forced expiratory volume in one second - FEV1(p<0.05), increasing of kyphosis (p<0.01) and decreasing of ATR (p<0.05) were observed

Conclusion: Using of joint physiotherapeutic methods in the treatment of AIS provides to the functionally improvement of the respiratory system and the morphology of the ribcage in the short time.

Affiliation
Department of Rehabilitation University Hospital Medical Center of Silesia Ziolowa Str. 45/47 40-635 Katowice Poland
<table>
<thead>
<tr>
<th>Topic</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Senile osteoporosis – two models of physiotherapy.</td>
</tr>
<tr>
<td>Authors</td>
<td>Walusiak M., Durmala J., Detko E., Wnuk B., Kolebacz M.</td>
</tr>
</tbody>
</table>
| Abstract     | **Background:** Osteoporosis is a big problem in medical, economic and social aspects. The main consequences of osteoporosis are fractures provided to a disability and death in the elderly persons. The aim of the prospective study is evaluation of effectiveness of two models of physiotherapy in group of in-patients with senile osteoporosis (short-term analysis -3 weeks).  

**Material and method:** 34 female with senile osteoporosis in the age 65-84 years were examined. All patients were divided into two randomized groups. Both groups were applied the same programme of physiotherapy (antigravity, strengthening, balance, stretching, coordination, circulatory, respiratory, relaxation exercises). The only difference in these two groups was the type of walking training performed on a treadmill (in the group “F” was applied forward waking and in the group “B” backward walking). Two parameters were subjected to assessment - the strength of the knee extensor muscles (by tensometry) and correction of thoracic kyphosis (by plurimeter-V).  

**Results:** Statistically significant increase of the knee extensor torque was observed. The increase was significantly higher in the group “B” in comparison to the group “F”. The correction of thoracic kyphosis was seen in both groups.  

**Conclusions:** Using backward walking training in the physiotherapy of female senile osteoporosis patients, greater increase the knee extensors torque has been received in comparison with forward walking training in the same period. Backward walking training provided to the significant postural improvements in senile osteoporosis patients. |

<p>| Affiliation   | Department of Rehabilitation University Hospital Medical Center of Silesia Ziolowa Str. 45/47 40-635 Katowice Poland |</p>
<table>
<thead>
<tr>
<th>Abstract</th>
</tr>
</thead>
</table>
| **Objectives:** Non-invasive dynamic analysis of movement ranges, asymmetries in scoliosis and other back deformities and averaging of series of images.  
**Background:** Objective parameters in diagnostics and treatment of back problems are normally acquired through invasive, time-consuming and/or expensive methods. Non-invasive and significant objective parameters can be extracted from a dynamical 4D reconstruction.  
**Methods:** The Formetric 4D measurement system dynamically scans and reconstructs human back surfaces with a frequency up to 24 Hz. Automatic detectable fix points and invariant features on the surfaces correlate with a high degree of accuracy with the spinal processes and pelvis. Thus it is possible to calculate parameters derived from spine and pelvic position, displacement and rotation, like kyphotic and lordotic angles, pelvic symmetry and torsion, spinal rotation and displacement. Variations in postural movements in upright position of patients may however lead to significant reduction of repeatability of examinations. Series of images with automatic calculation of the average values solve this problem. In a dynamic examination, predefined movements are analysed regarding symmetry and range of motion.  
**Results:** The robustness and reproducibility of reconstruction parameters significantly improve by taking average of a series of images recorded over a period of 3-10 sec. In the Matthias’s test, kyphotic and lordotic angles show the break-up of the standing posture over time. The Romberg test gives information about fluctuation movements of upper body relative to pelvis. Asymmetry by stepping gives information about pelvic and spinal blockages.  
**Conclusion:** Significant dynamic parameters can be calculated without invasive or radiation methods.  

| Affiliation | Diers International, Dillenbergweg 4, 65388 Schlangenbad, Germany |
Abstract

Objectives: Defining through non-invasive surface instruments a way to measure Objective Aesthetic Parameters and obtain an aesthetic Classification of idiopathic Scoliosis.

Background: Aesthetics is a main aim in scoliosis treatment as defined by SOSORT. Objectivation of aesthetics is difficult; recently TRACE has been proposed as a possible option, being the objectivation of the subjective medical expert evaluation. Objective measures are needed for an automatic classification of aesthetics in scoliosis and other severe back deformities. A 3D reconstruction of the back surface delivers a set of objective parameters used as a basis for an aesthetic classification.

Methods: The Formetric measurement system reconstructs human back surfaces in semi-real time. From the acquiesced 3D data a set of objective anatomical and aesthetical parameters can be calculated in an automatic way: – shoulder rotation, slope angle and height difference – scapula symmetry – symmetry of flanks and waist triangles – humps and asymmetry in waist region – pelvic displacements The above parameters form a basis from where classification indexes can be calculated and derived according to a specific set of expert rules.

Results: Especially in severe cases it is possible to transfer the essentials of relative subjective classifications to objective measures and parameters. Vague and hard-to-catch impressions like “it doesn’t look good” can to a certain degree be judged by neutral criteria: Shoulder and pelvis symmetry; angles, area- and height-differences of scapula; differences in waist triangles, etc.

Conclusions: The visual impression of aesthetic correlates closely to the above parameters.
**Topic**  Physiotherapy for Scoliosis

**Title**  Pulmonary Function In Adult Scoliosis: A Prospective Case Report

**Authors**  Moramarco, Marc

**Abstract**  

**Objective:** To evaluate efficacy of a three-dimensional exercise program for adult scoliosis treatment, when executed on an outpatient basis.

**Background:** Thoracic scoliosis patients exhibit reduced vital capacity (VC) (<80% predicted for age and height) and chest expansion. To date, the long-term impact of these changes on health and function in scoliosis patients remain unexplored. However, reduced VC (<80%) is correlated with increased mortality in healthy subjects (Mannino et al., 2003 Thorax 58: 388). In a previous study (Weiss, 1991; Spine 16:88), improved VC and chest expansion were documented across a population of 800 patients in a four-week intensive inpatient treatment. In the current study, the potential for implementing the principles of this program on an outpatient basis was explored.

**Case:** The patient, aged 53 years, presents with a 37º right thoracic curve from T4 to T11. Treatment constituted a one-on-one three-hour per day Schroth program (Weiss, 1991). This nine-day program over a two-week period includes an initial examination, patient education, specific scoliosis mobilization, Physio-logic exercises, Schroth exercises and ADL’s (Activities of Daily Living). Outcome measures included spirometry, chest expansion, Cobb angle, and clinical photographs. Measurements were taken at intervals over five months. A patient of similar age with a curvature that did not involve upper thoracic vertebrae was included for comparison.

**Results:** Chest expansion improved from 4 cm (9/7/08) to 4.6 cm (9/16/08) to 5.0 cm (1/23/09). At the same time points, VC improved progressively from 2058 ±63 ml (86% predicted) to 2358 ±38 ml to 2517 ±17 ml (105% predicted). No changes in VC or chest expansion occurred in the control case.

**Conclusions:** A two-week intensive outpatient Schroth scoliosis program resulted in an 18% improvement in VC and a corresponding 20% increase in chest expansion, in an adult patient. The >450-ml increase in VC is comparable to results obtained with adult patients treated on an in-patient basis (Weiss, 1991). Long-term results will be followed.

**Affiliation**  Sole Practitioner 3 Baldwin Green Common, 78 - Suite 204Woburn, Massachusetts 01801 USA
**Topic**: Bracing for Scoliosis

**Title**: The Treatment of adolescent idiopathic scoliosis with Cheneau brace: long term outcome.

**Authors**: Cinnella P., Muratore M., Testa E., Bondente P.G.

**Abstract**

**AIM**: The aim of this study is to evaluate our results of the I.S. treatment with Cheneau brace with a medium follow up of 4.5 years

**Methods**: The criteria of inclusion for patients were:
- Diagnosis of evolutive idiopathic scoliosis (I.S.)
- Exclusive treatment by Cheneau brace
- 30 months of treatment at least
- Minimum follow up of 20 month

Every patient was studied with anamnesis, clinic exam, and a radiographic examination. From the medical history: age, sex, BMI, type of scoliosis, period of treatment, type or protocol of treatment, time of follow up, old Rx collection and re-evaluation of all curves with Cobb method. All patients were asked to complete a five questions questionnaire (SRS-22 modified) about treatment satisfaction and write a commentary about the main difficulties of treatment. At clinic examination, all anatomic findings were evaluated (height and weight, BMI, rib hump, shoulders and trunk asymmetry, etc). The Rx film was compared with old exams, evaluated with Cobb angle, and rotation of the vertebrae.

**Results**: From 650 patients called, 152 had inclusion criteria. The 91,5% of population were female. The middle time of follow up was of 56,3 months (from 20 to 132). The middle time of treatment was of 56,1 months (from 31 to 108). The 40,8% of patients presented a parent afflicted by scoliosis. The 78,9% of population was previously treated with cast (40,3% utilized only one cast for 3 month). At the final analysis:
- At the end of the treatment we observed an average initial curves improvement of 23,3% (maximum 45,1% - minimum 28,9%).
- At follow up we observed a average improvement of 15% from the beginning of treatment (maximum of improvement 37,2% - maximum of lost of 36,9%)

**Conclusions**: At the end of treatment we observed an improvement in correction around at 23% (p value < 0.05) from the beginning curves and after 5 years there was stabilization around at 15 % (p value < 0.05).

We can say that conservative treatment with Cheneau brace is corrective and not only contentious.

**Affiliation**: Istituto Chirurgico Ortopedico Regina Maria Adelaide L.go Dora Firenze 87 Torino - Italy
Painful adult scoliosis with kyphotic evolution and sagittal anterior trunk imbalance treated with physical therapy techniques: three case reports.

Villagrasa M, Pou E, Quera Salvá G, Rigo M.

The purpose of the study: to show positive clinical changes after physical therapy in three patients diagnosed with painful adult scoliosis with a kyphotic evolution.

Background: Painful adult scoliosis presenting a kyphotic evolution combined with an anterior imbalance of the trunk is one of the most difficult clinical conditions in rehabilitation. Clinical changes during rehabilitation treatment (physical therapy) can be measured by using surface topography although postural changes can produce fluctuations and interpretations should be made cautiously. However, this type of patients presents a considerable stiffness of the spine and especially their kyphotic deformity use to be irreducible.


Results: Patient 1: No pain, lateral deviation and rotation decreased from 34 mm and 16º to 26 mm and 12º. Frontal plane imbalance (T1-CSL) decreased from 27 mm to 12 mm. Significant correction of the anterior trunk imbalance and reduction of the kyphotic angle VP-ITL from 66º to 58º. Patient 2: No pain, lateral deviation and rotation decreased from 30 mm and 16º to 19 mm and 10º. Frontal plane imbalance decreased from 46 mm to 21 mm (T1-CSL). Significant correction of the lumbar kyphosis and the anterior trunk imbalance. Patient 3: no pain, lateral deviation and rotation decreased from 27 mm and 15.5º to 22.3 mm and 14º. Kyphotic angle VP-ITL decreased from 65º to 56º with a highly noticeable correction of the junctional kyphosis.

Conclusions: Painful adult scoliosis with kyphotic evolution and sagittal anterior trunk imbalance can be managed by using physical therapy techniques.
**Topic**  
Bracing for scoliosis

**Title**  
The relationship profit / risk and the side effects of the orthopaedic treatment.

**Authors**  
Le Blay Grégoire

**Abstract**  
The orthopaedic treatment by thermoformed material is an often long treatment and although there is not a contraindication absolved in this type of treatment, there are well enough known side effects. It is indispensable to present to the patient within the framework of the information about the treatment the various unwanted effects which he may meet [2, 3]. Cochrane analysis of existing data on corsets was published in 2008, but 7 studies found on the prevention and 8 studies reported to type of treatment were analyzed in term of efficiency on the pain. It was not brought back by data concerning the tolerance or the possible side effects connected to the wearing of the brace. Biot indeed brings back the history of the orthopaedic treatment Lyonnais which developed in the 1955s with Stagnara. He explains the indications, details, the progress with first time plastered during a month then a brace during 6 months. He presents the results obtained by various teams. Finally, he evokes the possible complications with: The gravest but exceptional is the cast syndrome which can arise during a circular plaster in case of important postural correction. It imposes a gastric draining by probe before the ablation of the brace – On the lung level the collapse of a respiratory failure can be provoked by a too stiff preservation in particular on a major kypho-scoliosis. A possible destabilization of the abdominal internal organs (hernia, cystocele). Vasculo-nervous hurts (lower limbs stasis, compression of the femoro-cutaneous nerve). Mammary hurts with type of nodules. Cutaneous hurts at the level of the zones of hyper support, with erythema, tanning of the skin which can go to the reversible blackening, the ulceration, bursitis, finally microbial infectious hurts or mycosis were bound to the maceration. Psychological and aesthetic genes are finally evoked as well as the habituation possible for the port of the brace. In this abstract we report a study over 50 braces worn more than 6 months and we present the side effects reported by the patients.

**Affiliation**  
Centre medico-chirurgical et de réadaptation des Massues Lyon - France
Surgical treatment for Scheuermann juvenile kyphosis: presentation of four cases.

Kotwicki T., Janusz P., Szulc A.

Abstract: Surgical treatment is reported to be rarely necessary for Scheuermann juvenile kyphosis. Important deformity, thoraco-lumbar location and back pain are considered indications for operation. The aim of the study is to present the patients surgically treated for Scheuermann juvenile kyphosis during ten years of our department activity.

Material: Since 1999 one-hundred-ten patients were admitted for conservative treatment of Scheuermann juvenile kyphosis. The number of out-patient treatments was not accessible. Four patients (4% of hospitalized patients) underwent surgical treatment. The age of surgery was 16, 16, 17 and 18 years, respectively. The sagittal thoracic Th4-Th12 Cobb angle was 80°, 85°, 80°, and 100°, respectively. The level was middle thoracic. The reasons for surgery were: (1) back pain non calmed with conservative therapy, (2) deformity unacceptable for the patient.

Methods: The surgery consisted of posterior correction with Cotrel-Dubousset instrumentation and spinal fusion using autologous iliac bone graft. The sagittal Cobb angle was measured before and at follow-up on a standing long cassette lateral spinal radiograph.

Results: The postoperative sagittal Cobb angle was 36°, 42°, 38°, and 70° respectively; the values equivalent to the pre-operative supine fulcrum bending test. There was no loss of correction (5° or more) in the follow-up period in three patients. One patient (patient 2) presented implant dislodgement at 24 months after surgery, accompanied by deep infection around the instrumentation, requiring implants removal; in this patient the correction was lost from 42° to 80° at 5 years follow-up. The clinical result was satisfactory in the three patients but insufficient in one. No patient revealed back pain at follow-up.

Conclusion: Surgical correction of Scheuermann juvenile kyphosis concerned 4% of patients, those who presented an unacceptable and painful deformity. Operation resulted in important angular correction equal to pre-operative supine bending test. Late postoperative complications caused loss of correction in one patient.
Bracing for Scoliosis

Debate on: Bracing in Adolescent Idiopathic Scoliosis Trial (BrAIST) – will the expenditure pay?

Weiss H.R.

Abstract
Adolescent idiopathic scoliosis has been regarded as being a disease of relatively benign character without disastrous effects on the individuals health [1]. Therefore treatment indications can be primarily regarded as aiming at psychological / cometic benefits of the treatments [2]. As a matter of fact level II evidence has been established for conservative treatment [3], while there is no evidence of higher level for operative treatment [4] and the real existing risks of surgery have not been clearly defined, yet [5,6,7].

A five-year, >$5 million project is being funded by the United States National Institutes of Health, the Canadian Institute of Health Research, and other international spine centers. Although a randomization protocol scientifically can only be used in standardized and therefore comparable treatments and conditions, this study design has been chosen to follow-up patients with scoliosis. Neither the condition with a variety of different curve pattern, different curve stiffness and possible different stages of maturity (even when the data show agreement), nor the braces of different standards and different approaches can be standardized satisfyingly. Therefore the RCT is not at all the appropriate protocol for the attempt to answer the question risen. Of course RCTs offer the highest evidence, but only if the design can be estimated as being appropriate and for this population it is not.

There is already evidence on a high level for bracing and to expose the control population of this study to the high risks of surgery in case scoliosis progresses to an extent the patient cannot comply with, seems rather negligent. Even more, when one considers (1) the high risks of surgery [5,6,7], that (2) there will be no guarantee for improvement of the clinical condition [8] and (3) that health related problems can neither be solved nor prevented by surgical treatment [5,9], this study from the patients perspective seems a risky endeavour. How reliable can a scientific society be regarded, whose members do not believe in a prospective controlled study on bracing they have established themselves [10] and at the same time can go ahead with surgical treatment, which scientifically raises more questions than it can provide answers. Last not least: initially a measure for the brace quality was not included in the study protocol! So with whatever strict or not strict inclusion criteria: if the subject (brace) investigated in a RCT cannot be clearly defined, the outcome of that study will say one thing: Nothing at all!


Orthopedic Rehabilitation Services Alzeyer Str. 23 D-55457 Gensingen, Germany
**Topic**: Bracing for Scoliosis  

**Title**: The Treatment of Adult Scoliosis Utilising the SpineCor Dynamic Corrective Brace.  

**Authors**: Louise Marcotte BSc DC, Christine Coillard MD, Pascale Dion DC, Charles-Hilaire Rivard MD.  

**Abstract**  

**Introduction**: Scoliosis and spinal deformities offer little hope for rehabilitation in the adult population. Pain and viscerosomatic dysfunction are frequently encountered and conventional medical care uses rigid bracing, medication and surgery in the most serious cases. The treatment of adult scoliosis with The SpineCor® Dynamic Corrective Brace deserves more attention. It offers a great variety of combinations to better spinal alignment and posture, depending on the curve type, its severity and rigidity. The main therapeutic goal is to reduce pain and the strain on the neuromusculoskeletal system. The brace acts as a dynamic support against compressive loading on the inter-vertebral joints, while creating a corrective movement in the spine which produces neuromuscular integration.  

**Methods**: 73 adult scoliosis patients, 63 females and 10 males, aged between 18 and 93, with Cobb angles of 15 to 93° of curves of all types and many different etiologies, were fitted with a SpineCor® Brace. Results: Of the 65 who have actively been wearing it anywhere from 10 to 154 hrs/week, 29 have seen complete resolution of their symptoms while in brace, 14 of which had a Numerical Pain Scale (NPS) of 5/10 and over. Although the brace had little effect on the curve itself, especially in older patients, and while there has been 1 reported case of aggravation in leg radiculopathy, we found an overall 60% improvement in the pain status of these patients who have been actively wearing their brace.  

**Discussion**: These results suggest that the SpineCor® Dynamic Corrective Brace is a promising conservative method for the treatment of scoliosis in the adult population as it allows for the patients to improve their pain status and wellbeing.  

**Affiliation**: Posturetek 2823 Boulevard Rosemont Montréal, Québec H1Y 1L6 Canada
**Topic**  Bracing for Kyphosis  

**Title**  The treatment of Hyperkyphosis utilising the SpineCor® Dynamic Corrective Brace: some preliminary results.  

**Authors**  Louise Marcotte BSc DC, Christine Coillard MD, Pascale Dion DC, Charles-Hilaire Rivard MD.

**Abstract**  

**Introduction:** Hyperkyphosis has long been reported to be associated with many health disorders, both psychological and patho-mechanical. Very few options for the management of this condition are available in medicine, while conservative treatment like chiropractic and physiotherapy can only offer limited structural rehabilitation. Although originally designed for the treatment of AIS, The SpineCor® Dynamic Brace offers a great variety of options for the treatment of Hyperkyphosis. According to our morphologic classification of hyperkyphotic thoracic curves: Upper Thoracic (UT) (often associated with an anterior thoracic translation relative to pelvis); mid-thoracic (MT) (often associated with hyperlordosis and no significant ribcage translation), and lower thoracic (LT) (often associated with posterior translation of ribcage), many combinations of brace fittings have been designed for the creation of vectors that create a specific corrective movement for the patient spine and posture.

**Methods:** 16 adult hyperthoracic kyphotic patients, 12 males and 4 females, aged 19 to 81 were fitted with a SpineCor Dynamic Brace according to the morphology of their curves: UT (6 patients) MT (4 patients) and LT (6 patients). Postural comparative evaluation was made with PosturePrint® software which provides a Posture Index, and radiologic measurements were made with a posterior tangent method using segmental angles, and then compared to the Harrison Sagittal Spinal Model (HSSM).

**Results:** The UT group got significant pain relief from 2.4 to 1/10 while their posture index went from 15.3 to 12.2; pain in the MT group went from 3.75 down to 2/10 while the posture index reduced significantly from 17.75 to 12.75; and the LT group seemed to benefit the most from the brace as their overall pain went from 5.7 to 2.2 although their posture index actually increased slightly from 14.7 to 17.3. Although their overall sagittal balance was better, none of these groups benefited from a significant change in their thoracic lateral curve, as is to be expected in adults.

**Discussion:** These results suggest that the treatment of adult thoracic hyperkyphosis with the SpineCor® Dynamic brace appears to be promising. It should imperatively be applied to younger patients who have the potential to grow out of their deformity.

**Affiliation**  Posturetek 2823 Boulevard Rosemont Montréal, Québec H1Y 1L6 Canada
<table>
<thead>
<tr>
<th>Topic</th>
<th>Bracing for Kyphosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>On the Necessity to Differentiate Between Thoracic Hyperkyphotic Curve Types Based on Architecture in Order to Elaborate an Appropriate Treatment Strategy.</td>
</tr>
<tr>
<td>Authors</td>
<td>Louise Marcotte BSc DC, Christine Coillard MD, Pascale Dion DC, Charles-Hilaire Rivard MD.</td>
</tr>
<tr>
<td>Abstract</td>
<td><strong>Introduction</strong>: Regardless of aetiology, a morphologic classification of thoracic hyperkyphosis is needed for health care professionals to treat their patients adequately. Traditionally, thoracic hyperkyphosis has been defined as a curve of more than 50° using the Cobb angle at differing vertebral levels. This radiologic curvature cut-point offers limited understanding of the overall deformity that occurs in the spines of hyperkyphotic patients. For example, hyperkyphosis can be created by different postures in the sagittal plane and can be localized to different regions in the thoracic spine for a given Cobb angle. Recently, ideal geometric, average geometric, and individual optimized geometric sagittal plane curve models for thoracic kyphosis have been presented in the literature. Using these models as a normative starting positions of thoracic kyphosis it may be possible to describe and differentiate types of hyperkyphosis. <strong>Methods</strong>: According to our clinical experience and based on the Harrison Sagittal Spinal Model (HSSM), we have chosen to distinguish between at least three (3) great morphologic categories of hyperkyphosis in the general population, plus a fourth one in the geriatric population, which has already been described in depth in the scientific literature. Postural analysis should include the lumbopelvic/inferior limb relative to feet and shoulder/cervical relative to ribcage, as well as any posterior or anterior translation of the ribcage relative to pelvis and to shoulders/ribcage. According to the postural and vertebral segmental alignment defined by rotations around the X axis and translations along the Z axis, and segmental angles created by tangents drawn on the posterior vertebral bodies (HSSM), we can observe where the deformity is most accentuated: • Lower thoracic (mostly postural) Hyperkyphosis often associated with a posterior translation of the ribcage relative to the pelvis, (except for Sheuermann’s kyphosis type II). • Mid-thoracic (and often most severe) Hyperkyphosis often associated with lumbar hyperlordosis but no significant translation of ribcage relative to pelvis (except for Sheuermann’s kyphosis type I). • High thoracic Hyperkyphosis often associated with anterior translation of ribcage relative to pelvis. And thus use a treatment strategy that is much more precisely as well as globally addressing the deformity for best rehabilitative results.</td>
</tr>
<tr>
<td>Affiliation</td>
<td>Posturetek 2823 Boulevard Rosemont Montréal, Québec H1Y 1L6 Canada</td>
</tr>
</tbody>
</table>
Topic: Adult Deformity

Title: Treating Adult Scoliosis and Back Pain with the SpineCor Pain Relief Back Brace.

Authors: McAviney J., Pappas T.

Abstract: Objective: This presentation explores the issues of treating adult scoliosis and pain by conservative means. We present two case studies of different types of adult scoliosis, successfully managed with the SpineCor brace.

Background: Management of pain in adult scoliosis represents a significant clinical challenge. Both adolescent scoliosis in the adult (ASA) and degenerative de-novo scoliosis (DDS) can cause significant pain. Over recent years the SpineCor brace has been used by practitioners in the treatment of painful adult scoliosis. To date SpineCor has been used clinically in adult treatment in hundreds of cases and the empirical results seem positive.

Methods and Results: Patient A: A 26 year old female with painful ASA, had pain prior to SpineCor treatment an average of 7/10. Using the SpineCor brace, daily 8 to 12 hours for 3 months, she had a gradual relief of her pain to 1-2/10. Initial x-ray shows a 32° right thoracic scoliosis. In the SpineCor brace 1 month after fitting the x-ray shows an improvement of 8° to 24°. Her pain relief of 1-2/10 and spinal correction have been maintained for over 2 years by using the SpineCor brace on an occasional basis.

Patient B: A 47 year old female with a DDS, had pain prior to treatment an average of 8/10. In the SpineCor brace, she had an immediate relief of her pain to 3/10. The initial x-ray shows a 40° degenerative lumbar scoliosis. In the SpineCor brace, x-rays show an improvement of 7° to a 33° curve. Her pain relief of 0-3/10 and spinal correction have been maintained for over 2 years by using the SpineCor brace on a daily basis. Note the improved left lateral shift showing “spinal off loading”.

Outcome: Both patients achieved significant pain reductions over a 2 year period, demonstrating that in these cases the SpineCor brace has been an effective treatment for pain related to ASA and DDS.

Conclusion: Prospective research in a large population is required to determine the overall effectiveness of the SpineCor brace but early results seem positive.

Affiliation: The London Scoliosis Clinic UK
Bracing for Scoliosis

**Title**
Initial results of SpineCor treatment of Adolescent Idiopathic Scoliosis in Seville, Spain.

**Authors**
Vera Miller A.

**Abstract**

**Objective:** The objective of this study was to understand the effectiveness of the SpineCor brace in patients treated in Seville, Spain.

**Background:** The SpineCor brace is used at St. Justine Children’s Hospital in Montréal. There results claim that SpineCor is an effective treatment for AIS. We chose to study the effect of the brace on our patients and see if they were similar to the Montreal results.

**Methods:** Thirty seven (37) patients were treated using the SpineCor Brace in Seville. Of the thirty seven (37), thirty three (33) patients met criteria of the SpineCor Corporation international multicenter study treatment protocol. These patients were still under treatment and had not yet achieved a definitive outcome i.e. two years follow up post brace treatment. The girls were premenarchal or less than 1 year postmenarchal. Effectiveness was looked at as (1) a percentage of patients with an initial Cobb angle reduction of 5 degrees or greater; (2) percentage of patients with an initial Cobb angle increase or decrease of less than 5 degrees (3) percentage of patients with an initial Cobb increase of 5 degrees or greater and (4) the number of cases progressing to require surgery or undergone surgery.

**Results:** To the end of the first year, successful treatment (correction >5 degrees, or stabilization +/- 5 degrees) was achieved in 32 of the 33 patients studied from the time of fitting of the SpineCor Brace to the point which last Cobb angle was measured during bracing. This meant an overall correction/stabilization for 97% of the patients in Seville, Spain during their first year of treatment. One out of 33 patients (3%) had curve progression of more than 5 degrees and has undergone surgery.

**Conclusions:** The SpineCor Brace is a potentially effective treatment of adolescent idiopathic scoliosis. We need to continue our study over a longer period until patients achieve a definitive result. However these initial results seem promising and are similar to the initial results originally achieved at the St. Justine Hospital.

**Affiliation**
Centro de Enfermedades de la Columna Vertebral. C/Jáuregui 4-6, portal D, B-2. 41003 Seville - Spain
**Abstract**

Since its creation, the foundation has focused on researching the Etiopathogeny of idiopathic scoliosis. All research projects submitted to the Foundation are reviewed by the Scientific Board. If they are pre-selected, they are to be approved (on a financial level as well) by the Administrative Board. Research projects are usually supported for 2 to 3 years.

**CURRENT RESEARCH STATUS**

Since 2000, 29 research laboratories spread all over the world (18 laboratories, 9 countries) are supported both financially and scientifically. In fact, each year the Foundation organizes meetings at the Institut de France, gathering all researchers. It enables them to discuss their work, to acquire a better knowledge in areas they are not familiar with and have fruitful inter-disciplinary talks.

Today, these research are listed under 4 main themes

- Genetics
- Neuro-sensory
- Metabolic
- Biomechanical

1. **Genetics**

A great number of candidate genes were identified on many chromosomes within the families of patients (more than 1900 cases), more particularly on the proximal area of chromosome 8q, but also on chromosomes 6, 9, 16, 17, 19. (Teams in Baltimore, Dallas, St-Louis, Hong-Kong)

Big scale and high density genotyping (400 satellites markers or even now 800 markers) on 5 multiple families, with at least 7 persons affected has enabled a research by sequencing the candidate genes. It has shown those areas 17p11 et 19p13 were involved, as well as 2 loci on chromosome 6 (Lyon P. Edery).

In the genetics area, a few remarks can be made:
- The important amount of familial cases,
- A big concordance within homozygote twins,
- Some candidate genes code for the melatonin receptor,
- Idiopathic scoliosis is a polygenic disorder, probably not linked to X chromosome and can be associated to oestrogen receptors.
- Idiopathic scoliosis is a pluri-factorial disease, linking one or many genes to environmental factors.

2. **Neuro-sensory and neuro-muscular physiopathology**

Different projects undertaken by teams who did not know each other and who would explore the neurosensory area via different means have demonstrated the importance of postural balance and its regulation by neurosensory receptors (Paris, Lille, Nancy, Marseille, Québec, Los Angeles, Hong-kong)

The following was demonstrated in patients affected by scoliosis:
- Frequency of anomalies in the vestibular otolith function (Paris S W-V)
- High level of perturbations in somatosensory evoked potential (SSEP), which are very often asymmetrical (Hong Kong),
- Links between abnormal SSEP and posture (Sensory Organisation Test) (Nancy),
- Somatosensory dysfunction was observed by different teams, using different approaches (vision, somesthesy, vestibular function...) (Nancy, Marseille).

A cranio-facial anomaly exists in 8 to 10% of the normal population. It is more frequent in scoliotic patients. Orbital and labyrinth deformity affects the proprioception of the body image and of vestibule-spinal signals. Links between vestibule-spinal reflex and postural balance/control are now well established.

The ocular torsion measured by the AOB right and left (the angle being determined by a horizontal line going from the emergence of the papilla vessels and the line joining this vascular emergency and the fovea) is a sign of vestibular problem if the AOB eye difference between right and left is superior to 4.

A fine study using a MRI model of the semi-circular canals (including bones and membranes) has shown an increased frequency of anomalies for scoliotic patients. A research project is currently conducted to assess the possible association with genetic anomalies (Lille, Paris)

These research imply that scoliosis does not only have a postural origin but that it is also linked to central troubles at the head trunk, controlled by neuro-sensory and somesthesic impulse and by neurotransmitters, with a possible defect in postural balance regulation.

3. **Metabolic and endocrinology**

Hypothesis on the role of melatonin are known. It was demonstrated that a negative correlation between the evolutivity of scoliosis and the blood level of melatonin. A counter-proof/check test was done, giving melatonin to the patient to prevent progression of the deformity (J Dubousset, Machida).

Many studies have confirmed a dysfunction of the platelet calmodulin, more noticeably for scoliotic patients. Platelets share similarities with isolated muscular cells and at the same time melatonin and calmodulin are antagonist. The effect and level of spinal deformation for the pinealectomized chicks are lowered if Tamoxifen is used (Tamoxifen is a known calmodulin antagonist). Research on the calmodulin regulation by chelating agents Ca 2+ATPases will enable non only to progress in the metabolic study of scoliosis but could also result in a non invasive test, a way to detect evolutive scoliosis (Paris, Bobe, Enouf).

A signalling defect of the melatonin was demonstrated in idiopathic scoliosis. Numerous tissues and systems are involved in this anomaly. This particular defect has an effect on osteoblasts (osteopenia), muscle fibers (tonicity problems), proprioceptive functions, vestibular and postural balance. There is a rise in the platelet calmodulin level. Osteoblasts are taken from scoliotic patients. Their culture shows a phosphorylation of the Gi proteins (coupled to MT2 melatonin receptors) which could be the cause of the melatonin signalling defect. This anomaly could be extended to other genes and involve osteopontin. (Montréal A.Moreau)

Based on this, various clinical and biological collections are being processed. There are various purposes:
- relationship with genetic support
- the identification and the value of a predictive factor for the spinal deformity aggravation
- role of the estrogens on the melatonin receptors and their implication in idiopathic scoliosis
- study the inactivation of a gene or the evaluation of a pharmacological element which could prevent the spinal deformity

The neuro-hormonal role of melatonin or its by-products seems to be confirmed.
4. Biomechanics

A study involving 72 scoliotic patients with 3-D modelling and axial vertical pressure simulation aimed to assess biomechanical predictive factors in the aggravation of early detected (and with a small angle) scoliosis. It has been shown how important the axial inter-vertebral rotation degree is at the junction area, either above or below the apex. This confirms the interest of the specific rotation as described by Perdriolle.

Other studies are currently on-going. They aim to specify:
- the importance of the discs’ structure and role,
- the concave and convex morphology
- the biological aspects (i.e. scoliosis and Marfan syndrome)
- the study of collagens and fibril disc, thanks to molecular biology on transgenic mice
- the study of the mechanisms sending nutriments to scoliotic discs through growth plates
- the study of Cerebral Spinal Flow between the concavity and convexity of the curve
- the bone marrow growth, determine if it can induce a deformity
- evaluate the role of the pre-existent vertebral rotation and of dorsal shear forces in fully upright posture (Castelein)

What lies in the future?
The 2000 schema by Thomas Lowe (published in Spine review) has most likely been influential for many researchers. Each team has successfully tried to assess and deepen their knowledge in this area.

All these research will enable an improvement in this enigma that still is idiopathic scoliosis. Their regular comparisons/collations show many converging or complementary points. The boundaries between all disciplines seem to fade. Multifactorial phenomena appear. Clinical tests are being discussed. They could enable the possibility to predict the aggravation of a deformity or even better the apparition of AIS. That would be a major step in the management of this disease.

Were all possible “research paths” explored? Probably not. Which other directions could be considered? How to go further on? These questions are regularly raised by the Scientific Board of the Cotrel Foundation – Institut de France.

The opinions and advices from a group of high level experts (outside the field of the AIS) was sought in order to consider future hypotheses and strategies. How to go further on? What could be the next steps? This group included specialists in areas such as embryology, developmental biology, myology, neurophysiology, genetics or molecular biology.

Each one of them presented a precise synthesis in front of the researchers and the scientific board. They made comments and suggestions for future guidance.

Strong ideas have emerged from this fruitful symposium:
- Animal modelling, to validate genetic or bio molecular hypothesis
- Pre and post-natal development of the basic elements of the spine
- Puberty, along with is numerous implications, and regulation
- Left/right asymmetry, its reasons and its components
- Differences between male and female’s spatial representation and neuro-sensory perception
- A more specific role of the muscles and discs
- Progressive versus non progressive scoliosis
- Central nervous system and its evolution during growth period
- Mechano-transduction or mechano-biology
- The particular input of infantile or some non idiopathic scoliosis
• Additional genetic approaches
• The expansion to research on secondary scoliosis
• The environment
This is quite an ambitious program.
The Foundation will make announcements for more specified researches, based on these orientations.

Two major points have emerged:
- The need to set a precise definition of the idiopathic scoliosis phenotype, for everyone to comply with
- The need for the researchers to access important cohorts of patients, which means a better organization and a more active participation of Departments specializing in scoliosis.

It seems obvious that the improvement of the communication and the possibility to exchange data (either clinical, biological or imaging) on an international level is necessary. That would enable the implementation of databases which could be used by all those involved in these researches.

That would be a major step in a better knowledge and understanding of this mysterious disease named idiopathic scoliosis.
The Pelvis: "Strange attractor" of the postural system. A study based on a group of 332 children between 2 and 12 years old.

Authors: Fimiani A.

Abstract

Objectives

The AIM of this work is to show that the pelvis represents the "strange attractor" of the postural system, or rather, the link between muscular and skeletal systems. Being the pelvis the seat of insertion of muscular chains of legs and trunk, and being muscles controlled by the automatic postural system, the esoreceptorial information lead to condition the spatial order of muscle-skeletal system, so that a correct esoreceptorial conditioning involves a new muscle-skeletal ranging aligned with the centre of gravity.

Background

Theories about postural systems were born during the seventies: they are mainly represented by the Fine Postural System by P. M. Gagey and the Tonic Postural System by B. Bricot. Moreover, in 2005 J. C. de Mauroy supposed the existence of a "strange attractor" leading towards a vertebral curvature of a child's spine. From ontogenesis was evicted that it's the pelvis which, during the verticalization, takes on the role of body stabilizer in the space. Method materials In a period of 5 years 332 children were observed, between 2 and 12 years old. Among them 210 started a receptorial therapy for a term of 24 months. 182 patients showed at the first visit an AP full-spine and lateral full-spine x-rays. Children were photographed, at the first visit and at three months intervals, on the frontal (anterior, posterior) and sagittal plans, in standard position with plantar support with an angle of 30 degrees.

Outcome

Clinical evidences show that in 12 months the pelvis relines, with a consequent re-established balance of the legs. 33 patients with a scoliosis attitude and dorsolumbar deviations - Cobb included between 10 and 18 degrees - at 12 months show an overwhelming improvement (p = 0.0005; r = 0.708). 29 patients with Risser zero and dorsolumbar deviation - Cobb included between 10 and 30 degrees and vertebral rotations included between 5 and 15 degrees - at 24 months show a significal improvement of curves.

Conclusion

The pelvis really is the strange attractor of muscle-skeletal system, it is managed by the automatic postural system, and an automatic postural component exists even in idiopathic scoliosis.

Affiliation

via Dello Stadio 79 Ischia (NA) - 80077 - Italy
**Title**  
The enormous sensitivity of the automatic postural system as origin of iatrogenic pathologies of the skeleton. Transversal study and clinical cases.

**Authors**  
Fimiani A. Di Vincenzo M.

**Abstract**  

**Objectives**  
The purpose of this work is to show the high reactivity of the automatic postural system to every smallest interference on the receptor foot. Interferences can favour the balance or be the cause of lack of balance of muscular chains; in this case they interact on the skeleton through the adaptation of the pelvis.

**Background**  
In 1963 the theory of chaos points out the non-uprightness and the sensibility of systems to the initial conditions; Baron (1955), Bourdiol (1970), Fournier (1980), showed the non-uprightness of the postural system; Roll (1994) showed the influence of the foot on the system. Bricot (1980) supposes that muscle-skeletal pathologies are consequence of the lack of balance of the tonic postural system.

**Method**  
A group of 100 adults has been tested using the subtraction of plantar information test, executed with anaesthetic spray, and some stimulus in addition such as proprioceptive insoles, electro-magnetic insoles, biophotonic flux insoles, PSP frequencial insoles, common comfort insoles, and unilateral support of 4 mm. The behaviour of the system has been documented using a dynamometric foot-board according to Ouaknine with surveys at time zero and with each stimulation; the data have been analysed with the ANOVA method.

**Outcome**  
The analysis of data points out that at eyes open there are no statistically significant variations, as if sight behaved as a superior tampon; some significant variations, instead, are noticed at eyes closed, when proprioception prevails. The spray test points out that the skin of the foot, through the spinothalamic and reticulum-spinal ways, interferes on the symmetry of muscular tone; the addition test proves that all stimulations are significant, as they favour a reduction of tone of calf muscles; this means that it is the muscle-skeletal proprioception of the foot that manages the stability on the tibiotarsal. Clinical cases show that the interferences can do iatrogenic harms.

**Conclusion**  
The transversal observation shows that every information given to feet provokes a reaction, so the automatic postural system is continuously in adaptation; if the stimulations are opposite to its balance, they cause an adaptation of the skeleton with a consequent pathology.

**Affiliation**  
via Dello Stadio 79 Ischia (NA) - 80077 - Italy
**Evaluation (Scoliosis & Kyphosis)**

**Title**
The Surface Evaluation of Spine Through Infrared Stereophotographic Technique: The 3D TMT System

**Authors**
Nali G., D’Osualdo F., Schierano S., Visentini D., Gaudenzi M., Cisotti C.

**Abstract**

**Background**
This study intends to show the first clinical data obtained with a new instrument for non radiographic evaluation of spine deformities, produced by Microsystem (WebCare Division, Milan, Italy). It works through stereofotography (infrared cameras).

**Methods and Results**
Application of reflective markers on patient skin is mandatory, following a precise template, specific for the spine disorder we are evaluating for. The output is constituted of many parameters, some of them are: surface kyphosis (total and portions of it), length of kyphosis, lateral deviations, projections of trunk (C7-L5, or only lumbar tract), trunk movements on sagittal and frontal plane, trunk rotations at different levels, trunk length.

We can measure patients in different attitudes and in different positions. Patient stays in the greatest precision area, well equidistant from the cameras, at a distance from them of 2.30-2.50 mt (ideal position). To measure instrument precision we repeated 15 measures on a dummy, either in the ideal position as described above, or with the dummy inclined, rotated and lifted to the right or left. Errors were the limits of the 2SD from means. We present differences between radiographic and surface evaluations too, and errors due to repetition of measures on a real patient (data in progress).

**Outcomes**
Mechanical precision is 1-2 mm. For a simple measure we need about 30 minutes. In repeated measures with the dummy in the ideal position, the errors were: 1° for sagittal curves and for trunk rotation (level L1), 2 to 7 mm for trunk projection (respectively frontal and sagittal planes), 1 mm for height of posterior iliac spines, 10 mm for trunk length (C7-S1). No errors were made in identification of the inferior limit of surface kyphosis (marker L1).

**Conclusions**
This instrument allows the non radiographic measure of many parameters of interest in care for patients with scoliosis and hyperkyphosis, with subsequent great reduction of total number of rx examination during follow up period; it carries many other potential applications if used in a research context. It has an excellent precision, given that the patient is adequately positioned and the reflective markers are carefully applied.

**Affiliation**
Center of Rehabilitation of Child Onset Pathologies ASS 4 Medio Friuli Via Gervasutta 48 33100 UDINE ITALY
### Abstract

**Background**
Some previous studies supported the clinical effectiveness of the Brügger-concept in the treatment of idiopathic scoliosis and showed that treatment can reduce the values of magnitude in thoracolumbar and lumbar curves. In the Brügger-Concept, which emphasizes self exercises, is used alternating concentric and eccentric contraction against elastic resistance.

**Objectives** The purpose of this case study was to analyse EMG-activity by “Agistic-Eccentric-Contraction-Exercises” with elastic resistance according the Brügger-Concept with main respect to the trunk.

**Subject and Method**
The present pilot study is a case report on a single proband. Surface EMG (Noraxon) was recorded on one healthy subject by 3 exercises resisted by Thera-Band (blue colour). EMG-activity in the whole process of agistic-excentric-exercises were analysed on m. obliquus abdominis int., m. rectus abdominis, m. latissimus dorsi, m.errector spinae TH-L on the right and left side. The EMG activity was analysed and compared with MVC. Results By exercises for improvement the function of trunk lateroflection, rotation and frontal shift of thorax was documented the EMG-activity in m. latissimus dorsi 4 % MVC - 24 % MVC, in m. oblius abd. int. 6 % MVC - 73 % MVC, in m. errector spinae Th-L 1 % MVC - 52 % MVC and in m. rectus abdominis 2 % MVC - 3 % MVC. Throughout the exercise, increases and decreases EMG-activity were seen in analysed muscles. Detailed results will be described in the presentation.

**Conclusion** This pilot study indicates the effectiveness of elastic resistance Brügger-Exercising, which was developed empirically and under support of neurophysiological regulations. Fluent, harmonic motion, provided in whole range of motion, resisted by elastic band in which alternate concentric and eccentric muscle contractions - under permanent in- and decreasing of muscle activation effects agistic-eccentric-contraction-exercises with elastic resistance -a functional exercises in accordance with the Brügger theory. Analysed % of MVC are in conformity with generally functional training requirements. The analysed exercise with respect to the trunk can be therefore seen as one possibility how to prevent trunk deformities. The study was supported by grant from Czech Ministry of Education, Youth and Physical Education MSM 0021620864.

### Affiliation
*Charles University Prague, Dep. of Physiotherapy FTVS*

*J.Martiho 31, Prague 6, Czech Republic - 162 52 - Czech Republic*
**Abstract**

**Background**: Hyperkyphosis in juvenile patient, idiopathic kyphosis (IK) or Scheuermann kyphosis (SK), often require conservative management. We report a series of patients conservatively treated at our department.

**Objectives**: The aim of the study was to analyze the result of conservative treatment.

**Material**: From 01/2000 to 12/2003, 320 patients, 172 males and 148 females, aged 10-16 mean 13.8 ± 1.85 years; IK: 180; SK: 140. The location of kyphosis was middle in 65% of patients and thoraco-lumbar in 35%; we have not retained the cervico-thoracic forms.

**Methods**: Clinical evaluation: topography of curves, C7 and L3 plumbline distances, lower muscles contractures, radiological patterns: On the lateral full cassette standing radiograph the angle of thoracic kyphosis Th4-Th12, and lumbar lordosis Th12-S1 were measured. Cobb angle, bone age, dynamic test flexibility.

**Management**: Physiotherapy (PT), corrective casts if necessary, full time (22h/day), Milwaukee or brace with sternal support, mean duration of the treatment 3.35 years.

**Result**: Cobb angle 50°-60° = 51%; 61°-70° = 34% > 70° = 15%; Flexibility of kyphosis: > 70%; Gpe I = 120 patients (86 IK, 34 SK); Gpe II: flexibility of kyphosis 40% - 70% = 108 (66 IK, 42 SK); Gpe III

**Affiliation**

*Service MPR, unité enfants; Centre d’appareillage, HOPITAL DE BEN AKNOUN Route de Ben Aknoun, Alger 16030- Algeria*
Evaluation of the conservative therapy in the adolescent idiopathic scoliosis Patients with Scoliosis Research Society (SRS) -22

Authors Akiko Misawa, Yoichi Shimada, Naohisa Miyakoshi, Michio Hongo, Yuji Kasukawa, Shigeru Ando, Kana Sasaki.

Abstract

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.

Objectives
The purpose of this study was to investigate the relationship of Scoliosis Research Society (SRS) -22 outcome instrument and the athletic abilities in scoliosis patients during partial brace therapy.

Method and Results
Sixty-eight adolescent idiopathic scoliosis patients treated with brace therapy were investigated. The average age was 13.5 years and the average Cobb angle was 31 degrees. The follow-up period averaged 2.5 years. We conducted SRS-22 questionnaire. We evaluated the results of age, Cobb angle, flexibility of the spine and running ability for domains of SRS-22 (Function/activity, Pain, Self image/appearance, Mental health) using multivariate logistic regression analysis. The mean scores of SRS-22 were as follows: Function/activity: 4.7 ± 0.3; Pain: 4.6 ± 0.4; Self image/appearance: 3.2 ± 0.5; Mental health: 4.4 ± 0.5. There are no significant differences in Function/activity, Pain, Mental health for each factor. There is a significant difference in Self image/appearance for Cobb angle (P=0.044).

Conclusions
We investigated the athletic abilities as the factor related to Function/activity, however, it was revealed that they had not felt any disturbance in their Function/activity. There is also no significant difference for bracing as they were not affected with or without brace. We only found a positive association between Self image/appearance and Cobb angle in this study. It appeared that Cobb angle affects self image.

Affiliation Dept. of Orthopedic Surgery Akita University School of Medicine 1-1-1 Hondo, Akita, Japan - 0108543 - Japan
Comparing the score of Scoliosis Research Society Instrument (SRS-22) between idiopathic scoliosis patients and their brothers and/or sisters

Background
Scoliosis Research Society Instrument (SRS-22) was designed by International scoliosis society for scoliosis patients. However, because there is little data on healthy subjects, it is unknown how the patient is affected physically and psychologically. In this study, we conducted the SRS questionnaire for scoliosis patients, their brothers and/or sisters, who have same circumstances and backgrounds.

Objective
The purpose of this study was to compare the patient's data with the healthy subjects, and to investigate the factor affecting the SRS-22 score.

Methods
Twenty idiopathic scoliosis patients, who visited our out-patient clinic in 2009 and twenty-three of their brothers and/or sisters were included in this study. In the patient group, all of the participants were female and the normal group consisted of twelve males and eleven females. The mean age was 13.6 years old (range 5-21). We compared both group by unpaired t-test and analyzed the effects of four factors, (age, Cobb angle, treated with brace or not, athletic ability (subjective flexibility and short-distance sprint)) on SRS-22 score by Stepwise regression.

Results and Discussion
The averaged score of four domains in SRS-22 was as follows(mean±SD); in patient group Function/activity 9.4±1.4, Pain 9.0±1.4, Self image/appearance 13.4±3.9, Mental health 13.5±0.9. In normal group, Function/activity 9.2±1.4, Pain 8.8±1.0, Self image/appearance 8.7±3.0, Mental health 13.1±1.0. Only the score of Self image/appearance was significantly higher than the normal group (p<0.001). There were no significant relevance with four factors in Pain and Mental health. There was significant correlation between Cobb angle and the score of Self image/appearance (p=0.003). This result suggested that the degree of main curve affects an image of self appearance. We also recognized significant correlation between Function/activity and athletic ability (short-distance sprint) (p=0.004), however there wasn’t statistical difference between the patient and the healthy subjects. We indicated that another factor may affect the ability of short-distance sprint.
Objectives
Because of the present interest about the Health Related Quality of life in the scientific community, the aim of our research is to validate into Spanish the German questionnaire Bad Sobernheim Scoliosis Questionnaire (BSSQ) (mit Korsett), addressed to adolescents with brace.

Background
As adolescence is considered a critical phase, Idiopathic Adolescent Scoliosis has been valued a risk factor for the quality of life (Payne, Ogilvie, Resnick, Kane, Transfeldt, Blum,1997); besides, it could produce psychosocial problems as it strikes the Body Image of the adolescent. The brace could emphasize this aspect.

At the present there are two questionnaires designed to measure the quality of life in adolescents with scoliosis during a brace treatment: German one, Bad Sobernheim Stress Questionnaire (BSSQbrace) and Greek one, Brace Questionnaire (BrQ).

Method and Results
The applied method follows the trans-cultural adaptation through a translation and a back translation, according the use in the international literature.

The questionnaire translated was administered to a Spanish sample consisting of 35 adolescents, aged between 10 and 16 with scoliosis and wearing the same kind of brace (Rigo System Chêneau Brace). Besides, the SRS-22 and a socio-demographics data questionnaire have been used. For the statistical analysis, reliability and validity have been calculated on SPSS 16.0:

■ reliability:
  - test-retest method with a Pearson correlation coefficient of 0,902 (p<0,01);
  - internal consistency, with a Crombach's alpha of 0,809

■ validity:
  -criterion validity, using SRS-22 as criterion, Pearson correlation coefficient of 0,656 (p<0,01);
  -construct validity, in an exploratory Factorial Analysis: two Main Components are found to explicate the variance at 60,8%.

Conclusions
BSSQ.es is reliable with a satisfactory internal consistency and a temporal stability. It has a sufficient criterion validity and a latent structure of two Components according to the Main Components Analysis. It can be used with Spanish adolescents wearing brace to assess their quality of life level. The good statistical features are similar to the German ones.

In a future research, it is hopeful to increase the sample size, including those wearing different types of braces, and to clarify the structure above the questionnaire.

Affiliation
Instituto Elena Salvá. Via Augusta, 185. 08021 Barcelona. Spain
<table>
<thead>
<tr>
<th>Topic</th>
<th>Evaluation (Scoliosis &amp; Kyphosis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Surface Evaluation of Spine Deformities with a stereophotography: the 3D TMT system</td>
</tr>
<tr>
<td>Authors</td>
<td>Nali G., D’Osualdo F., Schierano S., Liva T., Visentini D., Gaudenzi M., Cisotti C.</td>
</tr>
</tbody>
</table>
| Abstract          | This study intends to show the first clinical data obtained with a new instrument for non radiographic evaluation of spine deformities, produced by Microsystem (WebCare Division, Milan, Italy). It works through stereofotography (infrared cameras).

**Objectives**

Application of reflective markers on patient skin is mandatory, following a precise template, specific for the spine disorder we are evaluating for. The output is constituted of many parameters, some of them are: surface kyphosis (total and portions of it), length of kyphosis, lateral deviations, projections of trunk (C7-L5, or only lumbar tract), trunk movements on sagittal and frontal plane, trunk rotations at different levels, trunk length. We can measure patients in different attitudes and in different positions. Patient stays in the greatest precision area, well equidistant from the cameras, at a distance from them of 2.30-2.50 mt (ideal position). To measure instrument precision we repeated 15 measures on a dummy, either in the ideal position as described above, or with the dummy inclined, rotated and lifted to the right or left. Errors were the limits of the 2SD from means. We present differences between radiographic and surface evaluations too, and errors due to repetition of measures on a real patient (data in progress).

**Methods and Results**

Mechanical precision is 1-2 mm. For a simple measure we need about 30 minutes. In repeated measures with the dummy in the ideal position, the errors were: 1° for sagittal curves and for trunk rotation (level L1), 2 to 7 mm for trunk projection (respectively frontal and sagittal planes), 1 mm for height of posterior iliac spines, 10 mm for trunk length (C7-S1). No errors were made in identification of the inferior limit of surface kyphosis (marker L1).

**Outcomes**

This instrument allows the non radiographic measure of many parameters of interest in care for patients with scoliosis and hyperkyphosis, with subsequent great reduction of total number of rx examination during follow up period; it carries many other potential applications if used in a research context. It has an excellent precision, given that the patient is adequately positioned and the reflective markers are carefully applied.

**Affiliation**

Center for Rehabilitation of Child Onset Disorders Institute of Physical Medicine and Rehabilitation, Udine University in Udine Via Gervasutta 48 UDINE - 33100 - Italy
### Abstract

**Background:** The need to limit disco-vertebral constraints without restricting the patient’s everyday activities during episodes of lumbar pain, has led to the production of a standard model brace, its design and functions targeting sagittal balance through: trunk reposition, spinal flexion reduction and lordosis maintenance without putting pressure on the posterior joints. The 4 clinical and experimental studies presented below confirm the importance of this orthosis.

**Clinical Test 1**

**Objective:** To evaluate the effects of wearing a LORDACTIV orthosis on the pain experienced by patients suffering from degenerative lumbar conditions.

**Method:**

113 patients suffering from lumbago were fitted with a corset (56 women and 57 men) with an average age of 42, presenting on average 8 months of persistent lumbar pain or radiculitis (intensity 7.3/10 on the Visual Analog Scale).

Simple X-rays and a MRI allowed the following to be distinguished:

- Discopathy: (black appearance in T2 for discs L4L5 and/or L5S1): 44 cases, average age 38
- Inflammatory disc degeneration (MODIC 1): 21 cases, average age 50
- Disc hernia: 33 cases, average age 42
- Spondylolisthesis: 15 cases, average age 44

**Protocol:**

Corset worn 8 hours a day for 4 weeks, no sick leave was given. Pain evaluation according to the Visual Analog Scale.

**Results:**

The VAS average result after 4 weeks stands at 1.5/10, representing a pain reduction of 80%. The patients judged this result ‘good’ or ‘very good’ in 78% of cases. As regards the different conditions studied, the greatest VAS reduction was for spondylolisthesis (7.3) followed by discopathy (6.5), MODIC discopathy (5.2), and finally disc hernias (5).

**Conclusion**

This study shows the rapid efficiency of the LORDACTIV orthosis on pain in the case of degenerative lumbar conditions.

![Graph showing pain reduction over 4 weeks](image)

---

**Clinical Test 2**

**Objective:** To compare spinal extension and flexion, between LORDACTIV, a conventional lumbar support belt and no orthosis.

**Method:**

<table>
<thead>
<tr>
<th>Condition</th>
<th>LORDACTIV (%)</th>
<th>Conventional Belt (%)</th>
<th>No Orthosis (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal Extension</td>
<td>10</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Spinal Flexion</td>
<td>15</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Discopathy</td>
<td>5</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Disc Hernia</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

*Note: The table above represents the average reduction in pain across different conditions.*
Rachimetric tests on 39 patients suffering from lumbar pain spread out equally between disc herniation DH spondylolisthesis by isthimic lysis SPD discopathy DISCO degenerative discopathy MODIC 1 mechanical sacroiliac conditions SI

**Results:**
The results show that spinal column flexion restriction is only significant with Lordactiv (63% for degenerative lumbar conditions) compared to traditional boned belts, which even facilitate flexion in the case of spondylolisthesis.

![Image](attachment://image.png)

**Experimental test 1**
**Objective:** Comparative study of postural control between LORDACTIV, a flexible belt and no orthosis.

**Introduction:**
Postural analysis is used to finely identify causes of balance problems. In patients suffering from lumbago greater sway compared to healthy subjects has been shown, underlining greater difficulties in maintaining an economical balanced posture. This denotes difficulty in maintaining constant muscular contraction.

**Method:**
6 patients suffering from lumbar pain with discopathy (normal or inflammatory) had to stand on force platform with their eyes closed (hands by their sides) minimising their movements, with or without an orthosis.

**Results:**
The reduction of the surface of movement of the Centre of Gravity (Diagram 1) demonstrates a reduction in body movements with LORDACTIV. The correction initiation time is shorter with LORDACTIV (the time lapse from the moment the subject moves away from the reference position before correcting their posture) compared to the flexible belt (Diagram 2). This means that patients correct disruptions in balance more quickly.

**Conclusion**
These first results show the importance of the LORDACTIV® orthosis in stabilising the posture of patients suffering from lumbar pain compared to a traditional support belt. The patient’s balance strategy is improved, which could be at the origin of spinal stabilization passive structure relief (intervertebral discs, ligaments, joints), and therefore an analgesic effect.
Experimental test 2  
Objective:  
To compare postural strategies with or without LORDACTIV in patients suffering from lumbago after one month of treatment.  
Method:  
6 subjects are observed performing two high risk tasks:  
Carrying a load standing (5 kg for women, 10 kg for men)  
Picking a pen up off the ground  
Results:  
The total duration of the action of picking up the pen is no different after the orthosis has been removed (4.3 seconds compared to 4.9 with an orthosis).  
The adoption of a more economic postural strategy can be observed: the axis of alignment of the trunk, during both bending and lifting, is preserved with or without LORDACTIV; two different strategies were noted, according to the degree of hip flexibility, with some individuals crouching (photos 1 and 2) and others placing their knee on the ground.  
Conclusion:  
There is a residual effect of this protective postural blocking, resulting without doubt from motor-sensory automatisms acquired when wearing LORDACTIVE.  
Residual postural effect after the orthosis has been removed.

Affiliation  
1 - Clinique du Parc – 155 Bd Stalingrad 69006 Lyon  
2 - Prodos, 449 ch. Wette Fays 69300 Caluire  
3 - Université de Savoie 73376 Le Bourget du lac
**LY087** 31 Mars 2009 16:35

<table>
<thead>
<tr>
<th>Topic</th>
<th>Bracing (Scoliosis &amp; Kyphosis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Thoraco-lombar scoliosis treatment with Michel-Allegre brace (three point). tc trocosis angle valuation.</td>
</tr>
<tr>
<td>Authors</td>
<td>Brina Luigi, Nacci Giuseppe</td>
</tr>
</tbody>
</table>
| Abstract       | **Method:**  
|                | Our study is based on trains patients aged between 12 and 15 years suffering from of the thoraco lumbar idiopathic scoliosis teenager, these patients were treated with BUSTO THREE POINTS OF MICHEL ALEGRE for 20 hours per day associated with remedial gymnastics; The angle of trocosi studied by CT has been considered by several AA. We have used different reference points of the coordinates radiographies.  
|                | **Results:**  
|                | Our study of the thirty patients treated with a brace with three points confirms that MICHEL-ALEGRE BRACE can be used for the treatment of lumbar-thoracic scoliosis too. This scoliosis was treated with CHENAU Brace.  
|                | The study was performed with PHILIPS equipment using TC AVE1 Before the CT evaluation was ever performed a radiograph of the spine in orthostatic projections antero-posterior and lateral to exclude other pathologies or not osteostrutturali related. For measuring the angle of scoliosis on AP Radiograms standards we have always calculated the angle COBB, for the evaluation of the angle of trocosi we changed the method of HO et al. considering how the horizontal plane passing through the anterior superior iliac spine in view of substantial anatomic and structural uniqueness of the iliac bone and the sacred. The line of intersection of each vertebral body is the median line on the angle between the plates drawn from the posterior junction of the internal surfaces of the wafer.  
|                | **Conclusion:**  
|                | Our method allows eliminating possible measurement errors due to incorrect positioning of the patient supine on the bed of the CT equipment. |

<p>| Affiliation     | via G. Fanelli 230/b Bari - Italy - 70100 - Italy |</p>
<table>
<thead>
<tr>
<th><strong>1st AUTHORS INDEX</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aulisa A.G., Guzzanti V., Perisano C., Mastantuoni G., Aulisa L.</strong></td>
</tr>
<tr>
<td><strong>Aulisa A.G., Guzzanti V., Perisano C., Falciglia F., Aulisa</strong></td>
</tr>
<tr>
<td><strong>Bernard J.C., Bard R., Pujol A., Combey A., Boussard D., Begue C., Salghetti A.M.</strong></td>
</tr>
<tr>
<td><strong>Bettany-Saltikov J.A., Warren J.G.</strong></td>
</tr>
<tr>
<td><strong>Bialek M., Kotwicki T.</strong></td>
</tr>
<tr>
<td><strong>Brox Jens Ivar, Adobor Raphael D, Rimeslåtten Silje, Kelle Anne</strong></td>
</tr>
<tr>
<td><strong>Chekryzhev D., Mezentsev A., Petrenko D., Levytskyi A.</strong></td>
</tr>
<tr>
<td><strong>Cheneau J., Chekrizhev D., Mezentsev A., Petrenko D.</strong></td>
</tr>
<tr>
<td><strong>Cinnella P. Muratore M. Testa E. Bondente P.G.</strong></td>
</tr>
<tr>
<td><strong>Circo A.B., Coillard C., Rivard C.H.</strong></td>
</tr>
<tr>
<td><strong>Coillard C., Circo A.B., Rivard C.H.</strong></td>
</tr>
<tr>
<td><strong>Alomar E., Castillo J.A., D’Agata E., Pérez Testor C., Rigo M</strong></td>
</tr>
<tr>
<td><strong>Diers H., Mooshake S., Heitmann K.R.</strong></td>
</tr>
<tr>
<td><strong>Dolan L.A., Weinstein, S.L.</strong></td>
</tr>
<tr>
<td><strong>Durmala J., Kotwicki T., Piotrowski J.</strong></td>
</tr>
<tr>
<td><strong>Eshraghi A E., Maroufi N., Sanjari M.A., Keyhani M.R., Saeedi H.</strong></td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Weiss H.R., Goodall D.</td>
</tr>
<tr>
<td>Fimiani A.</td>
</tr>
<tr>
<td>Grivas Theodoros B., Vasiliadis Elias S., Triantafyllopoulos Georgios, Kaspiris Angelos</td>
</tr>
<tr>
<td>Grivas Theodoros B., Burwell Richard G., Mihas Constantinos, Vasiliadis Elias S., Triantafyllopoulos Georgios G., Kaspiris Angelos</td>
</tr>
<tr>
<td>Herling Orna</td>
</tr>
<tr>
<td>Hermus J., Hulsbosch M., Guldemond N., Rhijn L. v</td>
</tr>
<tr>
<td>Kotwicki T., Kubiak A., Szulc A.</td>
</tr>
<tr>
<td>Knott Patrick T, Mardjetko Steven M., Kim Richard, Trznadel Nadine, Huang Jessica</td>
</tr>
<tr>
<td>Knott Patrick, Mardjetko Steven, Lamborne Drew, Stemer Jordan, Strasburg Annalyse</td>
</tr>
<tr>
<td>Kolebacz M., Durmala J., Czernicki K.</td>
</tr>
<tr>
<td>Lemolo Biagio</td>
</tr>
<tr>
<td>Lange JE, Steen H, Brox JI</td>
</tr>
<tr>
<td>LE BLAY Grégoire</td>
</tr>
<tr>
<td>Levvtskyi A., Yaroslavska S., Chekryzhev D., Ryhlevski K., Meshkova E, Bebeshko A, Platsev K, Veliky A.</td>
</tr>
<tr>
<td>Lou E. Hill D, Raso, J. Moreau M, Mahood J, Heddden D.</td>
</tr>
<tr>
<td>Maldji Y.</td>
</tr>
<tr>
<td>McAviney Jeb</td>
</tr>
<tr>
<td>Marcotte Louise, Coillard Christine, Dion</td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>Pascale, Rivard Charles-Hilaire,</td>
</tr>
<tr>
<td>Maruyama T., Takeshita K., Kitagawa T., Nakao Y.</td>
</tr>
<tr>
<td>Misawa Akiko, Shimada Yoichi, Miyakoshi Naohisa, Hongo Michio, Kasukawa Yuji, Ando Shigeru, Sasaki Kana.</td>
</tr>
<tr>
<td>Moramarco, Marc</td>
</tr>
<tr>
<td>Negrini S, Atanasio S, Fusco C, Zaina F Taiana M, Tessera S</td>
</tr>
<tr>
<td>Ogilvie James, Nelson Lesa, Chettier Rakesh, Ward Kenneth.</td>
</tr>
<tr>
<td>Pappas T., McAviney Jeb</td>
</tr>
<tr>
<td>Pavlí D., Pánek D.</td>
</tr>
<tr>
<td>Petrenko D., Chekrizhev D., Mezentsev A.,</td>
</tr>
<tr>
<td>Pizzetti P, Saveri F, Ziliani V, Negrini S, Romano M</td>
</tr>
<tr>
<td>Rigo M, Villagrasa M, Gallo D.</td>
</tr>
<tr>
<td>Sasaki Kana, Misawa Akiko, Miyakoshi Naohisa, Hongo Michio, Kasukawa Yuji, Ando Shigeru and Shimada Yoichi</td>
</tr>
<tr>
<td>Nali G., D’Osualdo F., Schierano S., Visentini D., Gaudenzi M., Cisotti C.</td>
</tr>
<tr>
<td>Van Loon P.J.M., Thunnissen F.B., Roukens M, Munneke J</td>
</tr>
<tr>
<td>Vera Miller A</td>
</tr>
<tr>
<td>Weiss H.R., Werkmann M., Bohr S.</td>
</tr>
<tr>
<td>Wiernicka M., Kaczmarek D., Łochyński D., Kamińska E., Cywińska – Wasilewska G., Lewandowski J.</td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>Wong M.S., Wong W.Y.</td>
</tr>
<tr>
<td>Zaina F., Negrini A., Atanasio S., Fusco C., Pizzetti P., Saveri F., Ziliani V., Negrini S.</td>
</tr>
</tbody>
</table>