

ABSTRACT PROGRAMME

THURSDAY

ABSTRACT SESSION 1

11. Does a Providence Nighttime Brace correct Adolescent Idiopathic Scoliosis in 3D?

Annemie J Sluijter; Moyo C Kruyt; Keita Ito; René M Castelein; Peter R Seevinck; Tom PC Schlösser

Introduction:	Braces for adolescent idiopathic scoliosis (AIS) aim to avoid further curve progression by correcting the three-dimensional deformity with external forces. The primary effectiveness is predominantly evaluated by in-brace coronal curve angle correction using conventional radiographs, as this plane is best accessible for correction forces. However, as the deformity itself is three-dimensional, the amount of correction in the sagittal and axial plane should be evaluated. This study aims to quantify the mechanism of correction of a Providence nighttime brace in 3D.
Material and Methods:	AIS patients with a coronal Cobb angle of 20-40 degrees indicated for brace treatment were included and underwent a dedicated full-spine MRI scan before (without brace), and 5 weeks after initiation of Providence nighttime brace treatment (in-brace). MRI acquisition included 3D T2 sequences, an MRI-based, AI-generated synthetic CT (sCT) as well as a chest MRI. Coronal curve angles, sagittal parameters, axial rotation and periapical coronal and sagittal IVD asymmetry were assessed for the primary main thoracic/(thoraco)lumbar curves.
Results:	19 female AIS patients (mean age 13.0±1.1 years) were included. The mean major Cobb angle reduced from 34±7 degrees in standing position, to 28±9 on the supine sCT before brace treatment, to 9±9 within the brace (74% in-brace correction, P <0.001). Thoracic kyphosis and lumbar lordosis respectively changed from 23 ± 9 and 54 ± 7 degrees in standing position, to 24 ± 9 and 42 ± 6 degrees on supine sCT without brace, to 21 ± 6 and 40 ± 7 degrees within brace (P = 0.319 and P < 0.001, respectively). Mean axial apical vertebral rotation was 11.3 ± 6.0 degrees before brace treatment and decreased to 7.0 ± 5.5 degrees in brace (40% derotation, P <0.001). The periapical coronal disc wedging decreased from a mean convex-concave difference of +37 ± 26 % without brace, to +7 ± 22 % in-brace (81% correction, (P = 0.001). Mean anterior-posterior height difference of the peri-apical discs decreased from 6 ± 14% to 3 ± 15% in-brace (P = 0.534)
Conclusion:	The nighttime brace corrects the three-dimensional deformity of the spine mostly coronally, followed by axially, and with limited correction in the sagittal plane. It corrects the coronal wedging of the peri-apical intervertebral discs to near-complete neutralization.

12. Towards a Universal Scoliosis Bracing Registry: International Consensus-Based Harmonization of Case Report Forms of Major Registries

Annemie J Sluijter; Ane Simony; Ashley Cole; Paul Gerdhem; Benjamin Roye; Alexander Park; Michael Brown; Fabio Zaina; Tom PC Schlösser

Introduction:	Brace treatment is the primary non-operative intervention for adolescent idiopathic scoliosis. Although clinical registries provide crucial real-world data to evaluate effectiveness, the field of scoliosis bracing lacks high-quality, large-scale research, leaving fundamental clinical questions unanswered. While several institutional and national registries exist, direct international comparisons are hindered by substantial variation in data collection, definitions, and documentation. To overcome these limitations and enable multicenter research, data harmonization is urgently required. Therefore, this study aims to establish international consensus on a standardized core dataset, providing a case report form (CRF) as the foundation for a Universal Scoliosis Bracing Registry.
Material and Methods:	CRFs from six major scoliosis bracing registries (three national, two institutional, one study group) across six countries (DK, IT, NL, SE, UK, US) were analyzed. Eight registry representatives participated in a consensus process. Variables were extracted and categorized into: patient characteristics, physical examination, imaging, treatment characteristics, and form data. Parameters appearing in ≥ 2 CRFs were discussed for universal inclusion; those in only one CRF were excluded. Finally, expert consensus was sought in 2 rounds to define the final set of variables, and outcome measures.
Results:	173 variables were available among the 6 individual CRFs: 31 on patient characteristics, 79 on physical examination, 46 on imaging, 15 on treatment characteristics and 2 on form data. 115 (66%) variables were only collected in 1 CRF and therefore excluded, 58 (34%) were collected in ≥ 2 , and 37 (21%) in ≥ 3 CRFs. Consensus was reached on a final set of 26 variables and outcome measures in the universal scoliosis bracing registry CRF.
Conclusion:	This international consensus-based core dataset provides a standardized framework for collecting scoliosis bracing data across multiple centers and countries. By ensuring homogeneity in data collection, this initiative will significantly facilitate high-quality, large-scale multicenter research

13. A Comparative Co-Design Study of Adolescents' and Caregivers' Perspectives on Mobile App Content for Conservative Scoliosis Management

Kamila Sykorova; Anna Mathew; Nenad Pavel; Parisa Gazerani; Trust Saidi; Mette Fløystad Kvammen; Minna Pikkarainen

Introduction:	Scoliosis represents a physical condition affecting spinal alignment, which is additionally associated with psychosocial challenges for adolescents undergoing long-term conservative treatment. These challenges may influence engagement and treatment adherence, increasing the need for greater mental support, and placing extra strain on caregivers. The growing use of mobile apps in healthcare offers an opportunity to address these challenges and complement standard scoliosis care. However, most existing scoliosis-related apps focus on physical monitoring and do not adequately address psychosocial and user-specific needs. This study aims to understand and compare adolescents' and caregivers' perspective on scoliosis mobile app content to identify shared and role-specific needs relevant to conservative treatment. A user-centered development approach can inform the design of the app reflecting lived experiences and aligning content with users' priorities.
Material and Methods:	An exploratory co-design study was conducted to compare adolescents' and caregivers' priorities for app content, informing the development of a user-centered mobile solution. A total of 46 participants (23 adolescents with scoliosis and 23 caregivers) were recruited through <i>Ryggforeningen i Norge</i> and participated in a workshop in September 2025. Data was collected using an anonymous Mentimeter survey including open-ended questions, Likert-scale items, and word clouds. Participants were grouped as adolescents or parents, with group-specific questions. Qualitative responses were analyzed using thematic analysis, involving coding and categorization to identify shared and role-specific themes. Descriptive statistics and group comparisons were applied for quantitative analysis. Ethical approval was granted by SIKT (ref. 658746); written informed consents were obtained.
Results:	Both adolescents and caregivers demonstrated high familiarity with mobile apps and digital engagement tools. Training/exercise functionality was the highest-ranked feature in both groups (adolescents 10/23; caregivers 19/23), demonstrating shared preferences on the importance of practical support for conservative scoliosis treatment. Social features were also highly valued, with chat or meeting place functions receiving the highest rating in both groups (adolescents mean 4.2/5; caregivers 4.6/5). Minor differences reflected distinct roles involved during treatment. Adolescents placed greater emphasis on peer support and treatment-related information functionalities, suggesting a need for connection and understanding during daily scoliosis management. Caregivers additionally prioritized as top ranked motivational features and follow up functionalities (mean 4.6/5), reflecting their focus on supporting adherence and long-term treatment engagement. Responses to AI-powered chatbot were mixed, reflecting both interest and uncertainty. Findings highlight complementary and quite convergent priorities between adolescents and caregivers for user-centered app design. Overall, findings indicate largely convergent priorities across groups, with differences reflecting distinct roles in treatment engagement.

Conclusion:	This exploratory study demonstrates that adolescents and caregivers share key priorities for mobile app-based support in scoliosis care, particularly related to exercise, communication, and peer support. These findings provide important user-centered insights to guide the development of technologies that may enhance adherence, engagement, and psychosocial support in scoliosis management.
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14. “I am trapped in my body”: Bodily Experiences During Brace Treatment in Adolescents with Idiopathic Scoliosis

Marit Fure; Kristine Risum; Lena Fauske; Hedda Eik

Introduction:	Adolescent idiopathic scoliosis (AIS) is a spinal deformity commonly treated with brace therapy to prevent curve progression during growth. While bracing is an effective non-surgical intervention, it can influence multiple aspects of adolescents’ daily lives. Previous research has mainly focused on clinical outcomes and treatment compliance, while less attention has been given to adolescents’ embodied experiences during brace treatment. The aim of this study was to explore how adolescents with AIS experience their bodies and everyday lives while undergoing brace treatment.
Material and Methods:	An exploratory qualitative study was conducted using in-depth interviews with adolescents undergoing brace treatment for AIS. Participants were recruited from a Oslo University Hospitals brace outpatient clinic and were eligible if they were aged 12–15 years and had worn a brace for at least six months. A total of 13 adolescents participated in the study. The interviews explored experiences of wearing a brace and its impact on daily life, physical activity, and self-perception. Data were analyzed using reflexive thematic analysis informed by a phenomenological perspective of embodiment.
Results:	Three central experiential themes emerged from the analysis. The first theme, “The Inhibited Body,” described how the brace imposed physical restrictions, limiting movement and participation in sports and social activities. The second theme, “The Alienated Body,” reflected increased body awareness and self-consciousness related to wearing the brace, often accompanied by concerns about appearance and social visibility. The third theme, “The Disciplined Body,” captured the internal negotiation between adhering to prescribed brace wear and maintaining a sense of normal adolescent life. Participants described navigating physical discomfort, social challenges, and treatment expectations simultaneously.
Conclusion:	Brace treatment for AIS influences adolescents’ bodily experiences beyond its biomechanical purpose. The findings highlight the complex interplay between physical restrictions, body image, and treatment adherence during adolescence. A holistic, patient-centered approach that addresses both physical and psychosocial aspects of brace treatment may help support adolescents’ well-being and engagement with treatment.

15. Paraspinal Muscle Activation Asymmetry During Walking and Running in Adolescents with Idiopathic Scoliosis

Sara Ylijärvi; Mikko Mattila; Andrey Zhdanov; Jari Arokoski; Juha-Pekka Kulmala

Introduction:	Etiology of adolescent idiopathic scoliosis (AIS) remains unknown. Asymmetry in the paraspinal muscle activation may potentially play a role in the development of scoliosis due to uneven active muscle forces applied on the developing spine. While some electromyographic (EMG) studies have reported higher activation in the convex side others have found no difference. Gait is a fundamental and constant daily activity. Within walking and running, the change in biomechanical loading may pose different requirements on the paraspinal muscles. Therefore, running analysis may reveal asymmetries in paraspinal muscle activation that are not witnessed in walking. We aimed to compare the paraspinal muscle activation asymmetry in our motion laboratory during walking and running in a group of AIS patients with mild scoliosis.
Material and Methods:	Paraspinal muscle activation at thoracic (T9 & T12) level and lumbar (L5) were recorded during self-paced walking and running. For maximal voluntary contraction (MVC), we used a standing back extension task (Figure1). EMG data were filtered with a bandpass filter (20-500Hz), and then rectified and low pass filtered using a 4th order Butterworth low-pass filter (10Hz). MVC normalized EMG values and asymmetry indexes were reported during walking and running from eleven untreated AIS patients. Paired t-tests were applied to assess side-to-side differences within each locomotion condition and differences in asymmetry indices between locomotion modes.
Results:	In this group of AIS patients, a trend towards greater right (convex) versus left (concave) side muscle activity at the T9 level was observed during walking ($P=0.077$). While during, side-to-side asymmetry at the T9 level was statistically significant, with right side showing greater activity ($P=0.012$) For 7/11 patients, greater right side activity was observed during walking with running tending to accentuate asymmetry, though the significance was not statistically significant.
Conclusion:	These findings suggest greater activation on the right (convex) compared with the left (concave) paraspinal muscles at the level of the curve apex (T9) during both walking and running. It remains unclear to what extent these differences depend on the patients altered activation strategy, the patients' ability to achieve maximum voluntary activation in the MVC task, or potential cross-talk from superficial muscles such as trapezius and latissimus dorsi.

16. Scoliosis Screening in a Healthy Adolescent Cohort: A Proof-of-Concept Study on Stepwise Screening Using the Forward Bending Test Followed by 3D Spinal Ultrasound

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Introduction:	Population-wide screening programs enable early detection of adolescent idiopathic scoliosis (AIS) to offer brace treatment which can limit curve progression. Conventional school screening with the Adam's forward bending test (FBT) has high sensitivity, but is limited by a low positive predictive value (PPV). This results in substantial referrals for spinal radiography to exclude scoliosis. This study investigates the effect of adding spinal ultrasound to FBT, to improve the PPV before radiography.
Material and Methods:	Healthy adolescents were recruited from a general population study and screened by FBT. Angle of trunk rotation (ATR) was measured with a scoliometer. All adolescents with a positive FBT (i.e. $ATR \geq 5^\circ$) were reassessed within 3 months with a dedicated, mobile 3D spinal ultrasound system (US). A second FBT was performed as well. Potentially relevant curves (US angle $\geq 12^\circ$) were referred for standing spinal radiography, serving as 'gold standard' for AIS diagnosis. The main outcome was the PPV for detection of clinically relevant scoliosis (radiographic curve $\geq 15^\circ$) with FBT followed by 3D spinal US. As secondary outcomes, the first and second FBT were compared, US and radiography curves were compared and the PPV of a higher ATR threshold ($\geq 7^\circ$ and $\geq 10^\circ$) for forwarding were calculated.
Results:	Of the initial 219 adolescents (mean age 15.4 years), 47 (21%) had a positive FBT. Forty-two were reassessed, while 5 were lost-to-follow-up. In this group, 7 individuals had a coronal curve angle $\geq 12^\circ$ on 3D spinal ultrasound. Three of these 7 individuals showed relevant scoliosis ($\geq 15^\circ$) on the spinal radiograph, all were girls. The PPV of the FBT for detecting relevant scoliosis was therefore 7% (3/42). When FBT was followed by 3D spinal ultrasound, the PPV increased to 43% (3/7). Positive first FBT were also positive during the second FBT in 35 of 42 cases (83%). In the 7 US positive individuals, 9 US curves of $\geq 12^\circ$ were found. Of these curves, 5 curves were on radiograph $\geq 15^\circ$ (56%), and 4 were $< 15^\circ$ (44%). One curve that was on US $< 12^\circ$, was on radiograph $\geq 15^\circ$. If ATR for referral was heightened to $\geq 7^\circ$, PPV increased to 50%, and with an ATR of $\geq 10^\circ$ PPV was 100%, but 1 scoliosis case was missed.
Conclusion:	This study demonstrates that a stepwise scoliosis screening approach incorporating 3D spinal ultrasound is effective. By adding 3D spinal imaging, the PPV for scoliosis increased from 7% to 43%. Importantly, 35 of 42 adolescents (83%) with a positive FBT did not need unnecessary radiographic follow-up. These findings demonstrate the potential of stepwise FBT with 3D ultrasound for population-based AIS screening.

17. Conservative Treatment of Idiopathic Scoliosis in Norway: A Retrospective Cohort Study

Helene Abendstein Kjellmo, MSc; Jon Dahl, MD, PhD

Introduction:	Idiopathic scoliosis has historically been treated in Norway with the modular Boston Brace. Since 2021, the brace team at Sophies Minde Ortopedi has transitioned to a 3D brace. This study aimed to evaluate current conservative treatment approaches for scoliosis and describe demographic distribution patterns. Second, it sought to identify the types of braces used in the management of idiopathic scoliosis at Oslo University Hospital and Sophies Minde Ortopedi. Finally, the study aimed to assess in-brace correction and compare radiographic outcomes between the Boston Brace and the newly developed Oslo3D brace in patients treated with full-time bracing.
Material and Methods:	This retrospective cohort study was based on data collected as part of a quality assurance project at Oslo University Hospital, Rikshospitalet. The study included all patients with idiopathic scoliosis who were treated conservatively with a scoliosis brace provided by Sophies Minde Ortopedi between January 1, 2015, and October 15, 2025. Eligible patients had an ICD-10 diagnosis of M41.2 (idiopathic scoliosis) and had been fitted with their first scoliosis brace by a certified prosthetist-orthotist at Sophies Minde Ortopedi.
Results:	An overall increase in brace treatment was observed, with the 4–9 age group showing the most notable rise, including a 100% increase in juvenile scoliosis cases following the introduction of postural screening in schools. A growing use of night-time bracing was also recorded. No significant differences in patient characteristics or in-brace correction were found between the Boston and Oslo3D braces. In the ≥ 10 group, mean in-brace correction was $47.1\% \pm 19.6$ for the Boston Brace and $50.8\% \pm 20.2$ for the Oslo3D. In the 4–9 group, correction was $54.7\% \pm 17.0$ and $55.5\% \pm 19.4$, respectively, though unequal group sizes limit statistical power. Effective correction was achieved without excessive posterior pelvic tilt. Among patients who completed bracing, 70.3% avoided surgical intervention.
Conclusion:	Brace treatment for idiopathic scoliosis has increased, likely due to earlier detection and improved skeletal maturity assessment. Night-time bracing has become more common among the AIS group. No significant difference in in-brace correction was found between the Boston Brace and Oslo3D brace. Since 3D-scanned braces provide better anatomical fit and no excessive posterior pelvic tilt, the findings support current clinical practise

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ABSTRACT SESSION 2

21. Understanding the Impact of Etiology on Mechanical Revision Rates and Patient-Reported Outcomes in Adult Spinal Deformity Surgery

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Introduction:	Adult spinal deformity (ASD) is a diverse condition that lacks a universally accepted classification system. Patient characteristics vary with respect to comorbidities, age, ASD etiologies, and surgical needs. Despite these differences, surgical outcomes are often reported as one ASD group. This study aimed to analyze differences in mechanical revision rates and patient-reported outcomes (PROs) among patients with ASD by underlying etiology.
Material and Methods:	In this retrospective, single-center cohort study, we included patients who underwent ASD surgery between 2017 and 2023 and had a 2-year follow-up. Exclusion criteria were trauma, infection, and malignancy. Patients were classified by etiology of deformity: de novo, idiopathic, iatrogenic, and other less common conditions (e.g., congenital, neuromuscular, Bechterew, fracture sequelae). The primary outcome was the 2-year revision rate for mechanical failure, including distal junctional failure, drophead, misplaced implant, proximal junctional failure, rod breakage, screw breakage, screw loosening, and implant failure that was unspecified in the surgical note. Revision rates were compared between groups using logistic regression with multivariate adjustment for other clinically relevant factors (sex, age, BMI, CCI score, instrumented levels, and three-column osteotomy). Secondary outcomes were preoperative and 2-year postoperative SRS-22r scores, compared between groups using a mixed-effects model.
Results:	A total of 451 patients were included. The idiopathic group was significantly younger, healthier, with a lower BMI, and less extensive surgery. Overall, the mechanical revision rate was 18%, highest in de novo (25%) and lowest in idiopathic (9.2%). Revision rates for de novo and iatrogenic deformity were significantly higher than for idiopathic scoliosis (odds ratio (OR) 3.27, 95% CI 1.49-7.51 and 2.84, 95% CI 1.41-6.15, respectively). In the multivariate analysis, only the number of instrumented levels was significantly associated with revisions (OR 1.08, 95% CI: 1.01-1.15). Patients with idiopathic disease had higher preoperative SRS-22r scores, although no significant pre-to-postoperative change was observed between the groups. All groups improved significantly from baseline to 2 years postoperatively. The idiopathic group had significantly higher satisfaction scores (4.29 ± 0.12 , $p < 0.001$).
Conclusion:	Revision rates vary significantly across ASD etiologies, but improvements in PRO scores were similar. "ASD" is an imprecise term that does not reflect the underlying condition and risk of mechanical revision. This should be considered in treatment planning, research, and patient counseling.

22. Five-Year Follow-Up International Retrospective Cohort Study on the Use of a One-Way Self-Expanding Rod System in Patients with Neuromuscular Scoliosis

Dr. A.M. Post; Dr. M. Gaume; Dr. Dema; A. Stadhouder; F. Solla; Dr. Cinnella; E. Janssen; Dr. L. Miladi, PhD; Prof. Dr. B.J. van Royen

Introduction:	Progressive neuromuscular scoliosis (NMS) in skeletally immature patients poses a significant surgical challenge. Posterior spinal fusion (PSF), though effective, permanently sacrifices spinal mobility and growth potential, carrying well-documented long-term complications. Fusionless techniques have therefore gained popularity as a means of correcting and stabilising scoliotic curves while preserving axial growth. The first generation of the one-way self-expanding rod (OWSER) system offers a minimally invasive, growth-sparing alternative that avoids repeated surgical lengthening. However, long-term evidence beyond two years in large international cohorts remains lacking. This study evaluates clinical and radiological outcomes at five-year follow-up following bilateral OWSER instrumentation in patients with NMS.
Material and Methods:	Patients with NMS who underwent bilateral OWSER (1 st generation) instrumentation from the upper cervicothoracic spine to the pelvis and completed five-year follow-up were retrospectively included. Radiological parameters were assessed preoperatively and at follow-up. Clinical performance was evaluated based on complications and unplanned reoperations.
Results:	Forty-eight patients (28 female) from five international centers were included. Mean age at surgery was 10.2 ± 2.8 years and mean weight was 28.9 ± 10.4. Mean Cobb angle improved from $80 \pm 24^\circ$ preoperatively to $38 \pm 17^\circ$ postoperative and remained significantly stable at five-year follow-up. Segment T1-S1 increased 5.3 cm peri-operatively, and patients showed a mean growth after instrumentation from 35 ± 7 cm to 38 ± 9 cm in five years. Four patients required rod revision due to reaching the end of growth. A total of 15 mechanical complications, 5 alignment complications and 3 surgical site infections occurred in 18 patients. The mechanical complications consisted of 6 domino failures, 4 rod breakage, 2 failing of connector, 1 rod pull-out, 1 dislodgement of the proximal hooks and 1 malposition of iliosacral screw. Due to these complications, 3 patients underwent revision to PSF and 3 to an alternative system. This has resulted in a total of 23 unplanned surgeries. In the early development stage of the OWSER system 8 patients experienced a blockage of the rod which required revision surgery. This has resulted in 8 additional unplanned surgeries.
Conclusion:	OWSER provides a stable correction of the Cobb angle at five-year follow-up while allowing continued spinal growth. This technique represents a reliable treatment in the scoliosis correction for NMS patients. However, this technique is still accompanied by relative high complication rates in a fragile patient population. This led to a significant adaptation of the system, preventing several of the complications described in the early stage of system development. Therefore, a large scale international retrospective cohort study on the five-year follow-up is currently being performed.

23. Surgical Treatment for High-Grade Spondylolisthesis – A Cross-Sectional Follow-Up of 16 Operated Patients

Thomas Johan Kibsgård, MD, PhD; Kathrine Framås Syversen, Stud. Med.

Introduction:	High-grade spondylolisthesis is a rare condition with several surgical options and no gold standard for operative technique. There are controversies regarding fusion length (L4-S1 vs L5/S1), the use of iliac screws, and the degree of reduction needed to achieve good short- and long-term surgical outcomes. At Oslo University Hospital, we have operated these patients using in-situ/partial reduction, decompression, and fixation from L4 with trans-sacral screws from S1 to L5, with or without fibular graft. The main goal of the study was to evaluate surgical outcomes. We also wanted to examine radiological correction and sagittal balance at follow-up.
Material and Methods:	Patients operated between 2015 and 2023 were identified. We retrospectively reviewed electronic patient records and X-rays, and patients completed a questionnaire that included the SRS-22, Numeric Rating Scale (NRS), activity level, and work situation.
Results:	20 patients were identified, and 16 completed the questionnaire. The mean age at the time of surgery was 16.5 years. Fourteen were girls and two were boys. The mean slippage percentage was 69% (range: 52-100). Eleven out of 16 had an additional L5/S1 fibular graft. The mean follow-up period was 4.4 years postoperatively. The mean total SRS-22 score was 3.6. The patients reported a mean 3-point decrease (from 5.8 to 2.8) in NRS back pain and a mean 5.4-point decrease in NRS leg pain (from 6.4 to 1). Eighty-one percent of patients reported they were much better or totally cured. The mean absolute reduction in spondylolisthesis (slippage percentage) was 10% (range: 0-30%). 13 out of 16 patients were working normally or pursuing education. There were 2 re-operations and only a few mild complications. Out of the 11 with postoperative long sagittal x-rays, the pelvic tilt was a mean of 24 (range 11-41).
Conclusion:	In situ or a small partial reduction, decompression, and L4 to S1 fusion with trans-sacral screws seems to be a safe and efficient option for high-grade spondylolisthesis in adolescence. This method avoids the use of iliac screws. Adding a fibular graft is an easy and safe way to enhance fusion between L5 and S1. The surgical outcome is acceptable. The remaining pelvic tilt raises some concern about the long-term outcome.

24. Minimal Invasive, Growth-Sparing Surgery for the Treatment of Adolescent Idiopathic Scoliosis Patients: Early Results of an International Retrospective Cohort Study

A.M. Post, MD; P. Neagoe, MD; J. Mielenbrink, MD; E. Janssen, PhD; Prof. Dr. B.J. van Royen

Introduction:	Posterior spinal fusion (PSF) remains the standard surgical treatment for progressive AIS with a Cobb angle ≥ 45–50°. Although effective in deformity correction, PSF results in permanent loss of spinal mobility and associated long-term clinical disadvantages, including adjacent segment disease and reduced quality of life. Minimally invasive growing rod techniques have demonstrated promising results in early onset scoliosis (EOS) and neuromuscular scoliosis (NMS); however, their application in AIS has not yet been reported. The objective of this study was to evaluate the safety and efficacy of a minimally invasive one-way self-expanding rod (OWSER) system for the treatment of adolescent idiopathic scoliosis (AIS).
Material and Methods:	Patients with AIS in whom conservative treatment had failed were considered for growth-sparing surgery using the OWSER system, a CE-certified commercially available spinal implant. Surgical indication required a Cobb angle ≥ 45–50° with documented curve progression despite conservative management. All patients had a minimum follow-up of two years and were monitored as part of routine clinical care across two international centres. One patient had a history of prior spinal surgery for a tethered spinal cord. Radiological outcomes, including Cobb angle measurement, were assessed preoperatively, postoperatively, and at two-year follow-up. Complications were recorded and classified accordingly.
Results:	Ten patients (7 female, 3 male) were included. Mean age at surgery was 12 years (range 10–14). The mean Cobb angle improved significantly from 71° (SD 23°) preoperatively to 32° (SD 11°) postoperatively, representing a mean correction of 38.6°. Correction remained stable at two-year follow-up ($p = 0.362$), demonstrating durable maintenance of deformity correction without fusion. The overall complication rate was 50% (5/10). Complications consisted of growing rod domino connector failure ($n=2$), rod fracture ($n=1$), screw breakage ($n=1$) and progression of spinal curvature ($n=1$). Revision surgery was required in 2 patients, with one additional revision currently planned.
Conclusion:	We report the first two-year follow-up of an OWSER system in 10 patients with progressive adolescent idiopathic scoliosis. The postoperative Cobb angle remained stable at two-year follow-up; however, 5 mechanical complications occurred in five patients. The OWSER system might be useful in postponing, or potentially avoiding, posterior spinal fusion in a selected patient population. Further studies are required to better define the safety, indications, and long-term effectiveness of this system.

25. A Two-Year Multicenter International Retrospective Cohort Study Comparing the Efficacy and Complication Rates of the OWSER and MCGR Systems in the Treatment of Spinal Muscular Atrophy

A.M. Post; L. Colombo; L. Miladi; J.P. Kaleeta-Malu; Dr. Boissiere; Dr. Kruyt; Dr. Renkens; E. Janssen; B.J. van Royen

Introduction:	Scoliosis is a common and progressive complication in children with spinal muscular atrophy (SMA) and can significantly impair sitting balance, mobility, and respiratory function. Growth-sparing techniques, including magnetically controlled growing rods (MCGRs), have been introduced to mitigate these risks, yet remain associated with substantial complication and revision rates. The One-Way Self-Expanding Rod (OWSER) system is a novel fusionless technique designed to allow passive spinal growth while minimizing the need for repeated surgical interventions. The objective of this retrospective international cohort study was to compare the two-year complication rates and clinical efficacy of the OWSER system and MCGRs in the surgical management of scoliosis in patients with spinal muscular atrophy.
Material and Methods:	SMA patients who underwent primary surgical treatment with either the OWSER system or MCGRs between 2016 and 2024 and had a minimum follow-up of two years were included. The primary outcome was the overall two-year complication rate. Secondary outcomes included revision surgery and radiographic correction.
Results:	Sixty-four patients (38 female) were included (30 OWSER, 34 MCGR). Baseline characteristics, Cobb angle and T1S1 height were similar in both groups preoperative and at two-year follow-up. Patients who underwent surgical correction with the MCGR system additionally had to undergo an average of 6.5 lengthening procedures. Whereas the OWSER patients did not undergo any additional lengthening procedures. In the OWSER group, three complications occurred: revision due to insufficient rod lengthening, prominent cross-link causing delayed scar forming, medical treatment of neurogenic bladder. In the MCGR group, two complications occurred: screw pull-out requiring revision, rod breakage resulting in rod revision
Conclusion:	This study represents the first large international comparison of MCGRs and the OWSER system in patients with spinal muscular atrophy. Comparable radiographic and complication-related outcomes were observed between the two treatment modalities. However, patients operated on with the MCGR required an average of 6.5 lengthening procedures in two years' time. To provide more clinically relevant evidence, a large international retrospective cohort study is currently conducted.

26. Postoperative Outcomes of Ponte Osteotomies vs. No Osteotomy in the Treatment of Adolescent Idiopathic Scoliosis: A Multicenter, Randomized Clinical Trial

Matti Ahonen; Johanna Syvänen; Linda Helenius; Aron Frantzen; Mikko Mattila; Tanja Perokorpi; Jenni Jalkanen; Juha Suuronen; Antti Saarinen; Ilkka Helenius

Introduction:	Ponte osteotomies are widely used to facilitate correction of adolescent idiopathic scoliosis (AIS) and may improve coronal and sagittal deformity correction, but no Level I studies have evaluated their effectiveness in instrumented posterior spinal fusion. The aim of this study was to evaluate the effect of Ponte osteotomies on radiographic correction in patients undergoing surgical treatment for (AIS).
Material and Methods:	Adolescents aged 10–21 years with idiopathic scoliosis and a major curve $\geq 45^\circ$ were eligible for inclusion in this randomized superiority trial (n = 185). 116 adolescents undergoing segmental pedicle screw instrumentation were randomised in a 1:1 ratio to no Ponte osteotomies or apical Ponte osteotomies (minimum 2, maximum 4) at the time of spinal exposure using a sealed-envelope technique. The primary outcome was radiographic correction of the curvature, assessed by changes in coronal and sagittal Cobb angles. Secondary outcomes included operative time, total blood loss, 48-hour oxycodone consumption, and complications.
Results:	All 116 patients were included in the primary outcome analysis (no Ponte, n = 59; Ponte, n = 57). The main curve of the scoliosis improved from preoperative values of 54.7° (SD 8.5) in the no Ponte group and 53.4° (SD 8.1) in the Ponte group to postoperative values of 19.0° (SD 5.6) and 18.0° (SD 5.5), respectively, with an adjusted mean difference of -0.78° (95% CI -2.8 to 1.2 ; p = 0.45). Thoracic kyphosis improved from 18.6° (SD 12.1) and 19.1° (SD 12.0) preoperatively to 20.4° (SD 7.6) and 21.9° (SD 7.5) postoperatively in the no Ponte and Ponte groups, with an adjusted mean difference of 1.1° (95% CI -1.2 to 3.3 ; p = 0.354). A subgroup analysis of Lenke types 1–4 demonstrated no significant differences in main curve or thoracic kyphosis correction. No significant differences were observed in the secondary outcomes.
Conclusion:	Apical Ponte osteotomies did not improve radiographic outcomes in adolescents with idiopathic scoliosis. Routine use of Ponte osteotomies does not appear to be necessary in the surgical treatment of moderate AIS.

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ABSTRACT SESSION 3

31. SRS-22r Normative Data from a Population Without Back Issues – A Systematic Review and Meta-Analysis

Kristian Havndrup Rasmussen; Ane Simony; Rene Castelein; Frederik Damsgaard Højsager

Introduction:	The Scoliosis Research Society questionnaire 22 revised (SRS-22r) is a commonly used patient-reported outcome measure of quality of life in scoliosis patients. The questionnaire includes five domains relevant for quality of life. There is a lack of literature comparing the SRS-22r scores in scoliosis patients and the general population, which could provide valuable information about the usefulness of this questionnaire. We aim to evaluate normative data on SRS-22r scores from the healthy population.
Material and Methods:	A systematic review and meta-analysis were conducted in accordance with PRISMA guidelines. The literature search was conducted across five databases for studies including SRS-22r scores in a population without back issues. Screening and data extraction were performed by two independent reviewers. Differences were resolved through discussion. Meta-analysis was performed using the metamean package in R software. Heterogeneity was assessed using I^2 -statistics.
Results:	The literature search identified 3505 reports. After full-text review, 12 studies including 13 cohorts with a total of 5957 individuals were included for systematic review and meta-analysis. The meta-mean of the total SRS-22r score is 4.21 [4.20; 4.22]. The meta-means of the mental health, self image, function, and pain domains are 4.00 [3.98; 4.01], 4.20 [4.19; 4.22], 4.27 [4.26; 4.28], and 4.56 [4.55; 4.57], respectively.
Conclusion:	We provide the first meta-analysis of normative data on total and domain specific SRS-22r scores from 12 studies including 5957 individuals without back issues. Although limited by large study heterogeneity, these findings provide valuable insights into the use of SRS-22r for adolescent idiopathic scoliosis patients in a clinical setting.

32. Two Decades of Change: Nationwide Trends in Scoliosis Surgery in Denmark, 2001–2018

Frederik Damsgaard Højsager; Line Parst Sørensen; Ane Simony

Introduction:	The treatment of scoliosis has changed substantially over recent decades. During this period, spinal instrumentation evolved rapidly, surgical techniques matured, and the organisation of scoliosis care changed. How these developments influenced national surgical activity has not previously been described. The aim of this study therefore was to describe nationwide trends in scoliosis surgery in Denmark from 2001 to 2018.
Material and Methods:	Using the Danish National Patient Registry, all hospital procedure codes related to scoliosis surgery were identified between 2001 and 2018. Annual numbers of surgical procedures were extracted and temporal trends were analysed descriptively.
Results:	Nationwide surgical activity increased dramatically during the study period. From 2001 and onwards the annual numbers of scoliosis surgery rose steadily, peaking at more than 200 procedures in 2015 before stabilising at around 150 procedures per year. The increase occurred over nearly two decades, suggesting a gradual change rather than an abrupt shift in clinical practice. The average age at surgery had a small increase throughout the observational period, with the average age being roughly 14 in 2003–2006, and nearing 15 throughout the rest of the period.
Conclusion:	Scoliosis surgery in Denmark expanded markedly between 2001 and 2018. The observed trend coincided with a period characterised by major advances in spinal deformity surgery and organisational changes in scoliosis care. Our findings mirror those of Swedish cohorts, where an increase in incidence was seen throughout the 2000s and early 2010s. These nationwide data document how clinical practice evolved over time and provide a foundation for future studies exploring the drivers behind these changes.

33. Systematic, Comprehensive Radiographic Analysis of Early-Onset Scoliosis: Evaluating the Reliability and Validity of a Point-Based Landmark Workflow

A. Abdi; R. Maat; V. Arbabi; M.C. Kruyt; T.P.C. Schlösser

Introduction:	Systematic radiographic assessment of early-onset scoliosis (EOS) requires evaluation of numerous spinal, thoracic, and pelvic measurements, which is time-consuming and susceptible to observer variability. (Semi-)automated assessment tools can improve efficiency and reliability and uniformity; however, no disease specific assessment tools currently exists. We extended our in-house Orthopaedic Digital Image Analysis (ODIA) software with an EOS-specific spine module. The aim of this study was to introduce and clinically validate a comprehensive, point-based landmark annotation framework for 2D radiographic assessment in EOS, evaluating its intra-observer reliability, measurement efficiency, and parameter redundancy as a foundational step toward automated, software-based clinical analysis.
Material and Methods:	On 90 sets of preoperative anteroposterior (AP) and lateral full-spine radiographs from 49 patients with EOS, 217 anatomical landmarks (169 spinal, 22 pelvic, and 26 thoracic) were annotated. Patients with congenital scoliosis were excluded. ODIA automatically converted the landmark coordinates into 232 clinical parameters, including global, regional, and segmental measurements; 205 parameters concerned vertebral or (intervertebral) disc heights. For clinical validity, selected parameters were manually measured using the routine clinical radiography system in a subset of 20 patients. Landmark annotation was repeated after two weeks to assess intrarater reliability. Validity relative to reference measurements, intraclass correlation coefficients (ICCs), completion time, and multicollinearity were evaluated.
Results:	The point-based workflow showed minimal systematic differences compared with manual reference measurements, indicating limited systematic bias. Small systematic differences were present for selected disc-height measurements, whereas no statistically significant systematic differences were found for the principal global and regional measurements. The intrarater reliability was high for the global parameters (e.g., AP and lateral T1-T12 height ICC > 0.950). This also applied for regional parameters such as Primary Cobb angle (ICC: 0.867), but lower for segmental vertebral and disc-height measurements. The case completion time decreased from approximately 120 minutes with conventional manual measurement to 10–20 minutes with the point-based workflow, corresponding to an estimated 83–92% reduction. Multicollinearity analysis demonstrated substantial redundancy, particularly among height, freehand-length, and sagittal-alignment parameters.
Conclusion:	The EOS-specific extension of the in-house ODIA software using a point-based landmark annotation support a valid, reliable, and faster assessment of radiographic EOS parameters compared with the reference standard. Segmental vertebral and disc-height measurements require further refinement before clinical use. The landmark annotations allow for the development of a (semi-)automated platform for systematic radiographic evaluation of EOS patients.

34. In Vivo Retensioning of a Dynamic Spinal Implant in a Göttingen Minipig Model: A Proof-of-Principle Study

A. Abdi; M. Wesselink; J. Kok; T.P.C. Schlösser; M. Asseln; G.J.M. Tuijthof; M.C. Kruyt

Introduction:	The Double Spring Reduction (DSR) is a prototype dynamic scoliosis correction implant consisting of compression and torsion springs that provide continuous corrective three-dimensional forces while permitting growth. Previous in vivo studies demonstrated the feasibility of the concept. However, the corrective loads applied by the implant, decrease over time due to viscoelastic adaptation of the spine, thereby affecting the effective correction. A solution for this is to restore the initial corrective forces by retensioning the springs, but the effect of this procedure on the achieved correction remains unknown. Therefore, this study aimed to evaluate how restoring the initial preload of a dynamic scoliosis implant through retensioning affects the axial rotation in an in vivo Göttingen minipig model.
Material and Methods:	A DSR was implanted in one 8-month old Göttingen minipig, spanning nine vertebrae (T9-L3). It contained two torsion springs connected to T9-T13 and T13-L3, each preloaded to 1 Nm torque (2 Nm in total) to induce axial rotation. Reduction surgery was performed after twelve weeks by reversing the spring preload to 1 Nm in the opposite direction. After ten days, the lost preload was restored through minimally invasive retensioning by increasing the torque an additional 0.30 Nm (0.15 Nm on each spring). CT scans were obtained after 12 weeks of induction, immediately after reduction, before retensioning, and prior to termination (20 days after reduction) to determine axial rotation. The in vivo orientation of the torsional implant was measured two times daily from reduction surgery until termination using three six-degrees-of-freedom electromagnetic attached with 3D-printed nylon clamping fixations. The implant orientation recorded over time was used to determine the torque. The change in torque over time served as proxy for the viscoelastic adaptation of the spine.
Results:	After 12 weeks of induction, the axial rotation increased from -4° before implantation of the DSR to 12° at maximum induction, which remained stable immediately after reduction. Prior to retensioning, the axial rotation further decreased from 12 to 3° after ten days. This corresponded with a decrease of 0.15 Nm (15%) in each spring. After retensioning, the torque decreased by 0.06 Nm (6%) at the cranial spring (T9-T13), while the force remained stable in the caudal spring. At termination, the integrity of the sensor clamping fixations was preserved, the sensors remained in their original position within the fixation, and the sensor wires remained functional.
Conclusion:	This study showed that restoring the torque results in a substantially smaller viscoelastic effect compared to the initial viscoelastic responses observed after reduction of axial rotation. No additional axial correction was observed after retensioning. These findings provide valuable insights into the dynamic responses of the spine to altered implant loading and may contribute to optimizing implant loading strategies to improve correction.

35. Prevalence and Predictors of Pre-Operative Vitamin D Deficiency in a Tertiary Paediatric Spine Surgery Unit for 615 Patients Undergoing Scoliosis Corrective Surgery in London, UK

Jonathan Lucas; John Wong; Richard Pinder

Introduction:	To determine the prevalence and predictors of Vitamin D deficiency in a Paediatric Tertiary Spine Surgery Unit of paediatric patients undergoing spinal deformity corrective surgery.
Material and Methods:	Between 01 June 2020 to 31 December 2025, 615 patients had 25 Hydroxy Vitamin D levels measured prior to surgery. Patients were categorised to sufficient ($>50\text{nmol/L}$), insufficient ($25\text{-}50\text{nmol/L}$) and deficient ($<25\text{nmol/L}$). Multiple linear regression (including age, sex, ethnicity groups and season) was conducted to identify predictors.
Results:	There was a significantly higher levels of Vitamin D in patients with a neuromuscular/syndromic (NM) diagnosis (mean=62.00 nmol/L) when compared with patients with an idiopathic diagnosis (mean=44.71 nmol/L) ($p<0.0001$). There were significantly higher levels of Vitamin D in patients from a White background (mean=56.57 nmol/L) when compared with patients from an African/Caribbean/Any other Black background (AC) (mean=34.46 nmol/L), Indian/Pakistani/Any other Asian background (Asian) (mean=46.00 nmol/L) or a mixed background (mean=42.08 nmol/L) ($p<0.05$). We found a significantly higher level of Vitamin D in summer and autumn months when compared with spring ($p<0.05$), and no significant difference between spring and winter ($p>0.05$). Age, AC, Asian, mixed backgrounds, summer and autumn months were statistically significant predictors of Vitamin D levels in our population of patients from our multiple linear regression model ($p<0.05, r^2=0.1764$).
Conclusion:	Patients with neuromuscular/syndromic diagnosis had significantly higher Vitamin D levels when compared with the idiopathic group, perhaps due to supplementation via enteral feeding. Age, AC, Asian, mixed ethnic group, summer and autumn months are statistically significant predictors of Vitamin D levels in our population of patients.

36. A Pre-Operative Surgical Education Programme as Part of Surgical Pre-Assessment for Paediatric Scoliosis Surgery, Increased Preparedness and Understanding for Surgery, Reduces Anxiety, and Was Associated with Reduced Length of Stay

Jonathan Lucas; John Wong; Jenny Nicholson; Richard Pinder

Introduction:	On 24 September 2019, a new pre-operative assessment process, known as the Spinal Investigation Day (SID) was introduced at Evelina London Children's Hospital. This included a Pre-Operative Surgical Education (POSE) Programme. We evaluated the impact of SID/POSE.
Material and Methods:	A pre-SID/POSE and post-SID/POSE questionnaire was completed by patients and their families. Length of Stay (LOS) for patients with Adolescent Idiopathic Scoliosis (AIS) who underwent Posterior Instrumented Scoliosis Correction were collected for five years pre- and five years post-introduction of SID/POSE.
Results:	We collected data from 81 patients pre-SID/POSE and 57 patients post-SID/POSE. A Likert score of 1 indicates not prepared/no understanding/not at all anxious. Maximum score is 5 indicating very well prepared/very good understanding/very anxious. For preparedness, mean score increased from 2.95 pre-SID/POSE to 3.72 post-SID/POSE ($p<0.0001$). For understanding of surgery, mean score increased from 3.09 pre-SID/POSE to 4.14 post-SID/POSE ($p<0.0001$). For anxiety for spinal surgery, mean score reduced from 3.69 pre-SID/POSE to 3.18 post-SID/POSE ($p=0.0109$). The total LOS for AIS patients in the five years pre-SID/POSE, $n=340$ patients, median age 15.15 years (range = 11.39 to 34.93 years), mean LOS 5.74 days (SD = 1.097), median LOS 6 days; and in the five years post-SID/POSE, $n=358$ patients, median age 15.15 years (range = 11.05 to 27.92 years), mean LOS 4.94 days (SD = 1.397), median LOS 5 days, which is a significant reduction in the LOS $p<0.0001$.
Conclusion:	A POSE programme significantly increased patient preparedness and understanding, and reduced anxiety for surgery. There was a significant reduction in total LOS after introduction of SID/POSE. A POSE programme can be incorporated into the pre-assessment process to enhance patient experience, knowledge, expectations and reduce LOS.

37. Development and Validation of a Multivariable Prognostic Model for Nighttime Brace Treatment in Adolescent Idiopathic Scoliosis

Vojtech Capek, MD, PhD; Helena Brisby, MD, PhD; Olof Westin, MD, PhD

Introduction:	Individualized treatment is essential in multifactorial conditions such as adolescent idiopathic scoliosis (AIS). Nighttime brace treatment (NBT) has been proposed as an alternative to full-time bracing to reduce treatment burden while maintaining effectiveness. Although prognostic tools exist for estimating treatment success with full-time bracing, the patient characteristics associated with successful NBT remain unclear. Previous studies have demonstrated comparable outcomes in selected subgroups, such as patients with small curves or lumbar curves; however, the lack of clear clinical criteria for NBT limits its broader clinical application.
Material and Methods:	Multivariable regression models were developed using a retrospective cohort of patients treated with NBT. A total of 289 skeletally immature consecutive patients with Cobb angles of 25°-44° and complete clinical and radiographic follow-up were included. Candidate predictors included sex, age, curve type, menarcheal status, Cobb angle, in-brace correction, skeletal maturity, and treatment compliance. Two outcomes were evaluated: (1) SRS-defined treatment failure (Cobb angle increase $\geq 6^\circ$, final Cobb angle $\geq 45^\circ$, or surgery) and (2) progression to a final Cobb angle $\geq 45^\circ$ at follow-up. The cohort was randomly divided into training (60%) and test (40%) datasets. Multiple penalized regression models were assessed. The best-performing model was developed using the training dataset and subsequently evaluated in the test dataset, with model performance compared between cohorts. Finally, risk classifications were generated, and an optimal probability cut-off for identifying patients at high risk of treatment failure was determined.
Results:	Overall, 149 patients (52%) met the SRS criteria for treatment success, while 233 patients (81%) did not progress to a final Cobb angle of $\geq 45^\circ$ at follow-up. Cobb angle, in-brace correction, skeletal maturity, and treatment compliance, together with selected interaction terms identified through penalized regression, were retained in the final model predicting progression to a Cobb angle of $\geq 45^\circ$. The best-performing model achieved an AUC of 0.77 (95% CI, 0.65-0.89). An optimal probability cut-off of 0.19 for progression to a Cobb angle of $\geq 45^\circ$ yielded a sensitivity of 75% and specificity of 75% in the test dataset, with negative and positive predictive values of 93% and 40%, respectively. Models predicting the SRS outcome demonstrated insufficient performance and were not further pursued. Based on the final model, a Nighttime Brace Calculator was developed to support individualized assessment of NBT suitability and the likelihood of avoiding progression to a Cobb angle of $\geq 45^\circ$.
Conclusion:	This study presents a clinically relevant prognostic model to support individualized treatment planning in AIS. The calculator derived from this model may help identify patients most likely to benefit from NBT, supporting the selection of a less burdensome treatment approach while facilitating patient and family engagement.

FRIDAY

ABSTRACT SESSION 4

41. Early Vertebral Rotation Before the Adolescent Growth Spurt in Subjects at High Risk for Adolescent Idiopathic Scoliosis

Annemie J Sluijter; Peter PG Lafranca; JOE Bennink; René M Castelein; Moyo C Kruyt; Keita Ito; Tom PC Schlösser

Introduction:	Adolescent idiopathic scoliosis (AIS) is a three-dimensional, rotational deformity of the spine that is traditionally thought to develop in otherwise healthy girls during the adolescent growth spurt. It remains unknown whether abnormalities in spinal development, especially in spinal rotation, are already present prior to adolescence. The prospective EARLYBIRD study investigates spinal growth in children at increased risk of developing idiopathic scoliosis, starting before the adolescent growth spurt.
Material and Methods:	In this prospective cohort study, spinal growth is followed in younger sisters or daughters of patients with AIS, aged 8–10 years and without clinical signs of scoliosis at inclusion. These siblings are known to have a 10-20% risk of developing scoliosis. Using artificial intelligence, a synthetic CT scan was generated from bone MRI data. Axial vertebral rotation from vertebral level T2 to T12 was measured systematically using a semi-automated method and compared with a control group consisting of trauma CT scans from children without spinal pathology.
Results:	A total of 45 girls (mean age 9.5 ± 0.9 years) were included in the high-risk group. The control group consisted of 16 girls (mean age 9.6 ± 1.3 years). In both high-risk subjects and controls aged 8–10 years, a pre-existing vertebral rotation to the right was observed between T6 and T12 (mean $0-3^\circ$). In contrast, rotation to the right at level T5 was only observed in the control group ($P < 0.03$). No other statistically significant differences in the rotational pattern were found.
Conclusion:	Before the adolescent growth spurt, there were no obvious differences in the rotational pattern of the spine between a population at higher risk, as compared to controls. Further longitudinal follow-up is required to determine whether increased thoracic vertebral rotation prior to the growth spurt is involved in the development of clinically relevant AIS.

42. Torsion and Asymmetry of Intervertebral Discs Versus Vertebral Bodies in Mild Adolescent Idiopathic Scoliosis

Annemie J Sluijter; Peter PG Lafranica; Moyo C Kruyt; Keita Ito; René M Castelein; Tom PC Schlösser

Introduction:	Adolescent idiopathic scoliosis (AIS) is a three-dimensional spinal and trunk deformity characterized by coronal curvature, axial rotation, and sagittal plane abnormalities. Previous studies have suggested that the intervertebral discs (IVDs) are more affected than the vertebral bodies (VBs) in severe scoliotic curves, indicating that disc deformation may play a primary role in the pathogenesis of AIS. However, less is known about the relative contribution of the intervertebral discs compared to the vertebral bodies in earlier stages of the disease (etiology). This cross-sectional study aims to evaluate the local contribution of the intervertebral discs and vertebral bodies to the three-dimensional spinal deformity in early AIS.
Material and Methods:	Female AIS patients with a coronal Cobb angle of 20-40 degrees indicated for brace treatment were included and underwent a dedicated full-spine MRI scan (3D T2 sequences + AI-generated synthetic CT). Using a previously validated semi-automated image processing method, mechanical torsion (°/cm height) and coronal and sagittal wedging (convex-concave height difference (%) and anterior-posterior height difference (%), respectively), were assessed for 82 IVDs and 97 VBs of the primary curves.
Results:	15 female AIS patients (mean age 13.0 ± 1.1 years) with a mean Cobb angle of 34 ± 7 degrees were included. Their primary curves were analyzed. 10 curves were thoracic, 5 were (thoraco)lumbar. Respectively, for the IVDs versus the VBs, the mean mechanical torsion was 5.0 ± 2.3 versus 1.4 ± 0.5 °/cm height ($P < 0.001$). The mean convex-concave difference was $+24.9 \pm 18.2$ versus $+4.8 \pm 4.8$ % ($P = 0.021$) and the mean anterior-posterior height difference was $+6.5 \pm 10.4$ % versus -2.2 ± 3.2 % ($P = 0.001$).
Conclusion:	In early AIS curves, intervertebral discs are more affected than vertebral bodies with respect to mechanical torsion and coronal wedging. In the sagittal plane, the vertebral bodies were still kyphotic, while the discs were already lordotic. This confirms that disc deformation may represent an early and primary component of the scoliotic deformity and etiology, and that the anterior overgrowth of the vertebral bodies is secondary.

43. Scoring the (Un)seen? Patients' and Peers' Perceptions in Evaluation of Physical Appearance in Adolescent Idiopathic Scoliosis

Van de Fliert, D.G.; van Hooff, M.L.; Bisseling, P.; de Kleuver, M.; Rutges, J.P.H.J.; Schlösser, T.P.C.; Kempen, D.H.R.

Introduction:	Adolescent idiopathic scoliosis (AIS) is a spine and chest deformity that affects trunk appearance. The Spinal Appearance Questionnaire (SAQ) evaluates patients' perception of appearance. This study investigates whether patients' appearance perception differs after visualizing themselves and other AIS patients, and whether patients' and peers' appearance perceptions align.
Material and Methods:	Seventy-four AIS patients (15.3 years [SD 2.2], 82% girls) and 39 non-scoliotic peers (15.0 years [10.4-19.8], 87% girls) were included. Patients completed an initial SAQ, second SAQ after viewing their own photographs (four cropped, standardized photographs), SAQs of photographs of four other AIS patients, and final SAQ after viewing other AIS patients. Peers completed SAQs based on AIS patients' photographs. Ten item and appearance domain SAQ scores were compared.
Results:	After viewing photographs of themselves, patients scored items about prominence and head position (lateral/bending forward position), and appearance domain significantly higher (=worse). Patients scored items about flank and spine prominence significantly higher after viewing other AIS patients' photographs. Low agreement was found between the patients' and peers' perceptions of appearance for each item (ICC ranging 0.09–0.27) and total appearance domain (ICC 0.33 [95%CI 0.12–0.51])
Conclusion:	After viewing photographs of themselves and of other AIS patients, significant higher scores were found for indirectly visible items, highlighting this SAQ's limitation. Patients' and peers' perceptions of appearance do not align. The SAQ in its current form has questionable clinical value. A questionnaire aiming to measure patients' perceptions of their appearance should find a way to address parts of the trunk shape that patients cannot see and score.

44. Improvement of Aesthetics in Scoliosis Patients Using Pattern-Specific Rehabilitation

Frederik Damsgaard Højsager; Lisa Elliot; Pernille Winsløv Wied; Maarten de Groot; Mathilde Poos; Robyn Tesselaar; Rene M Castelein; Ane Simony

Introduction:	Among patients with scoliosis body asymmetry is a primary concern and improved aesthetics is often a goal of treatment. Most studies on Physiotherapeutic scoliosis-specific Exercises (PSSE) focus on radiographic improvement of Cobb angle, trunk rotation and patient objectives as pain relief as the primary target for improvement. Few studies focus on the aesthetic improvement, measured objectively. The aim of this study is to report the objective measured aesthetic improvement by TRACE (Trunk Aesthetic Clinical Evaluation), in patients with scoliosis treated with PSSE (Schroth Best Practice).
Material and Methods:	Data was collected at two different specialist scoliosis clinics, both treating AIS patients by PSSE (Schroth Best Practice). Patients with scoliosis were included in the study based on the inclusion criteria: AIS, age 15-45 years, radiographs available prior to treatment, no previous spine surgery and follow up assessment after at least 12 weeks of PSSE training. Patients were classified according to their curve type (thoracal, lumbar, thoracolumbar and double). The thoracal and lumbar angle of trunk rotation (ATR) was measured prior to treatment and at follow-up. Objective evaluation of aesthetics was performed by using the TRACE tool to evaluate patient photos in a relaxed posture. Evaluation was performed from the first and a follow up consultation and were evaluated by two independent blinded assessors: an spine surgeon and a physical therapist with more than 10 years of experience. Changes in TRACE were reported as the mean change between the two assessors.
Results:	A total of 169 patients were included in the original cohort, of which 111 (65.7%) had complete data available with radiograph, ATR and TRACE scores before and after PSSE and completed their training program. Overall PSSE was associated to better aesthetic outcomes (mean change in TRACE -1.4, sd 1.4), with a difference in lumbar (mean -1.1, sd 1.2) and thoracal/thoracolumbar (mean -1.6, sd 1.5). In lumbar curves the mean lumbar ATR decreased by 2.0 degrees, with thoracic ATR decreasing by 0.4 degrees. In thoracic curves, the contrary was seen, where the mean thoracic ATR was decreased by 3.1, compared to a mean decrease of lumbar ATR of 1.4.
Conclusion:	This is the first study to demonstrate, that PSSE is associated to a correction of the aesthetic outcomes, when rated by two blinded observers using the TRACE scale. It further suggests that the change in ATR corresponds to the curve type and PSSE training and that a derotation of the curve is present if patients are adherent to their program.

45. Serum Proteomic Signature Associated with Bone Mineral Density at Youth in Individuals With and Without Idiopathic Scoliosis

Georgopoulos I; Cheng T; Diarbakerli E; Schizas N; Gerdhem P

Introduction:	We and others have previously reported lower bone mineral density in individuals with idiopathic scoliosis compared to controls at youth. We performed an exploratory analysis of circulating serum protein abundance in individuals with and without idiopathic scoliosis and its association to bone mineral density.
Material and Methods:	Serum samples were retrieved from 43 individuals with moderate scoliosis (non-surgically treated), and 43 sex and age matched non-scoliotic controls. The OLINK Explore HT assay, analysing 5,415 unique proteins, was used. Areal bone mineral density and muscle mass were measured with dual-energy X-ray absorptiometry (DXA) and volumetric bone mineral density and muscle mass with peripheral quantitative computed tomography (pqCT), available in up to 41 individuals with scoliosis and in 43 controls. Associations between protein abundance and total hip bone mineral density assessed by DXA were analysed using linear regression adjusted for sex and age, with sensitivity analyses performed with adjustment for group and BMI. Gene set enrichment analysis using Reactome pathways was performed.
Results:	In the scoliosis group mean Cobb was 28 (range 16-41) degrees. Both groups had similar mean chronological and skeletal age (Tanner-Whitehouse 3), 14 years. Mean (SD) BMI was 19 (4) and 20 (4) kg/m ² , in the scoliosis and control groups respectively. No individual protein remained significant after correction for multiple testing in the linear regression. The Reactome gene set enrichment analysis identified Striated Muscle Contraction as the top enriched pathway (normalized enrichment score 2.01, false discovery rate 0.017), mainly driven by MYBPC1, MYBPC2, ACTN2, MYL3, TNNC1, TNNI3, DMD, and TTN. Individuals with scoliosis tended to have lower DXA-derived muscle mass and pqCT derived muscle area, but similar muscle density as controls.
Conclusion:	Total hip bone mineral density in individuals with idiopathic scoliosis and controls at youth was associated with a circulating serum proteomic signature related to skeletal muscle contraction. The findings suggest that muscle-related biological pathways are associated with variation in bone mineral density in both individuals with idiopathic scoliosis and controls.

46. Serum Proteomic Signature in Idiopathic Scoliosis

Cheng T; Einarsdottir E; Diarbakerli E; Gerdhem P

Introduction:	Genetics currently only explains a minor part of the etiology in idiopathic scoliosis. To increase our understanding of the etiology we performed an exploratory analysis of serum protein abundance, comparing young individuals with and without idiopathic scoliosis.
Material and Methods:	Serum samples were retrieved from 43 individuals with moderate scoliosis (non-surgically treated), 43 age matched non-scoliotic individuals, 43 individuals with severe scoliosis (planned for or had undergone surgery), and 43 age matched non-scoliotic individuals. The OLINK Explore HT assay was used, analysing 5,415 unique proteins. Regression analyses were performed, adjusted for sex and age.
Results:	Mean age in the moderate scoliosis group (mean Cobb 28 degrees) and their controls were 14.0 years, and in the severe group (mean Cobb 56 degrees) and their controls 15.1 years. The number of females in the groups were 31, 30, 31 and 35, respectively, and the mean skeletal age according to Tanner-Whitehouse 3 was 13.5, 13.7, 15.2 and 13.8 years, and mean BMI 20.8, 19.2, 20.4, and 24.4 kg/m². We found a shared proteomic signature represented by 296 proteins shared between moderate and severe scoliosis, and with a highly consistent effect size in both groups, $r=0.83$, $p<0.001$. Using principal component analysis, the first principal component explained 35% of the variance among individuals with scoliosis. This proteomic axis was associated with the Cobb angle, and still significant after adjustments ($\beta=-0.36$, $p=0.018$). Among single proteins, IGFBP3 showed the strongest and significant correlation to the Cobb angle ($r=0.5$, $p<0.001$), while ITIH1, C3, SERPING1 showed weaker correlations, which did not reach statistical significance. Gene ontology analyses revealed the enrichment of biological processes related to immune regulation, protease and hydrolase regulation, nervous system guidance, axonal development and MAPK-signalling. Reactome analyses demonstrated enrichment of innate immune system, complement cascade and neutrophil degranulation.
Conclusion:	A serum proteomic signature was associated with idiopathic scoliosis and showed a modest correlation with curve severity. Whether these findings are primary or secondary to the development of scoliosis needs to be clarified.

SATURDAY

WILLNER SESSION

51. Intrathecal Morphine Versus Continuous Epidural Analgesia After Adolescent Idiopathic Scoliosis Correction: A Retrospective Practice-Change Cohort Study

Lisa Grytås; Jonathan Mathers; Torstein Lyngøy; Jarle Ottesen; Truls Hanestad; Thomas Natvik. Haukeland Universitetssjukehus, Bergen

Introduction:	Adolescent idiopathic scoliosis (AIS) correction surgery is associated with significant postoperative pain and adequate management can be challenging. Evidence directly comparing continuous epidural analgesia (EDA) and intrathecal morphine (ITM) after AIS correction surgery is limited. After our institution replaced EDA with ITM in april 2023, we evaluated the recovery course in terms of length of stay, systemic rescue-opioid use, mobilisation, antiemetic administration and discharge analgesia.
Material and Methods:	We performed a retrospective non-concurrent cohort study of 98 adolescents undergoing posterior spinal fusion for idiopathic scoliosis at a Norwegian tertiary centre. 50 patients received EDA and 48 received ITM after exclusion of two patients with incomplete ITM dose documentation. The primary outcome was length of stay. Recovery outcomes included mobilisation on postoperative day 0, rescue opioid administration, discharge analgesia, antiemetic administration, and adverse respiratory events. Adjusted analyses included age, weight, Cobb angle, operative time, and number of spinal levels fused.
Results:	Compared with EDA, ITM was associated with shorter hospital stay, earlier mobilisation, lower intraoperative fentanyl use, and less frequent discharge with strong opioids. Length of stay was shorter after ITM than EDA (median 5.0 vs. 6.0 days, $p = 0.007$). Recorded administered systemic oral morphine equivalents over 96 hours was higher after ITM than EDA (median 144 mg [113-197] vs. 105 mg [62-129], $p < 0.001$), but this calculation excluded epidural fentanyl delivered continuously in the EDA group and was therefore not interpreted as total opioid exposure. Total antiemetic use did not differ significantly between groups. No adverse respiratory events were observed in either group.
Conclusion:	In this retrospective practice-change cohort study, replacing continuous epidural analgesia with intrathecal morphine was associated with earlier mobilization, shorter hospital stay, and less frequent prescription of strong opioids at discharge, with no observed adverse respiratory events, but with higher recorded rescue-opioid requirements during the first 96 postoperative hours. These findings suggest a clinically relevant recovery trade-off and support prospective studies evaluating standardised multimodal analgesia, optimal ITM dose and patient-centred recovery outcomes after adolescent idiopathic scoliosis surgery.

52. Reducing Allogenic Blood Transfusion in Paediatric Scoliosis Surgery – Reporting Twenty-Six Years of a Multi-Disciplinary, Evidence-Based Quality Improvement Project from a Tertiary Paediatric Spine Surgery Unit in the United Kingdom

Jonathan Lucas; John Wong; Richard Pinder

Introduction:	It is known that Paediatric scoliosis surgery for both idiopathic and neuromuscular curves have historically been associated with significant blood loss requiring blood transfusion. The aim of this study is to evaluate the efficacy of a care pathway developed at our institution with a focus on reducing the need for allogenic blood transfusions in children undergoing spinal corrective surgery for Adolescent Idiopathic and Neuromuscular scoliosis over a 26 year period.
Material and Methods:	A retrospective review from our institution's prospectively collected data base recording of paediatric spinal surgery and transfusion rates between 2000 and 2025 was undertaken. Over the 26 years, measures to reduce the risk of allogenic blood transfusion from the introduction of Tranexamic Acid, through an extensive menu of additional measures have been implemented. In addition, in 2013, we undertook a comprehensive review of all the paediatric spinal surgical correction pathways with subsequent implementation of quality improvement initiatives to improve outcomes.
Results:	Between 2000 and 2025, there were a total of 1455 procedures for patients with Adolescent Idiopathic Scoliosis (AIS All) aged between 10 to 25 years old, of which 1206 procedures were a single stage Posterior Instrumented Scoliosis Correction (AIS Posterior). There were a total of 744 procedures for patients with Neuromuscular or Syndromic scoliosis (NMS). Overall, for the 26 year period, AIS all procedures had a transfusion rate of 7.8%, AIS Posterior a transfusion rate of 3.9%, and NMS procedures, a transfusion rate of 40.1%. Between the years 2000 to 2013, the transfusion rate was 19.5%, 11.5% and 59.7% for AIS All, AIS Posterior and NMS groups respectively. Between 2014 to 2025, the transfusion rate was 1.5%, 1.2% and 25.2% for AIS All, AIS Posterior and NMS groups respectively. There was a significant difference for all groups between the two time periods, $p < 0.05$ (chi-square test). We reviewed the transfusion rates across sequential two-years aliquots. There was a downward trend of transfusion rates from 2000 to end of 2025 in all three groups studied. In 2000 to 2001, the rate of transfusion was 78.9%, 80.0%, and 80.0% for AIS All, AIS Posterior and NMS groups respectively. In 2024 to 2025, the rate of transfusion was 1.0%, 1.0% and 21.6% for AIS All, AIS Posterior and NMS groups respectively. A simple linear regression analysis showed decreasing transfusion rates over time for all groups, an R squared of 0.6721, 0.6601 and 0.8546 for AIS All, AIS Posterior and NMS groups respectively which was significant ($p < 0.05$) for all three groups.
Conclusion:	The quality improvement initiatives implemented at our institution has reduced allogenic blood transfusion rates over time in both idiopathic and neuromuscular diagnostic groups significantly and favorably as compared with other studies.

53. Evaluating the Impact of Lowest Instrumented Vertebra in Selective Fusion of Main Thoracic AIS with Type C Lumbar Curves

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Introduction:	Selective thoracic fusion for Lenke 1C and 2C adolescent idiopathic scoliosis (AIS) is well established; however, selection of the lowest instrumented vertebra (LIV) remains controversial due to postoperative risks of coronal imbalance or residual lumbar curve progression. It is not clearly understood how LIV selection affects these outcomes. This study aimed to evaluate the effect of LIV selection on lumbar curve correction, postoperative lumbar curve stability, and coronal imbalance in main thoracic, C-modifier AIS.
Material and Methods:	This multicenter retrospective study included patients with Lenke 1C and 2C AIS that underwent selective thoracic fusion, defined by LIV proximal to the lumbar apex. Radiographic data were collected preoperatively, postoperatively, and at 2-year follow-up. Patients were grouped by LIV selection relative to their end vertebra (EV): at/proximal to EV, EV+1, EV+2, or EV+3 or distal. Coronal imbalance was defined as >2cm at 2y follow-up. Lumbar curve progression was defined as a >5° increase in the lumbar curve from immediate postoperative measurement to 2-year follow-up. Univariate analysis and multivariable regression were performed.
Results:	Eighty-seven patients were included (68 1C, 19 2C). Mean preoperative main thoracic curve was $59 \pm 10^\circ$, lumbar curve was $45 \pm 6^\circ$, and mean lumbar flexibility was $70 \pm 14\%$. LIV selection groupings resulted in 19 fused at/proximal to EV, 32 at EV+1, 18 at EV+2, and 18 at EV+3 or greater. Univariate analysis between LIV selection groups demonstrated significant differences in postoperative lumbar correction (ANOVA, $p < 0.001$), with fusion to EV+3 or distal having significantly greater lumbar correction ($62 \pm 20\%$) than fusion to EV ($43 \pm 13\%$, $p = 0.005$) and EV+1 ($43 \pm 17\%$, $p < 0.001$). On multivariable linear regression, fusion to EV+2 and EV +3 was independently associated with greater lumbar correction compared to fusion to the EV ($\beta = 11\%$, 95% CI 2–20 and 24%, 95% CI 14–33, respectively) Lenke 2C curves were also independently associated with greater lumbar correction compared to Lenke 1C ($\beta = 13\%$, 95% CI 5–21; $p = 0.001$). Preoperative main curve, lumbar curve, and lumbar flexibility were not significantly associated with lumbar correction. At 2-year follow-up, there were no differences between LIV groups in the proportion of patients with lumbar progression or coronal imbalance ($p = 0.432$ and $p = 0.190$, respectively). Multivariable logistic regression demonstrated no independent association between LIV selection and either outcome.
Conclusion:	To our knowledge, this multicenter study represents the largest cohort evaluating selective thoracic fusion in Lenke 1C and 2C AIS. A more distal LIV selection in relation to EV demonstrated a graded improvement in lumbar curve correction, with no difference in coronal balance or postoperative stability of the lumbar curve.

54. In Vivo Electromagnetic Tracking of Viscoelasticity During Scoliosis Induction in Göttingen Minipigs

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Introduction:	In growth-friendly, non-fusion surgery for pediatric scoliosis, the spinal tissues continuously adapt to applied forces, directly affecting how correction evolves over time. The Double Spring Reduction system is a prototype dynamic scoliosis reduction implant, combining distraction and torsion springs, investigated in a previous animal study. While this device demonstrated effective three-dimensional correction of scoliosis, the implant loading was not optimized. The aim of this experimental animal study is to characterize the in vivo viscoelastic response of the spine under torsional loads during the first 11 days after scoliosis induction surgery using a novel electromagnetic tracking approach.
Material and Methods:	Eight Göttingen minipigs received a left-sided tether with 2 right-sided torsional springs (preloaded with a torque of 1 Nm each) to induce a right-sided thoracolumbar scoliosis. To closely monitor the in vivo 3-D implant orientation, three 3D-printed nylon sensor clamping fixations and six-degrees-of-freedom sensors tracked the position and orientation three times daily during the first 11 postoperative days. The 3-D positions were converted into implant loads and the decrease in axial torque served as proxy for the viscoelastic response of the spine. To monitor the deformation and validate the sensor data, radiological imaging (X-ray and CT) was performed pre-operatively, post-operatively, and 11 days later, prior to sensor removal.
Results:	One animal was euthanized due to a spinal cord injury caused by screw malposition. Sensor readouts were successfully obtained from the other seven animals until day 11, except for one sensor that was damaged after seven days. The remaining sensors remained functional after removal. During the first 24 hours, the torque at the cranial and caudal torsion spring decreased by -0.1 Nm (-10.6%) and -0.9 Nm (-9.2%), respectively. This viscoelastic effect diminished over time: between 24 hours and 72 hours, the torque decreased by a further 0.02 Nm (-2.4%) in the cranial spring and 0.02 Nm (-2.2%) in the caudal spring, after which the torque remained stable until day 11. Simultaneously, the axial rotation increased from $-1 \pm 3^\circ$ pre-operatively to $8 \pm 3^\circ$ at day 11. The mean radiographic Cobb angle increased from $1 \pm 2^\circ$ pre-operatively to $5 \pm 4^\circ$ direct postoperatively, to $8 \pm 3^\circ$ at day 11.
Conclusion:	Most torsional viscoelastic changes during scoliosis induction occurred within the first 72 hours after loading, primarily at the intervertebral disk. Thereafter, these changes remained stable. Understanding viscoelastic behavior may help optimize 3D correction while preserving controlled growth, thereby enhancing durability and long-term deformity control.

55. Development and Validation of the Pelvic Maturity Indicators: A Novel Skeletal Maturity Classification Integrating the Risser Sign and Triradiate Cartilage Maturation

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Introduction:	Accurate skeletal maturity assessment is essential for treatment planning in adolescent idiopathic scoliosis (AIS). While the Sanders Maturity Scale (SMS) is commonly used to assess growth potential, it requires hand radiographs. The US Risser staging system (0-5) is widely used in clinical practice but provides limited information during the pubertal growth spurt, as iliac apophysis ossification appears after the period of peak growth and greatest risk of curve deterioration. To address this limitation, the Pelvic Maturity Indicators (PMI) were developed by combining triradiate cartilage maturity with Risser staging into a pelvic-radiograph-based classification. This study aimed to evaluate the relationship between PMI and SMS and independently validate the PMI and its reliability.
Material and Methods:	Two consecutive studies were performed. First, PMI was developed using a cohort of 130 AIS patients with paired pelvic and hand radiographs obtained within a three-month interval. PMI consists of seven maturity stages (PMI 2-8) based on triradiate cartilage status and Risser staging and was designed to align with corresponding SMS stages (2-8). Correlation and agreement between PMI and SMS were evaluated using Spearman's rank correlation and weighted Cohen's κ . Second, an independent validation study included 67 AIS patients with paired pelvic and hand radiographs. Four raters independently assessed anonymized and randomized radiographs using SMS and PMI. Agreement between PMI and SMS was evaluated using Spearman's correlation and Cohen's κ , while intra-rater and inter-rater reliability were assessed using Cohen's κ and Krippendorff's α , respectively.
Results:	In the development cohort, PMI demonstrated strong correlation with SMS ($\rho = 0.79$; 95% CI 0.72-0.85) and substantial agreement ($\kappa = 0.67$; 95% CI 0.58-0.75). Open and closing triradiate cartilage corresponded closely to SMS stages 2 and 3, respectively, while triradiate cartilage closure corresponded approximately to SMS stage 4 and preceded progression through the Risser stages. Predicted SMS values increased progressively across PMI stages, supporting construct validity. These findings were confirmed in the validation cohort. PMI demonstrated strong correlation with SMS ($\rho = 0.88$; 95% CI 0.77-0.93) and substantial agreement ($\kappa = 0.69$; 95% CI 0.60-0.79). Exact stage concordance between PMI and SMS was observed in 51% of cases. Inter-rater reliability was substantial for PMI ($\alpha = 0.82$; 95% CI 0.78-0.86) and near-perfect for SMS ($\alpha = 0.96$; 95% CI 0.95-0.97).
Conclusion:	The PMI is a valid and reliable extension of the Risser sign that integrates triradiate cartilage and iliac apophysis maturation into a pelvic-radiograph-based maturity assessment. Across both development and validation cohorts, PMI demonstrated strong correlation and substantial agreement with SMS while maintaining substantial inter-rater reliability. By identifying maturity stages corresponding to SMS 2 and 3 before appearance of the Risser sign, PMI provides a practical framework for growth assessment and treatment decision-making in AIS when hand radiographs are unavailable.

56. Brace Yourself: Is 70% In-Brace Correction Correlated with Better Outcomes in Nighttime Brace?

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Introduction:	In-brace correction is considered an important predictor of brace treatment success in adolescent idiopathic scoliosis (AIS), which has been demonstrated in full time bracing. The optimal correction in nighttime bracing however remains uncertain. The aim of this study therefore was to evaluate the association between 70% in-brace correction and treatment outcome in patients treated with nighttime brace.
Material and Methods:	This bicentre retrospective cohort study included patients treated with nighttime brace at two tertiary scoliosis centres (Hospital Lillebaelt, Denmark, and Karolinska University Hospital, Sweden). Logistic regression analyses evaluated the association between in-brace correction and three clinically relevant outcomes: ● Curve progression $>6^{\circ}$ ● Progression to Cobb angle $>50^{\circ}$ ● Surgery performed Analyses were performed in the full cohort (n=125) and separately in females (n=107). Multivariable models adjusted for baseline Cobb angle and, in females, menarche status.
Results:	In-brace correction $> 70\%$ was associated with significantly reduced odds of curve progression ($>6^{\circ}$) (adjusted OR 0.25, 95% CI 0.10–0.60) and progression to surgery (adjusted OR 0.23, 95% CI 0.06–0.81) in the full cohort. Similar findings were observed in the female sub cohort.
Conclusion:	Greater in-brace correction is associated with improved treatment outcomes in patients treated with nighttime brace and it highlights the recommendation to aim for the best possible in-brace correction.