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04/29-05/01

eSOSORT 2021

Society on Scoliosis Orthopaedic and Rehabilitation Treatment

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An Invitation to the eSOSORT 2021 Virtual Meeting from SOSORT President, Eric Parent, PhD, PT

Dear SOSORT Members and Stakeholders,

I am very pleased to invite you to participate in our eSOSORT2021 virtual meeting. Once again due to the pandemic, we have had to postpone our San Sebastian face to face meeting. Instead, I welcome you to join us and participate in eSOSORT2021 safely from the comfort of wherever you are. Let's embrace this opportunity to reach out to new participants who may not have had the chance to travel to our annual meeting before and share the latest information on recent conservative care initiatives for patients with structural spine changes. This year's virtual meeting will begin with synchronous (live) presentations on Thursday April 29 th and Friday April 30 th from 9am to 11am Eastern time and on Saturday May 1 st from 9am to 1pm Eastern time. All the presentations will be recorded and be made available on-demand for a duration of 1 year on our conference website for registered participants. This event will include presentations by the SOSORT award nominees, our two guest speakers, the SRS and SOSORT presidents, in addition to our live scientific presentations selected by our Scientific Committee co-chaired by Patrick Knott and Judith Sanchez-Raya. Guest speakers Michelle Marks and Ferran Pellisé will describe their experience with, the value and their findings related to establishing the Harms and the ISSG study group databases to advance scoliosis research.

In planning this year's virtual meeting, we have invested important efforts to introduce opportunities to interact with speakers and with other conference participants. We trust eSOSORT2021 will preserve many of the networking opportunities that we value in face to face meetings. The website where we share conference material on-demand will include a question and answer forum for each presentation where you can type your questions and receive answers from the authors on our website. We will also use the ConnectEventHub virtual meeting room where you will be able to select which virtual table you wish to sit at before during and after the presentation allowing you to interact via videoconference with the other participants and with our sponsor in the side lounges.

Registration is now open and our preliminary program is available. Take advantage of the low cost of this virtual meeting to experience a SOSORT annual meeting. Spread the word as this is an excellent opportunity for clinicians and researchers to benefit from this unique opportunity to learn the latest information on conservative management for patients with scoliosis and other structural spine changes.

The Board and I are excited to be able to offer this opportunity for our society to meet despite the current difficulties surrounding Covid-19. I sincerely hope that this announcement helps to lift your spirits, meet your educational needs and I look forward to seeing you all at eSOSORT2021.

Eric Parent
SOSORT President

2021 Virtual Meeting Schedule

Note: Programming starts at 9am

Thursday 04/29
8:40am – 11:30am EST

8:40 – 9:00	Coffee time/Visit with our attendees and sponsors
9:00 – 9:15	Welcome and Opening Remarks
9:15 – 9:45	Keynote Speaker: Ferran Pellise, MD, PhD
9:45 – 10:45	Abstract Podium Presentations
10:45 – 11:00	Closing Remarks for the Day
11:00 – 11:30	Coffee time/Visit with out attendees and sponsors

Friday 04/30
8:45am – 11:30am EST

8:45 – 9:00	Coffee time/Visit with our attendees and sponsors
9:00 – 9:15	Day 2 Opening Remarks
9:15 – 9:45	Business Meeting
9:45 – 10:45	Abstract Podium Presentations
10:45 – 11:00	Closing Remarks for the Day
11:00 – 11:30	Coffee time/Visit with out attendees and sponsors

Saturday 05/01
8:45am – 1:00pm EST

8:45 – 9:00	Coffee time/Visit with our attendees and sponsors
9:00 – 9:15	Day 3 Opening Remarks
9:15 – 9:45	SRS President's Address: Muharrem Yazici, MD
9:45 – 10:15	Keynote Speaker: Michelle C. Marks, PT, MA
10:15 – 11:25	SOSORT Award Nominee Presentations
11:25 – 11:55	SOSORT President's Address: Eric Parent, PhD, PT
11:55 – 1:00	Virtual Social Activity

Keynote Speakers

The European Spine Study Group, from its conception to the present

Ferran Pellisé, MD, PhD

Dr Ferran Pellisé is entirely dedicated to the surgical treatment of spinal disorders, with special interest in scoliosis and other spinal deformities. He is the Chief of the Spine Unit at the Vall d'Hebron University Hospital, Director of the Spine Service at Hospital Quirón Barcelona and Professor of Orthopedics at the Universitat Autonoma de Barcelona. Dr Pellisé has published over 150 peer-review papers. His research work in spinal deformity has won the prestigious Hibbs award and the Whitecloud award from the Scoliosis Research Society, as well as the Best Paper Award from EuroSpine-The Spine Society of Europe, the European Association of Neurosurgical Societies, BASS-British association of Spinal Surgeons and GEER-The Spanish Spine Society.

He serves on the boards of several scholarly journals and has been Deputy-Editor of the European Spine Journal between 2005 and 2015. He has served on the boards of different medical associations including the Spanish Spine Society (President), the Spine Society of Europe (President) and the Scoliosis Research Society (Director at Large and Secretary Elect). In 2011, Dr Pellisé founded the European Spine Study Group (ESSG) together with other well-known researchers in the field of adult spinal deformities. Nowadays the ESSG is the main platform for the analysis and evaluation of adult spinal deformities in Europe.

Keynote Speakers

Collaborative Research Powers Innovation and Quality Improvement

Michelle C. Marks, PT, MA

Michelle Marks is the executive director of the Setting Scoliosis Straight Foundation and the research director of the Harms Study Group, the premier Pediatric Scoliosis research group. Michelle's professional career has spanned as a physical therapist at Rady Children's Hospital in San Diego, in the Motion Analysis Laboratory Research Labs at Connecticut Children's Hospital, and Rady Children's Hospital. For more than 23 years she has led the efforts, along with Dr. Peter Newton, of the Harms Study Group and in 2008 formed the nonprofit foundation, Setting Scoliosis Straight with a mission to advance the treatment of pediatric scoliosis patients through research and education. Michelle holds a B.S. in Physical Therapy from Mount St. Mary's College in Los Angeles and a master's degree in Biomechanical Research from San Diego State University. She resides in San Diego, California and is a wife and mother of two. She loves surfing, swimming, hiking, and riding her horses.

SRS – More than a surgery-oriented Society

Muharrem Yazici, MD

Muharrem Yazici is the Professor of Orthopedics at the Hacettept University in Ankara, Turkey. His clinical practice involves pediatric orthopedic and spine conditions. His research focuses on the treatment of early onset pediatric spine deformities. He edited two international textbooks and published more than 140 research articles in peer review international journals. He served as president for European Pediatric Orthpaedic Society (2012-2013) and as Board of Director (2012-2014), Chair of Growing Spine (2007) and Program Committees (2017) for the Scoliosis Research Society (SRS). He is currently serving as President of the SRS.
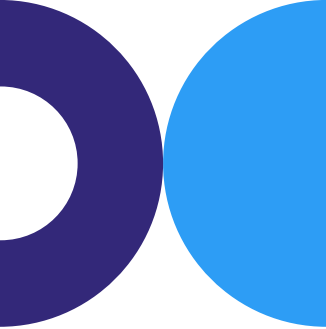
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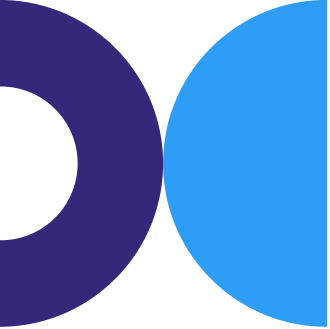Treasurer

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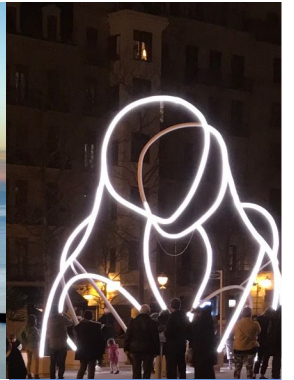Alessandra Negrini

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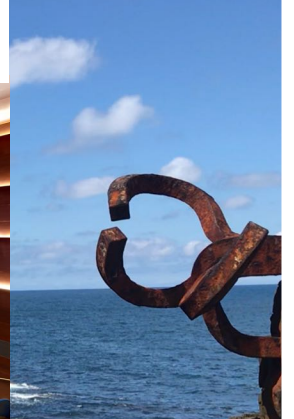Andrea Lebel

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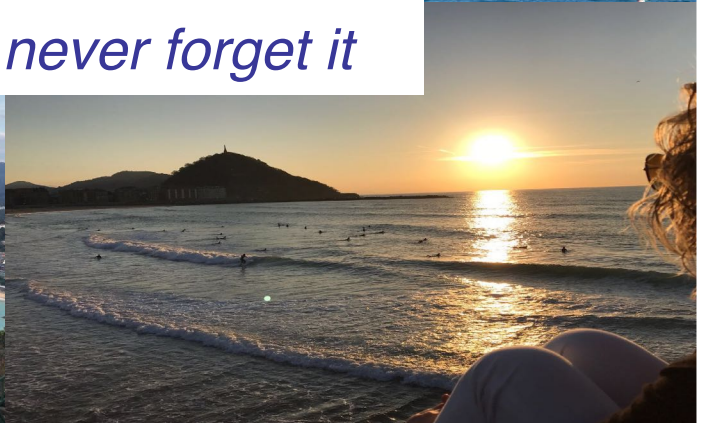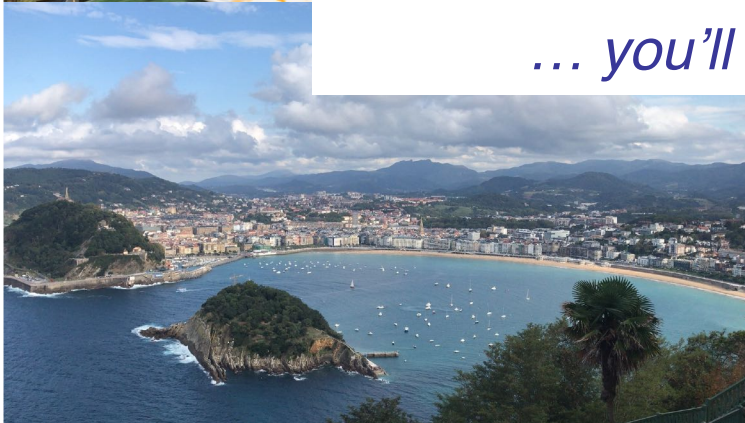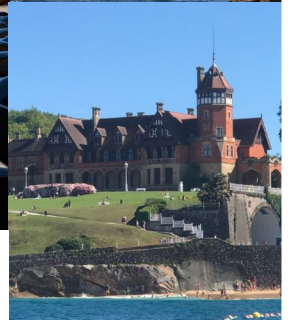
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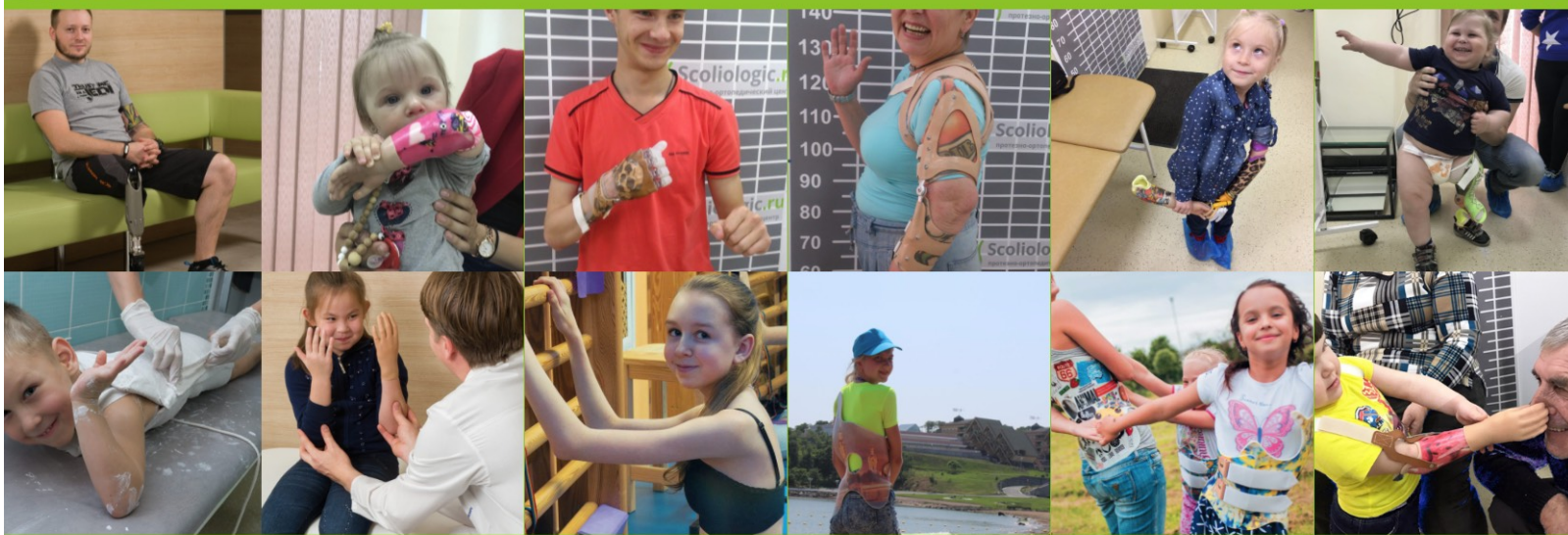
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SOSORT Award Nominees

Using Muscle Parameters to Predict Curve Progression in Adolescent Idiopathic Scoliosis (AIS)

by Rufina Wing Lum Lau | Ka Yee Cheuk | Vivian Wing Yin Hung | Fiona Wai Ping Yu | Elisa Man Shan Tam | Lyn Lee Ning Wong | Jiajun Zhang | Franco Tsz Fung Cheung | Wing Sze Yu | Wayne Yuk Wai Lee | Jack Chun Yiu Cheng | Tsz Ping Lam | School of Medical Health Sciences, Tung Wah College, Hong Kong SAR, China & Department of Orthopaedics and Traumatology, SH Ho Scoliosis Research Laboratory,   Joint Scoliosis Research Center of CUHK & Nanjing University, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China

Background

Adolescent Idiopathic Scoliosis (AIS) patients are found to have low bone mass, deranged bone qualities, low bone mechanical properties, low lean mass and muscle imbalance in previous studies. Previous findings from our group showed a unique correlation pattern of handgrip strength and bone qualities in AIS as compared to controls.

Objective

This longitudinal cohort study aimed to investigate whether baseline muscle and bone parameters in AIS could predict curve progression.

Methods

126 AIS girls aged 12-14 years old were recruited. AIS girls received clinical follow-up until reaching skeletal maturity and sub-grouped into progressive (increased Cobb angle ≥ 6 o) and stable (increased Cobb angle <6°) groups according to SRS criteria. Maximum handgrip strength at both hands was measured with a standard dynamometer, lean mass at arm, leg and trunk was measured by body impedance analysis, and bone qualities and bone mechanical properties of non-dominant distal radius were measured by high-resolution peripheral quantitative computed tomography (HR-pQCT). Logistic regression model was used to determine the predictors for curve progression.

Results

Forty-four AIS (34.9%) had curve progression with change of Cobb angle greater than or equal to 6o before skeletal maturity. Progressive AIS had similar age, curve severity and lifestyle but lower weight and Thumb Ossification Composite Index (TOCI) compared with stable AIS. They also had lower trunk (5.7%) and arm lean mass (8.9%), weaker handgrip strength at dominant side (8.8%), deranged cortical compartment (29.1% smaller area and 6.5% lower vBMD) and lower bone mechanical properties (13.2% lower stiffness and 12.5% lower estimated failure load) than stable AIS. With receiver operating characteristic (ROC) analysis, the best cut-off of maximum dominant handgrip strength is 19.75kg for distinguishing progressive AIS from stable AIS (75% sensitivity and 52.4% specificity, LR+ =1.577, p=0.011).

Conclusion

Our results showed progressive AIS had poorer muscle and bone parameters when compared to stable AIS. Our group further identified a cut-off threshold of 19.75 kg in the dominant handgrip strength, which might have the potential to use this value as a surrogate for predicting curve progression in AIS.

The relationship between electromyographic amplitude of paravertebral muscles and curve progression in Chinese adolescents with idiopathic scoliosis: a prospective cohort study

by Charlene Yunli Fan | Eric HK Yeung | Michael KT To | Jason PY Cheung | Zhuoman Xu | Jianbin Wu |Rong He | Ruiwen Zhang | zhidong Yang | Guangshuo Li | The University of Hong Kong | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong | The University of Hong Kong | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong - Shenzhen Hospital

Background

The imbalanced electromyographic activity (EMG) of paravertebral muscle has been commonly presented in adolescent idiopathic scoliosis (AIS). Previous study revealed a higher EMG ratio at the lower end vertebra (LEV) with a progressive AIS. However, limited sample size and the curve pattern were not clarified in previous studies, which caused systematic errors because of EMG signal varies from different back muscles.

Objective

This study aimed to define the relationship between paravertebral EMG of the major curve and curve progression in patients with AIS.

Methods

This was a prospective cohort study recruiting participants with AIS and age/gender matched health controls between January 2020 and January 2021. All participants undertook observation, yet without either therapeutic exercise or spinal orthosis during this study period. The EMG was performed on participants in sitting and doing back extension in prone lying at study initiation. The paravertebral EMG ratio was defined as the root meant square (rms) value of EMG amplitudes of the total recording time (corrected for cardiac contamination) of a convexity pair divided by a concavity pair at the upper end vertebra (UEV), apical vertebra (AV) and LEV levels of the major curve, respectively. For the health controls, EMG was placed on the paravertebral levels corresponding to their matched pairs. Scoliosis progression was defined as a D-value of Cobb angle larger than 5 degrees after observation for 6 months. The primary outcome was the relationship between scoliosis progression and each paravertebral EMG ratio; the secondary outcome was the difference of paravertebral EMG ratio between AIS and age/gender matched controls.

Results

A total of 320 participants, 160 with AIS (age: 11 to 16 years, 124 females and 36 males, 80 major thoracic curves and 80 major lumbar curves, Cobb angles of the major curve: 18 to 45 degrees) and 160 age- and gender-matched health controls were recruited. Prior to main study, a pilot study was conducted to assess the reliability and repeatability of the EMG measurements. Intraclass correlation coefficient (ICC) showed satisfactory reliability of the rms-EMG for sitting (ICC3,3 = 0.96) and the back-extension test (ICC3,3 = 0.98). Multiple regression

analysis revealed that the rms-EMG ratio at the AV level during the back- extension test (OR:2.2, 95% CI: 1.8 – 3.1, $p < 0.01$) and sitting (OR:1.7, 95% CI: 1.3 – 3.4, $p = 0.03$) were significantly correlated with a curve progression; rms-EMG of the LEV with a major thoracic curve at the sitting position (OR:1.8, 95% CI: 1.2 – 2.6, $p < 0.01$) was significantly related with a curve progression and gravity loading (R=0.87, $p < 0.01$).

Conclusion

A higher rms-EMG ratio at the AV level was significantly correlated with a curve progression. An imbalanced rms-EMG ratio at the LEV level was related with gravity loading alongside a curve progression in participants with major thoracic curves. These findings are values of predicting curve progression from a musculoskeletal perspective.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Adults with idiopathic scoliosis: progression over 5 Cobb degrees is predicted by menopause and metabolic bone disease.

by Sabrina Donzelli | Fabio Zaina | Sofia Cimarelli | Valentina Bartolini | Stefano Negrini | Italian Scientific Spine Institute | Italian Scientific Spine Institute | 5. Santo Stefano Riabilitazione, Centri Ambulatoriali Regione Marche, Italy | 4. Fondazione Don Carlo Gnocchi Onlus, Ancona, Italy | 1. Department of Biomedical, Surgical and Dental Sciences, University "La Statale", Milan, Italy 2. IRCCS Istituto Ortopedico Galeazzi, Milan, Italy

Background

According to the current knowledge, in idiopathic scoliosis adults' curves exceeding 50 Cobb degrees are expected to progress one Cobb degree per year on average. Therefore, regular follow-up is recommended. Following up patients with spine deformities for all life   is costly, and a better knowledge of the natural history would provide a better selection of subjects to be followed up in a shorter period, thus optimizing costs. Aging and spine degeneration play a role in the progression process, but which factors could be potentially involved as determinants of progression have never been investigated.

Objective

The aim was to analyze the factors determining a minimum 5 Cobb degrees curve progression in a large cohort of adults followed up for a 5-year minimum period.

Methods

Design Retrospective longitudinal cohort study. Participants we extracted a sample of 767 adults according to the following inclusion criteria: aged >20 years, idiopathic scoliosis curves above 10 Cobb degrees, two or more x-rays over a minimum 5-year period, no spine surgery before the entry date.

Primary curve progression exceeding 5° Cobb degrees as a binary variable. Cobb angle measures have been evaluated in consecutive x-rays (2 at minimum) during a 5-year minimum follow up.

Prognostic factors: Age at x-ray as the time variable. Baseline characteristics (gender, thoracic localization of the primary curve, bone metabolic disease, bone and joint inflammatory disease, referred back pain, neurologic associated disease, brace during growth and menopause).

Statistics: Population average model for binary logistic regression. The crude OR guided the choice of the explanatory variables to be included in the multivariate the significance level was set with $p<0.05$. ROC curve was used to check the discrimination ability of the model.

Results

Females were 88.8%, Cobb degrees at the baseline were Cobb 41.2±15.3, entry date mean age was 34.0+-12.4, 47.8+-13.0 at the last available x-ray. 421 (54.9%) subjects had a progression exceeding 5 Cobb degrees, while 220 (28.7%) progressed ten or more Cobb degrees. Brace treated patients during growth were 288 (37.6 %). The proportion of women in

menopause was 25%. A bone metabolic disease was reported for 69 patients (9%). Patients with a neurologic disease were 41 (5.4%) and 44 referred a bone and joints diseases; 512 (66.8%) referred backpain. Bone and metabolic disease exposed subjects to 64% higher odds of 5 Cobb degrees progression at the primary curve (CI95% 1.18-2.27). Patients in menopause had 80% higher odds of 5 Cobb degrees progression (CI95% 1.36-2.38). The present results reflect and confirm previous findings: the kinetics of progression is increased by 0.40 when age is over 50 (CI95% 0.3-0.5).

Conclusion

In patients with bone metabolic disease, age over 50, and in menopause, we encourage a shorter follow-up period. Larger analysis with longer follow up are needed to provide a better understanding of adult scoliosis

Conflict of Interest Disclosure

SD, FZ,SC, and VB have no Conflicts of Interest to disclose
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Brace and Physiotherapeutic Scoliosis Specific Exercises (PSSE) for Adolescent Idiopathic Scoliosis (AIS): A prospective study following Scoliosis Research Society (SRS) criteria

by Nikos Karavidas | Schroth Scoliosis & Spine Clinic, Athens, Greece

Background

A growing scientific evidence for conservative treatment of AIS has recently occurred, using PSSE for mild and bracing for moderate curves. Bracing have proved its superiority to natural history and is recommended by SRS for Cobb angles > 25°. Few studies have used a combination of PSSE and bracing, showing significantly better results than bracing alone.

Objective

Our aim was to investigate the effectiveness of bracing along with PSSE for AIS treatment. The main goal was to halt progression.

Methods

Prospective study, enrolling all eligible subjects from a prospective database. SRS research inclusion criteria were used (>10 years, 25° – 40°, Risser 0-2, < 1-year post-menarche, no prior treatment). 102 consecutive patients (87 females-15 males, mean age 12.8 years, Risser 0.48, Cobb Thoracic 29.2°, Lumbar 27.8o) followed treatment with Cheneau type brace and PSSE. Average follow-up time was 26.4 months. A scale from A to C was used to evaluate compliance with brace and PSSE (A: full-compliant, B: partially compliant, C: non- compliant). A threshold of 5° defined progression or improvement. 7 subjects dropped-out (6.8%), so finally 95 patients included for statistical analysis, using paired t-test.

Results

62 patients (65.3%) remained stable, 22 improved Cobb angle >5° (23.2%) and 11 progressed (11.5%). The mean in-brace correction (IBC) was 49.7% for thoracic curves and 61.7% for lumbar curves, post-treatment thoracic Cobb was 29.9° and lumbar 27°. A subsequent analysis for the progressed cases revealed that IBC was lower than average (31.7% for thoracic and 34.4% for lumbar curves), 9 patients (81.8%) were classified as C for brace compliance and 7 patients (63.6%) as C for PSSE compliance. Another analysis for A-compliant patients with both brace and PSSE (62 participants – 65,3%) showed significantly greater effectiveness (p=0.005) than overall average, as 44 patients (70.9%) stabilized Cobb angle, 18 (29.1%) improved and none progressed (0%).
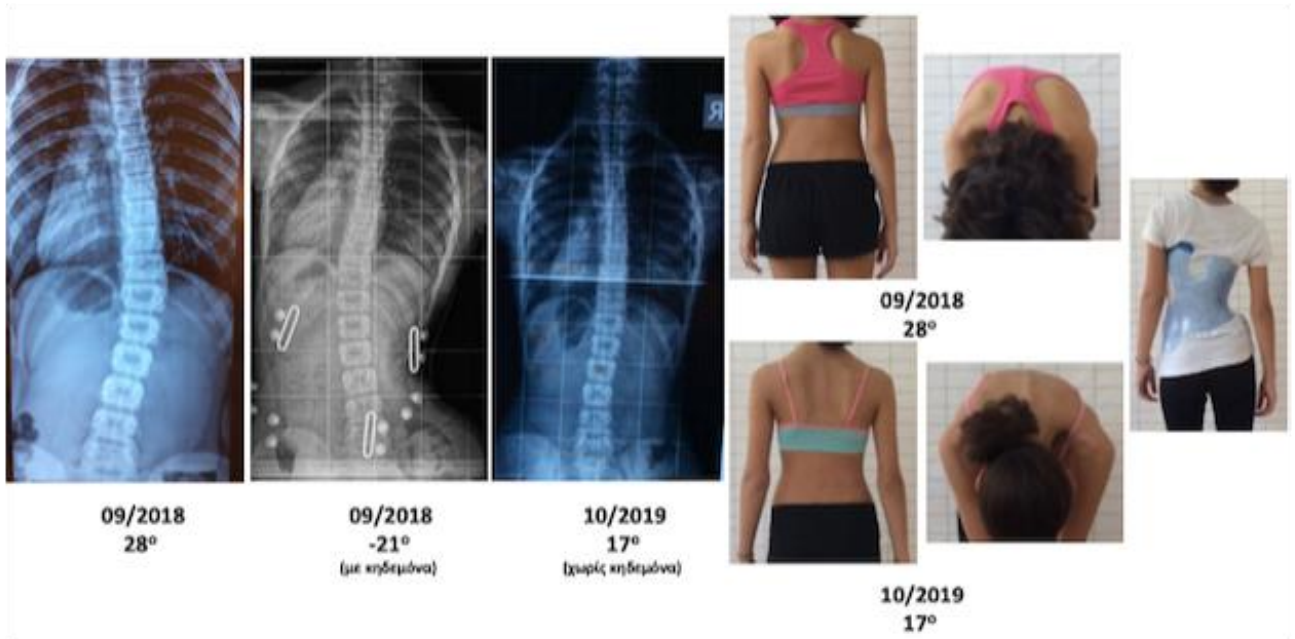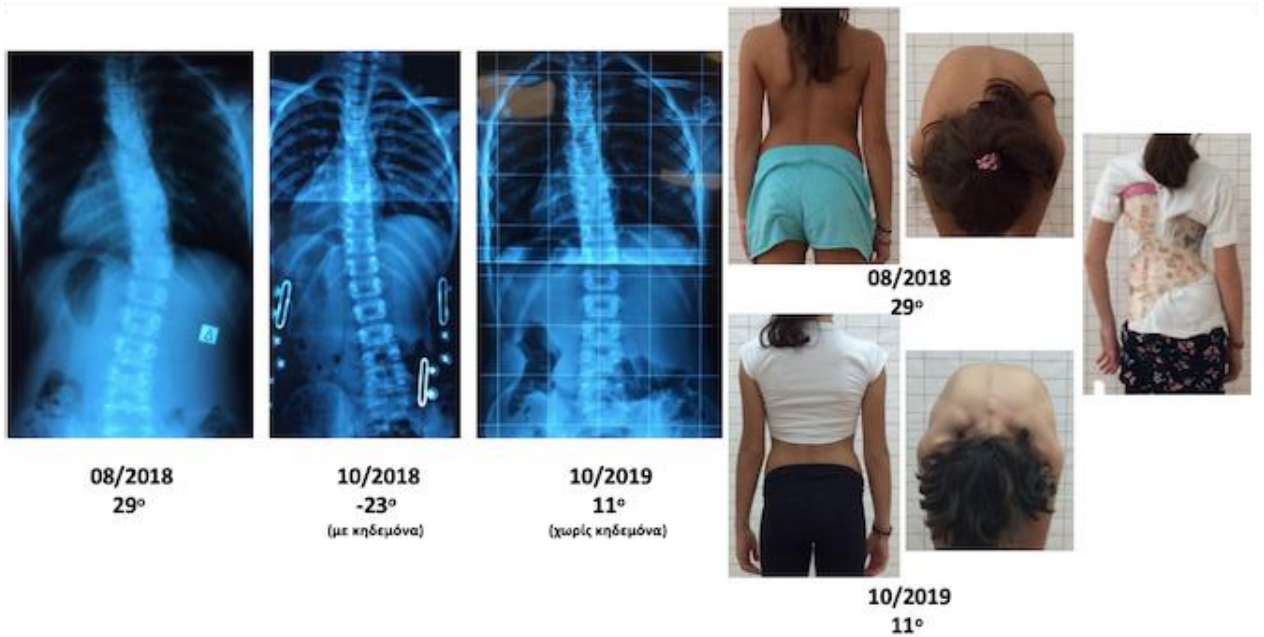
Conclusion

A combination of bracing and PSSE can effectively treat AIS, according to SRS inclusion criteria. 88.5% of patients did not progress more than 5° and only 6.4% overpassed surgical indication range. IBC and compliance are the most important prognostic factors for successful treatment result. Our multi-professional approach probably enhanced adherence to treatment protocol. Early detection of AIS is also necessary for increased possibilities of effective

conservative treatment. Future randomized controlled studies, with brace and PSSE, are recommended to provide stronger scientific evidence.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose

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17°

Effectiveness of Physiotherapeutic Scoliosis Specific Exercises (PSSE) on Adolescent with Progressive Spine Deformities Who Refused Brace Treatment – 5 Years Follow-Up

by Dmitry K. Tesakov | Darya D.Tesakova | Arkadii I.Kazmin | Republican Scientific and Practical Center of Traumatology and Orthopedics, Belarus, Minsk | Federal State Budgetary Educational Institution of Further Professional Education "Russian Medical Academy of Continuous Professional Education" of the Ministry of Healthcare of the Russian Federation | National Medical Research Center of Traumatology and Orthopedics named after N.N. Priorova, Russia, Moscow

Background

Scoliosis treatment is complex and requires constant patient involvement in the process. Even guidelines on SOSORT therapy are clear the Patient's perception of treatment when prescribing brace therapy remains controversial, but PSSE remains an indispensable resource for the treatment.

Objective

The objective of this study is to evaluate the efficacy of PSSE in adolescent patient population with different initial deformity parameters.

Methods

Prospective comparative study was performed from 2015-2019 years and enrolled 2006 6-10 y.o. patients with IS who were observed in the center for idiopathic scoliosis, performed physiotherapy exercises. PSSEs included the education of self-correction, specific correction and stabilization exercises 2-3 times a day with 1.5 to 3 hours general time. We excluded children treated with brace and awaiting surgery, but we included children with deformities over 200 who refused bracing. Female group included 1770 patients (88,2%), male group included 236 patients (11,8%). Initially, grade I (the Cobb angle ≤10 °) we found in 303 patients (15.1%), grade II (11°-25° angle) - in 327 (16.3%), grade III (angle 26°-40°) - in 645 (32.1%) and grade IV (arc angle ≥41°) - in 731 patients (36.5%).

Results

In Grade I group (n = 303) we achieved correction in 18 cases (6.0%), deformity stabilization in 198 (65.3%), and progression in 87 (28.7%). In group II (n = 327) sustained correction was in 27 cases (8.2%), stabilization - in 164 (50.2%), continued progression in 146 (41.6%). Grade III group (n = 645) showed 30 cases correction (4.6%), 143 (22.2%) stabilization and 472 (73.2%) - continued progression. Grade IV group (n = 731) showed correction in 28 patients (3.8%), stabilization in 84 (11.5%), in 619 (84.7%) deformity progression.

Conclusion

The presented study confirms the effectiveness of exercises for deformities up to 200 , but also shows the feasibility of their use for progressive deformities, when bracing is abandoned, deformity stabilization is possible in every fifth patient (p<0,05).

Conflict of Interest Disclosure

"We have no Conflicts of Interest to disclose."

Efficacy of bracing in infantile scoliosis. A 4-years prospective cohort shows that idiopathic respond better than secondary scoliosis

by Stefano Negrini | Sabrina Donzelli | Greta Jurenaite | Francesco Negrini | Fabio Zaina | University of Milan - IRCCS Istituto Ortopedico Galeazzi, Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan | IRCCS Istituto Ortopedico Galeazzi, Milan | ISICO (Italian Scientific Spine Institute), Milan

Background

According to Mehta results, Casting is considered the gold standard conservative treatment for infantile scoliosis. Casting requires repeated general anaesthesia, and recently doubts have been raised that this could cause potential brain damages in the long term. For this reason, renovated interest is growing about bracing, and some case series have been recently presented. In our Institute, we are using bracing for a long time to reduce invasivity for the patient. Moreover, the results of the Sforzesco brace have shown to be similar to casting in adolescents.

Objective

We aimed to check the results in the medium term of bracing of infantile scoliosis, comparing the two groups: idiopathic and secondary scoliosis.

Methods

We performed a retrospective study in a prospective cohort. We extracted from our prospective database all patients respecting the following inclusion criteria : infantile scoliosis patients (discovery of scoliosis below age 3), brace prescription, at least 3 consultations at our centre to exclude second opinions. We checked in-brace results and final results at the end of observation. After verifying for normal distribution, to check in- and between-groups results, we used t-test, paired and unpaired, respectively. Weconsidered the following categories at final consultation:
> full success <20° Cobb stable during progressive brace weaning partial success <30° Cobb stable during progressive brace weaning palliation: progression <5° but curve >30° at last consultation partial failure: progression >5°
> full failure: fusion

Results

We included 28 patients whose characteristics are reported below.

	Measure	Idiopathic Average	SD	Secondary Average	SD	T-test
Participants	Males:females	6:9		4:9		**NS**
	Age	aa.mm	1.11±0.10	1.11±0.10		**NS**
	First x-ray	°Cobb	43±14	46±20		**NS**
Scoliosis curves	Single	10	67%	8	62%	
	Double	3	20%	4	31%	**NS**
	Triple	1	7%	1	8%	
Time of observation	aa.mm	4.07±2.07	3.10±1.05			**NS**

At the end of the study, we found statistically and clinically significant differences between the two groups. These differences were already present at the in-brace first x-ray.

	Idiopathic Average	SD	Secondary Average	SD	T-test
Start x-ray	43	14	52	21	**NS**
In brace x-ray	27	12	43	16	**NS**
Brace correction	44%	24%	32%	13%	**NS**
T-test	**P<0.005**		**P<0.05**		
Final x-ray	25	13	52	27	**P<0.005**
Final correction	38%	34%	-4%	58%	**P<0.05**
T-test	P<0.0001		NS		

At the end of observation, one patient in the idiopathic group had been fused (start at 58°, age seven months – fused at 76°, age 2.5), and four had been completely weaned from the brace. No patients in the secondary scoliosis group had been weaned or fused. Final results were statistically different between the two groups and can be categorized as follows:

		Idiopathic N	%	Secondary N	%	Total N	%
Success	Full	6	40%	1	8%	7	25%
	Partial	5	33%	3	23%	8	29%
	Total	**11**	**73%**	**4**	**31%**	**15**	**54%**
Palliation	Palliation	2	13%	6	46%	8	29%
	Total	**2**	**13%**	**6**	**46%**	**8**	**29%**
Failure	Partial failure	1	6%	3	23%	4	14%
	Fusion	1	6%	0	0	1	4%
	Total	**2**	**13%**	**3**	**23%**	**5**	**18%**

Conclusion

Bracing offers promising results in the medium term for idiopathic scoliosis, with very few palliation and failure cases, while palliation prevails for secondary scoliosis.

Conflict of Interest Disclosure

SN has a stock of ISICO. Other authors have no Conflicts of Interest to disclose.

Effect of Schroth exercises on quality of life, physical activity, perceived appearance, and back muscle endurance in Adolescent Idiopathic Scoliosis (AIS): a randomized control trial (RCT)

by Courtney Hebert | Camille Warner | Eric Parent | Sanja Schreiber | Graham Murray | Sarah Southon | Marc Moreau | Jim Mahood | Eric Huang | Kyle Stampe | Edmond Lou | Department of Physical Therapy, University of Alberta, Edmonton, Canada | Department of Physical Therapy, University of Alberta, Edmonton, Canada | Department of Physical Therapy, University of Alberta, Edmonton, Canada | Department of Physical Therapy, University of Alberta, Edmonton, Canada; Curvy Spine Clinic, Edmonton, Canada; International 3-Dimensional Schroth Scoliosis Therapy, Edmonton, Canada | Department of Physical Therapy, University of Alberta, Edmonton, Canada; The Bridge Physiotherapy, Sherwood Park, Canada | Alberta Health Services, Edmonton, Canada; Department of Surgery, University of Alberta, Edmonton, Canada | Department of Surgery, University of Alberta, Edmonton, Canada | Department of Surgery, University of Alberta, Edmonton, Canada | Department of Surgery, University of Alberta, Edmonton, Canada | Department of Surgery, University of Alberta, Edmonton, Canada | Department of Surgery, University of Alberta, Edmonton, Canada; Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Canada

Background

The standard care for AIS in North America includes observation and bracing. Scoliosis- specific exercises have shown promising results. It is unknown whether the Schroth method should be recommended in the conservative treatment of AIS in North America.

Objective

The aim of this study was to determine the effect of six months of Schroth exercises added to standard care on quality of life, perceived appearance, back muscle endurance, and physical activity compared to standard care alone in participants with AIS.

Methods

In this assessor and statistician-blinded RCT, 124 participants with AIS aged 10-16, curves 10-45°, and Risser ≤3 were randomized to receive Schroth exercises added to standard care (experimental group, EXP) or standard care alone (control group, CTRL). The intervention included five private sessions, followed by weekly group classes, and daily home exercises for six months. Physical assessments and questionnaires were completed at baseline, three, and six months. Outcomes included the Scoliosis Research Society 22r (SRS-22r), Spinal Appearance Questionnaire (SAQ), Biering-Sorensen Back Muscle Endurance Test, and 3-Day Physical Activity Report (3DPAR). A per-protocol analysis was conducted using repeated measures ANOVA for 99 participants with complete data. Fifteen participants dropped out from CTRL and 10 from EXP.

Results

At baseline, the Schroth group (n=54) consisted of 92.6% females and 7.4% males, while the control group (n=45) consisted of 100% females. They were of similar age (EXP 13.2±1.6yrs;CTRL 13.1±1.7yrs), weight (EXP 44.3±11.8kg;CTRL 46.4±9.6kg), Cobb angles (EXP 26.9±8.7°;CTRL 27.7±8.8°), and maximum scoliometer values (EX 9.2± 3.3°;SoC 8.6±

3.5°). Curve types among Schroth and controls were respectively: 3c (8.9;11.1%), 3cp (33.3;29.6%), 4c (15.6;14.8%), 4cp (42.2;44.4%). Braces were worn by 74.1% of EXP and 73.3% of CRTLs. Prescribed visit attendance was 86% and home compliance was 78%.

At six months, both groups improved over time with no differences between groups for pain (p=0.002), satisfaction (p<0.001) or Total SRS-22r scores (p<0.001).(Table) We found no significant effects on SRS-22r function or mental health. The pattern of change for self- image was significantly different between groups, with a late improvement in EXP and a deterioration in CTRL. The patterns of change for SAQ appearance were significantly different; at 3 months, the Schroth group had significantly better scores. SAQ expectations changes were not significant. Back muscle endurance increased significantly over time in the Schroth group, but not in the control group. No significant differences for activity were observed, suggesting that participation in Schroth exercise did not reduce activity participation compared to controls.

Conclusion

Schroth exercises added to standard care significantly improved self-image, perceived appearance, and back muscle endurance compared to standard care alone without a negative impact on physical activity participation.

Conflict of Interest Disclosure

SS, GM are Schroth clinic therapists, SS is ISST instructor. No other disclosures.

Table. Comparison of outcome measurements at all time points in both groups.

	Group	Baseline mean±SE	3 month mean±SE	6 month mean±SE	Group*time p-value	Time p-value	Group p-value
SRS-22r Function /5	EXP	4.6±0.4	4.6±0.4	4.7±0.4	0.855	0.691	0.903
	CTRL	4.6±0.3	4.6±0.3	4.6±0.4			
SRS-22r Pain /5	EXP	4.3±0.6	4.4±0.6	4.5±0.6	0.402	**0.001**	0.941
	CTRL	4.3±0.7	4.5±0.5	4.5±0.6			
SRS-22r Self-Image /5	EXP	3.9±0.7	3.8±0.7	4.0±0.7	**0.028**	0.741	0.159
	CTRL	4.0±0.6	4.1±0.6	4.0±0.7			
SRS-22r Mental Health /5	EXP	4.1±0.6	4.1±0.7	4.2±0.6	0.605	0.256	0.553
	CTRL	4.2±0.6	4.2±0.6	4.2±0.7			
SRS-22r Satisfaction /5	EXP	3.7±0.8	4.2±0.8	4.4±0.7	0.299	**<0.001**	0.086
	CTRL	3.6±0.8	4.0±0.8	4.1±0.7			
SRS-22r Total /5	EXP	4.2±0.4	4.2±0.4	4.3±0.4	0.104	**<0.001**	**0.003**
	CTRL	4.2±0.4	4.3±0.4	4.3±0.4			
SAQ Perceived Appearance /35	EXP	17.8±4.5	18.9±5.9	18.2±5.2	**0.012**	0.426	0.214
	CTRL	17.0±3.1	16.5±4.3	18.0±6.8			
SAQ Expectations /20	EXP	11.2±6.0	11.6±5.3	11.1±5.8	0.783	0.748	0.739
	CTRL	10.9±5.2	10.7±5.5	10.6±5.3			
Sorensen Back Muscle Endurance (s)	EXP	108.2±55.9	129.2±56.4	136.0±56.1	**0.043**	**<0.001**	0.880
	CTRL	118.7±60.4	124.5±63.2	125.2±67.0			
3DPAR Mean METS (METS)	EXP	2.0±0.4	1.9±0.4	1.9±0.4	0.557	0.667	0.918
	CTRL	1.9±0.3	1.9±0.4	1.9±0.4			
3DPAR Number of activities >3 METS	EXP	3.9±2.5	4.0±2.9	3.5±2.8	0.899	0.389	0.732
	CTRL	3.9±2.7	4.1±3.2	3.8±2.6			

EXP = Experimental group of Schroth added to Standard care, CTRL = Standard Care

SOSORT Podium Presentations

Correlation between interface corrective force and discomfort level of AIS patients under brace treatment

by Huan Wang | Xianglong Meng | Daniel Tetteroo | Frank Delbressine | Keita Ito | Yong Hai | Panos Markopoulos | Department of Industrial Design, Eindhoven University of Technology, Eindhoven, NL. | Department of Orthopaedic Surgery, Beijing Chaoyang Hospital, Beijing, CN | Department of Industrial Design, Eindhoven University of Technology, Eindhoven, NL. | Department of Industrial Design, Eindhoven University of Technology, Eindhoven, NL. | Department of Biomedical Engineering, Eindhoven University of Technology, Eindhoven, NL. | Academic Department of Orthopaedic Surgery, Capital Medical University, Beijing, CN. | Department of Industrial Design, Eindhoven University of Technology, Eindhoven, NL.

Background

Adolescent idiopathic Scoliosis (AIS) patients undergoing rigid brace treatment are experiencing both physical and psychological complaints, which reported resulting low compliance. According to the Comfort Theory, patients will engage with more attention to seek healthy behaviors if they are more comfortable, and treatment tends to have more productive outcomes.

Objective

In our study, we follow the rationale behind Comfort Theory in measuring the comfort levels for scoliotic adolescents under brace treatment to pursue a better understanding of patients' wearing habits and preferences, as well as potential solutions to improve adherence.

Methods

Seventeen AIS patients (mean age,13.2 ±2.4 years [range, 10–17]) treated with Cheneau brace or Boston brace were recruited. The study consisted of a questionnaire survey, measuring brace/body interface corrective force and discomfort level, and an interview. All participants were administrated with Scoliosis Research Society-22 questionnaire (SRS-22), General Comfort questionnaire (GCQ), and Oswestry Disability Index (ODI) to assess their brace wearing experience. A TekScan FlexiForce Electronic (OEM Development Kit) was used to measure the body/brace interface corrective force acting upon the body in eight different positions, while participants used a feeling-of discomfort slider to indicate their level of discomfort on a scale from "comfortable" to "extremely uncomfortable".

Results

Regarding to the outcomes of GCQ, participants scored lowest on environmental and psycho-spiritual factors, with the psycho-spiritual domain showing smaller variation. Through the SRS-22 questionnaire, participants reported lower median scores for satisfaction and self-image, with satisfaction having a relatively large variance. No correlations between discomfort level and interface corrective force were found in supine position and weak correlations were found for the positions: standing, sitting, prone, standing with single leg, and these relations were not significant based on p-value. Significant moderate positive correlations were found for the lying positions. A moderate negative correlation between age and discomfort level was found in the prone position, and weak correlations were found in the other 7 positions, none of these were significant. A negligible correlation was found between treatment duration and discomfort level

in the lying on right side position, and a weak correlation was found in the other 7 positions, none of these relations were significant. Based on the interview survey, appearance, uncomfortable issues, inconvenience were the three most frequently mentioned problems of the daily feelings on brace treatment.

Conclusion

Participants have serious concerns on self-image and psycho-spiritual difficulties caused by negative peer attitudes and critical comments about their physical shape based on the outcomes of questionnaire and interview survey. We were unable to find any evidence on a relationship between interface corrective force and perceived comfort of bracing. We might be able to draw a conclusion that the interface corrective force is not the major contributory factor to an uncomfortable bracing experience based on the outcomes of the study.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Non-idiopathic scoliosis is related to intraspinal and extraspinal disorders in a related manner

by Franz Landauer | Klemens Trieb | Department of Orthopaedic and Trauma Surgery, Paracelsus Medical University, Salzburg, Austria | Department of Orthopaedic and Trauma Surgery, Paracelsus Medical University, Salzburg, Austria

Background

Idiopathic scoliosis must be differentiated from non-idiopathic scoliosis, which is caused by intraspinal and extraspinal pathologies. This is important, because the outcome of scoliosis brace treatment is influenced by the underlying disorder.

Objective

A thorough differential history and MRI of the spine should increase the diagnosed number of non-idiopathic scoliosis. This study presents the results of a prospective protocol to identify as many non-idiopathic scoliosis as possible and identify the underlying disorder.

Method

In this study, 105 consecutive patients with scoliosis with a Cobb angle > 10° were included. Scoliosis-related diagnoses were divided into intraspinal and extraspinal disorders.

Results

In the current study 26,5% (n=35) of patients were diagnosed with an idiopathic scoliosis and 70 with a non-idiopathic scoliosis (73,5%). In the idiopathic group, there were no infantile, 11 juvenile, and 25 adolescent scoliosis; in the non-idiopathic group, there were 4 infantile, 32 juvenile, and 34 adolescent scoliosis. In the idiopathic scoliosis group, the Cobb angle was less than 20° in 7 patients, and in the non-idiopathic group in 27. The Cobb angle was between 21° and 45° in 25 idiopathic (>45° in 3) and 39 in the non-idiopathic (>45° in 5). Furthermore, juvenile scoliosis is only in 25% idiopathic (11 patients out of 35 compared to 32 patients out of 70). A positive family history was found in 15 patients in the idiopathic group and 6 patients in the non-idiopathic group. Back pain was found only in non-idiopathic scoliosis (6 of 32). The Risser's sign was >2 in 4 of 25 patients in the idiopathic group and in 10 of 34 patients in the non-idiopathic group. In the non-idiopathic scoliosis group 27 (38,6%) had intraspinal and 43 (61,4%) had extraspinal disorders which are assumed cause of scoliosis. Intraspinal disorders (n=27): the most common cause of non-idiopathic scoliosis with intraspinal disorder is malformation. 11.1% (n=3) showed a complex malformation. Lumbosacral transition vertebra (Castellvi II-IV) accounted for 40.1% (n=11). Lumbarization was found in 1 case, Spondylolisthesis could be found in 18.8% (n=4) of patients. Syringomyelia was diagnosed in 18.5% (n=5) patients. Intraspinal malformation (tumor, spinal root and arachnoidal cyst, two of them had surgery) was diagnosed in 11,1% (n=3). Extraspinal disorders (n=43): in 60.5% (n=26) of patients a syndrome could be identified as the most probable cause and in 4.7% (n=2) a hemiatropia and other in 7% (n=3, each case 1). Thoracic surgery in early childhood was registered in 14% (n=6), 7% in torticollis (n=3) and 4,7% in juvenile arthritis (n=2).

Conclusion

In summary we can conclude: Infantile scoliosis is never idiopathic. Juvenile scoliosis is idiopathic in only 25% of the patients. Scoliosis diagnosis is delayed in the presence of underlying disease. A positive family history has a tendence towards idiopathic scoliosis. Back pain is found only in non-idiopathic scoliosis and is therefore a definite indication of a non-idiopathic cause of scoliosis. Advances in human genetics lead to further differentiation in the cause of scoliosis.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Does a Cheneau Style Brace Improve Curve Correction in Coronal and Sagittal Planes Compared to Standard TLSO?

by Ali Asma | Armagan Can Ulusaloglu | James Richard Bowen | Petya Yorgova | Heather Michalowski | Harry J Lawal III | Alicia McCharty | William Giles Stuart Mackenzie | Peter Gabos | suken shah | Nemours A I duPont Hospital, Delaware,US | Nemours A I duPont Hospital, Delaware,US | Nemours A I duPont Hospital, Delaware,US | Nemours A I duPont Hospital, Delaware,US | Lawall Prosthetics and Orthotics | Lawall Prosthetics and Orthotics | Nemours A I duPont Hospital, Delaware,US | Nemours A I duPont Hospital, Delaware,US | Nemours A I duPont Hospital, Delaware,US | Nemours A I duPont Hospital, Delaware,US

Background

Bracing is accepted as non-operative treatment in adolescent idiopathic scoliosis (AIS). Traditional- style TLSO fabrication involves truncal casting for brace molding while the newer Cheneau TLSO involves 3D truncal scanning with Computed Aided Design/Computer Aided Manufacturing (CAD/CAM) technology

Objective

The objective of this study is to compare initial coronal and sagittal curve reduction between a traditional brace (utilizing truncal cast molding) to the CAD Cheneau brace. Due to differences in the fabrication and application process, these two brace types may vary in the initial in-brace deformity correction.

Methods

Since 2018, we have utilized both a standard TLSO (SB) or Cheneau brace (CB). The inclusion criteria were identical: AIS cases with major curve angle between 20-45°; age 10-15; Risser 0-3; and radiographs (pre-brace and in-brace PA and lateral full spine images). 28 CB and 56 SB patients were analyzed

Results

There was no difference between groups regarding age (CB: 12.4±1.4, SB: 12.5±1.5), gender (CB: 24 female-4 male, SB: 47 female-9 male, p=0.831), body mass index (CB: 18.6±3.6, SB: 18.8±3.35), major curve location (thoracic vs thoracolumbar/lumbar) p=0.432) major curve degree (CB: 26.8±7.1, SB: 27.1±6.0), T5-T12 kyphosis (CB: 18.7±8.0, SB:18.1±11.4), T1-T12 kyphosis (CB: 25.4±11.7, SB: 27.1±14.0), lumbar
lordosis (CB: 54.4±13, SB: 53.5±11.0), T1-T5 kyphosis, T10-L2 degree, pelvic incidence, sacral slope, pelvic tilt, C7 Sagittal Vertical Axis (SVA), T1 slope, T1 pelvic angle(T1PVA), C2-C7 angle, C2-C7 SVA, C7 coronal balance and thoracic trunk shift. There were statistically significant changes between prebrace to inbrace measurement in favor of positive global balance and entire flattening of spine: decreased T5-T12 kyphosis (p<0.001), decreased lumbar lordosis (p<0.001), decreased sacral slope (p<0.004), increased C7-SVA (p<0.003) and increased T1 PVA (p<0. 001). Both groups had major curve correction that was statistically significantly reduced. Coronal plane major curve correction ratio was not different between two groups (CB: 64.3%±33.4, SB: 55.7%±31% p=0.236). In the CB group, the TL junction became more kyphotic (-0.8° to 3.2° p<0.030). In the SB group, both coronal balance and thoracic trunk

shift were shifted leftward (p<0.001). Although both groups had a significant increase in T1PVA, the CB group was higher than the SB group (p<0.045).

Conclusion

Both brace types exert a flattening effect on the spinal curvature and positive global sagittal balance change. Coronal plane major curve correction was similar for both groups. Coronal plane trunk shift and C7 coronal balance were significantly changed leftward after SB application. Thoracolumbar transition becomes more kyphotic after CB application. Although both braces have similar coronal plane curve correction and global sagittal plane change, due to the traditional plaster molding manufacturing, SB showed an effect more through coronal plane molding where CB braces had a greater impact on thoracolumbar transition and T1 PVA.

Conflict of Interest Disclosure

"We have no Conflicts of Interest to disclose."

Prebrace Comparison	Brace type	Mean	Std. Deviation	Std. Error Mean	
Age Before Bracing	Standard TLSO	12.51	1.46	0.20	0.739
	CAD Rigo-Cheneau	12.40	1.41	0.27	
BMI	Standard TLSO	18.77	3.35	0.45	0.840
	CAD Rigo-Cheneau	18.61	3.64	0.70	
T5 T12 Kyphosis	Standard TLSO	18.73	8.41	1.12	0.777
	CAD Rigo-Cheneau	18.11	11.45	2.16	
T10 L2 Kyphosis	Standard TLSO	0.27	9.49	1.27	0.622
	CAD Rigo-Cheneau	-0.82	9.57	1.81	
T1 T12 Kyphosis	Standard TLSO	25.39	11.73	1.57	0.568
	CAD Rigo-Cheneau	27.07	14.34	2.71	
Lumbar Lordosis L1 S1	Standard TLSO	-53.52	11.30	1.51	0.741
	CAD Rigo-Cheneau	-54.43	12.92	2.44	
Pelvic Incidence	Standard TLSO	48.16	10.63	1.42	0.439
	CAD Rigo-Cheneau	50.21	12.87	2.43	
Pelvic Tilt	Standard TLSO	8.52	8.84	1.18	0.345
	CAD Rigo-Cheneau	6.82	4.61	0.87	
Sacral Slope	Standard TLSO	40.09	11.11	1.48	0.147
	CAD Rigo-Cheneau	43.79	10.53	1.99	
C7 SVA	Standard TLSO	0.75	28.58	3.82	0.194
	CAD Rigo-Cheneau	8.75	21.28	4.02	
T1 PVA	Standard TLSO	1.43	8.77	1.17	0.328
	CAD Rigo-Cheneau	3.25	6.13	1.16	
Major Curve Degree	Standard TLSO	27.14	6.03	0.81	0.810
	CAD Rigo-Cheneau	26.79	7.09	1.34	
Thoracic Trunk Shift	Standard TLSO	-5.45	14.32	1.91	0.442
	CAD Rigo-Cheneau	-2.80	15.27	2.94	
Coronal Balance	Standard TLSO	-9.57	15.76	2.11	0.379
	CAD Rigo-Cheneau	-6.43	14.54	2.75	

Surface Topography Evaluation Schroth Exercise in Adolescents with Idiopathic Scoliosis: A Randomized Controlled Trial (RCT)

by Vivechana Acharya | Nada Mohamed | Mohammad Mehdi Ebadi | Eric C. Parent | Lindsey Westover | Department of Civil and Environmental Engineering, University of Alberta | Department of Mechanical Engineering, University of Alberta | Department of Civil and Environmental Engineering, University of Alberta | Department of Physical Therapy, Faculty of Rehabilitation Medicine, University of Alberta | Department of Mechanical Engineering, University of Alberta

Background

Adolescent idiopathic scoliosis (AIS) is a three-dimensional torsional structural change affecting the spine and trunk most prevalent in females. Treatments are prescribed based on the Cobb angle measurements and can include observation, bracing, or surgery. Schroth physiotherapy is an exercise program specific to scoliosis that aims to correct the posture and reduce curve progression.

Objective

The objective of this RCT was to determine effects of the Schroth exercises added to the standard of care compared to standard care alone on surface topography (ST) asymmetry in participants with AIS.

Methods

Participants with AIS between the ages of 10 and 18 with curves ranging 10 to 45 were randomly allocated into two groups: Control (n=55) and Schroth (n=65). The control group received standard care of observation or bracing. The Schroth group received six-months of Schroth exercise treatment added to the standard care. Full-torso ST images were acquired at baseline and 6months. A 3D model of the patient's torso was generated and reflected along a sagittal plane of symmetry. The reflected torso was aligned with the original by minimizing the distance between the surfaces. A deviation color map (DCM) was created based on the distances between the original and the reflected torso. Individual patches in the DCM represent the areas of asymmetry affected by scoliosis. A normal deviation was defined as smaller than the 3mm. Individual patches were isolated from the DCM. The maximum deviation (MaxDev) and root mean square (RMS) measurements were calculated for the largest patch for the thoracic and lumbar area. Asymmetry analysis was done by evaluators blinded to the group allocation. Intention-to-treat analysis was carried out to account for the missing data from participant dropouts or with missing images (n=26 for Schroth and n=21 for control).

Results

In an intention-to-treat analysis over the six-month period, RMS and MaxDev for the Schroth group decreased by 7.5% (-0.9mm, 95%–CI -0.3 to -1.5mm) and 8.7% (-1.5mm, 95%–CI -0.5 to -2.5mm), respectively. In the control group, both RMS and MaxDev increased by 0.8% (0.1mm, 95% CI -0.7 to 0.8mm) and 0.6% (0.1mm, 95%–CI -0.9 to 1.1mm), respectively. Repeated measures ANOVA yielded a significant time by group interaction for both RMS (=0.037) and MaxDev (=0.03).

The percentage of patients showing clinically important improvement asymmetry measures was higher in the Schroth group (24.6%) compared to the control group (12.7%). The Schroth group also demonstrated a lower percentage of patients with asymmetry worsening (16.9%) compared to the control group (29.1%). The remaining patients showed no change   in asymmetry measurement (58.2 % in Schroth and 58.5% in control). However, differences   in classification did not reach significance (Pearson Chi-square = 4.157, p=0.13).

Conclusion

Schroth exercise treatment offered in addition to standard care reduced asymmetry progression and led to more improvement in asymmetry measurements for patients with AIS than standard care alone.

Conflict of Interest Disclosure

No Conflicts of Interest to disclose.

Can Bone Health Improvement after Initial 2-Year Calcium and Vitamin D Supplementation be Maintained in Idiopathic Scoliosis after 4-Year of Treatment Discontinuation – A Prospective Randomized Double-blinded Placebo-controlled Trial

by Tsz-ping LAM | Guangpu YANG | Henry PANG | Benjamin Hon-kei YIP | Wayne Yuk Wai LEE | Alec Lik-hang HUNG | Nelson Leung Sang TANG | Kenneth Kin Wah TO | Yong QIU | Jack Chun-yiu CHENG | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong | The Jockey Club School of Public Health and Primary Care, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong | Department of Chemical Pathology, Faculty of Medicine, The Chinese University of Hong Kong | School of Pharmacy, Faculty of Medicine, The Chinese University of Hong Kong | Spine Surgery, The Affiliated Drum Tower Hospital of Nanjing University Medical School, Nanjing, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong

Background

Adolescent idiopathic scoliosis (AIS) is associated with low bone mass which could persists into adulthood and has been reported to be a significant and independent prognostic factor for curve progression in AIS. Given that AIS girls have low dietary calcium intake and high prevalence of Vit-D insufficiency, our group has previously reported the first 2-year randomized double-blinded placebo-controlled trial with calcium (Ca) and Vit-D supplementation to AIS girls with low bone mass (the Cal study) showing strong evidences of positive bone accretion effects with Ca+Vit-D supplementation.

This study was an extension of the Cal study to address the important issue whether bone health improvement from the initial 2-year Ca+Vit-D supplementation could persist as subjects approached Peak Bone Mass at 6-year i.e. after 4-year of supplement discontinuation.

Objective

This 6-year prospective cohort study aimed to investigate whether improvement in BMD and bone quality induced by 2-year Ca+Vit-D supplementation (600mg calcium + 400/800 IU Vit-D3/day) could persist after 4-year supplement discontinuation for low bone mass in AIS girls.

Methods

This was a randomized double-blinded placebo-controlled trial on AIS girls (11-14 years old, mean age = 12.9 years, Tanner stage < IV) with femoral neck aBMD Z-score < 0 and Cobb angle ≥ 15°. 330 subjects were randomized to Group1 (placebo), Group2 (600mgCalcium+400IUVit-D3/day) or Group3 (600mg Calcium+800IUVit-D3/day) for 2-year treatment. Investigations were done at baseline, 2-year and 6-year including High-resolution Peripheral Quantitative Computed Tomography (HR-pQCT) at distal radius and Dual Energy X-ray Absorptiometry (DXA) at proximal hips. ANCOVA was used for analysis. P value<0.05 was considered statistically significant.

Results

270(81.8%) subjects completed the treatment. At 2-year time-point, the increases in serum 25(OH)Vit-D, left femoral neck aBMD (Group 3), Trabecular vBMD, Trabecular Bone Volume to Tissue Volume Ratio and Trabecular Number were significantly greater in Group2 and 3 than in Group1 (p<0.05). At 6-year follow up after 4-year discontinuation of supplementation at a mean age of 19.2 years during the early phase of peak bone mass, no difference was noted except increase in Cortical Thickness being greater only in Group3 than in Group1.

Conclusion

This study provided strong evidence that 2-year supplementation with Ca+Vit-D improved bone health for low bone mass in AIS. At 6-year follow up with 4-year discontinuation of treatment, the treatment effect mostly regressed towards the null hypothesis indicating the need to continue supplementation in order to maintain the therapeutic effect on bone health up to the stage of peak bone mass.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose

The relations between genetic, biomechanical or morphometric properties of paraspinal muscle and spinal curvature in teenagers with adolescent idiopathic scoliosis – A systematic review.

by Arnold Wong | The Hong Kong Polytechnic University

Background

Adolescent idiopathic scoliosis (AIS) is a common tridimensional spinal structure changes in teenagers. Although etiologies of AIS remain unclear, multiple studies showed that patients with AIS demonstrated paraspinal muscle characteristics (e.g., asymmetry in muscle activity) that differ from non-scoliotic counterparts. However, no systematic review has summarized the relations between various muscle characteristics and spinal curvature in patients with AIS, which may help identify patients at risk of curve progression for early interventions.

Objective

To summarize evidence regarding: (1) the relations between various paraspinal muscle characteristics and spinal curvature in teenagers with AIS; and (2) whether baseline paraspinal muscle characteristics could predict future curve progression.

Methods

CINAHL, Academic Search Premier, MEDLINE, and Scopus were searched from their inception to October 30, 2020. Studies investigating the associations between the genetic, morphometric and/or biomechanical properties of paraspinal muscles and spinal curvatures in teenagers with AIS were eligible for inclusion. Two reviewers independently screened the titles, abstracts, and full-text of potential articles for eligibility. The two independent reviewers extracted data and appraised the methodological quality of the included studies using relevant risk of bias evaluation tools. Associations between various paraspinal muscle characteristics and spinal curvature/curve progression were summarized qualitatively.

Results

Of 1,473 identified citations, 15 studies (700 participants) met the inclusion criteria. One prospective cohort, four cross-sectional, and 10 case-control studies were rated with low (n=5), moderate (n=9), and high risk of bias (n=1). Very limited evidence supported that reduced PAX3 gene expression was associated with smaller paraspinal muscle volume on the concavity (r = 0.75, P<0.05). Very limited evidence corroborated that decreased PIEZO2 gene expression was correlated to reduced number of muscle fibers in paraspinal muscles in patients with AIS (r=0.34, P<0.05). There was very limited evidence that greater differences in satellite cell density between the concavity and convexity of the spine were associated with greater thoracic apical vertebral translation (r=0.74; P<0.01). Further, greater atrophy of types I and II fibers were noted on the concavity of these patients. Limited evidence supported that both the cross-sectional area (13.9%+6.4%) and volume (mean difference ranging from 70mm^3-130mm^3) of paraspinal muscles on the concavity was significantly smaller than that on the convexity. Conversely, intramuscular fatty infiltration on the concavity was significantly higher than the convexity by 9%-27% (P<0.05). Very limited evidence supported a greater intramuscular fatty infiltration on the concavity was associated with larger Cobb angles (P<0.01). Very limited

evidence supported that patients with curve progression (>10°/year) in the following 6 months were characterized by greater paraspinal muscle electromyographic activities on the convex side of the apex, and upper and lower end vertebra of the thoracic curve before the rapid growth period (>10mm/year).

Conclusion

This is the first systematic review to support that asymmetries in biomechanical or morphometric characteristics of paraspinal muscles are related to the presence/progression of spinal curve in patients with AIS. Future research should evaluate whether normalizations of these characteristics can improve the spinal curve.

Conflict of Interest Disclosure

We have no conflicts of interest to disclose.

Applying artificial intelligence to aid Cobb angle measurement on 3D ultrasound images for children with adolescent idiopathic scoliosis – a preliminary study

by Jason Wong | Marek Reformat | Eric Parent | Edmond Lou | University of Alberta | University of Alberta | University of Alberta | University of Alberta

Background

Ultrasound has become a useful imaging modality over radiography in imaging scoliosis, due to its ability to capture a 3D volume and lack of radiation emission. Cobb angle measurements on ultrasonographs are comparably accurate and reliable to radiographs but require significant training and more time to measure. Artificial intelligence, specifically machine learning, methods can accurately segment features from medical images and therefore have been employed to semi-automate the measurement process.

Objective

The objectives of this study were to 1) apply machine learning (ML) to aid Cobb angle US measurement and 2) investigate the validity of the ML-aided method by comparing with manual measurements.

Methods

An ML model, called a convolutional neural network, was trained on 70 spinal ultrasonographs with 2,276 segmented laminae to automatically identify the laminae of the thoracic and lumbar vertebrae. Using predicted laminae locations, both laminae from the same vertebrae were paired up manually, and the appropriate pairs were chosen to measure the Cobb angle. These steps were performed manually because extraneous landmarks are often detected as possible laminae. It makes an automatic pairing algorithm nontrivial to implement at this stage. For this preliminary study, 37 ultrasonographs were randomly selected from our records and measured using the developed ML-aided procedure. They were compared with manual US measurements performed previously by experienced observers. Among the 37 cases (6M, 31F; age 14.5±1.9 years), there were a total of 73 curves, comprised of 42 upper and main thoracic (UT-MT) and 31 thoracolumbar and lumbar (TL-L) curves. The average Cobb angle was 22.3°±7.4° (range 9°-40°). The intraclass correlation coefficients with 95% confidence intervals (ICC(3,1) [95%CI]) and the mean absolute differences (MAD) were calculated.

Results

Using the ML-aided method, 66/73 curves were detected. The MAD between the manual and ML-aided measurements of the 66 curves was 3.7°±2.9° and the ICC(3,1) was 0.85 [0.76, 0.90]. Additionally, 74.2% of the measurements were within clinical acceptance (≤5°). UT- MT curves (n=39) were measured more consistently within clinical acceptance than TL-L curves (n=27) (79.5% vs. 66.7%), and yielded a higher ICC(3,1) (0.89 [0.79, 0.94] vs. 0.78 [0.57, 0.89]). The average measurement time per ultrasonograph using the ML-aided procedure versus the manual one was 30 versus 90 seconds. Out of the 7 non-detected curves, 3 were UT-MT and 4 were TL-L. The primary reasons for non-detection were image quality and ambiguity of the laminae locations. Higher measurement differences tended to be from mild UT-MT and moderate TL-L curve severities.

Conclusion

The developed ML model could expedite and automate steps of Cobb angle US measurement while maintaining good reliability. TL-L curves were measured less frequently within clinical acceptance than MT-UT. The laminae in the lumbar region are harder to identify because these vertebrae have greater bony surface area that can cause the ultrasound signals to scatter and produce extraneous reflections. Future improvement will consist of refining laminae identification, possibly using the spinous process curve to guide placement, and developing a fully automated method to streamline the process.

Conflict of Interest Disclosure

The authors have no conflicts of interest.
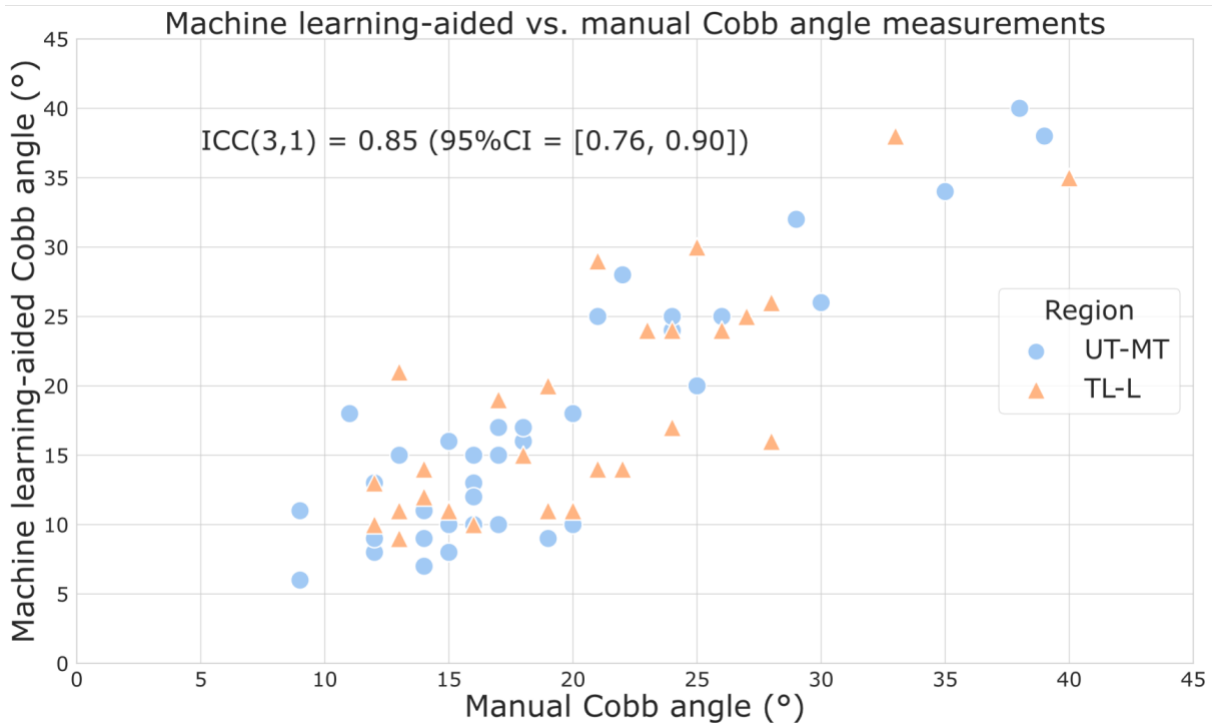
The measurement of health-related quality of life of patients with idiopathic scoliosis – comparison of ISYQOL versus SRS-22 questionnaire

by KRZYSZTOF KORBEL | EDYTA KINEL | PIOTR JANUSZ | MATEUSZ KOZINOGA | DARIUSZ CZAPROWSKI | TOMASZ KOTWICKI | Department of Rehabilitation and Physiotherapy, Physiotherapy Unit, University of Medical Sciences Poznan, Poland | Department of Rehabilitation and Physiotherapy, Clinic of Rehabilitation, University of Medical Sciences, Poznan, Poland | Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland | 1. Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland 2. Rehasport Clinic, Poznan, Poland | Department of Rehabilitation and Physiotherapy, Physiotherapy Unit, University of Medical Sciences, Poznan, Poland 2. Olsztyn University, Olsztyn, Poland | Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland

Background

Quality of life of adolescents with idiopathic scoliosis (IS) is studied with specific questionnaires. The SRS-22 questionnaire is most commonly used however, new tools are being developed. Italian Spine Youth Quality of Life (ISYQOL), now validated into Polish, is the questionnaire developed using the Rasch analysis.

Objective

The aim of the study was to compare the PLSYQOL scores versus the SRS-22 scores in order to evaluate the Polish version (PLSYQOL) of the ISYQOL for the concurrent and known- groups validity.

Methods

Eighty-one girls, aged 13.5 ±1.8 years, all with IS, all treated with a corrective TLSO brace, were included. Mean Cobb angle was 31.0 degree (±10.0) and mean duration of brace treatment was 2.6 years (±1.9).

The patients' scores were compared as follows: (1) age: adolescents (<13ys) vs. teenagers (>13ys); (2) scoliosis severity: mild (Cobb 10– 30°) vs. moderate (Cobb >30°); (3) single curve pattern vs. double curve pattern.

Spearman's rank correlation coefficient was used to evaluate the strength of the association between PLSYQOL and SRS-22 scores.

Depending on normality and homogeneity of variance, the parametric or non-parametric comparison tests (t-test, Mann-Whitney, Welch), have been applied to assess if PLSYQOL measure and SRS22 total score were significantly different in the different groups of patients.

Further investigated factors which could influence quality of life were analyzed using a 2- way ANOVA performing successively the following couple of factors, respectively: (1) age and Cobb angle; (2) number of curves and Cobb angle; (3) years of treatment and Cobb angle.

Results

The concurrent validity analysis showed a moderate validity of the PLSYQOL measure vs. SRS-22 (Spearman r=0.53) with respect to the criterion of standard measure of quality of life.

Using the SRS-22, no difference resulted in any of the between selected known-groups comparisons. Also, the PLSYQOL tool showed no difference between the group of adolescents vs. teenagers as well as between the group of single vs. double curves. The PLSYQOL was instead showing a significantly better quality of life in mild than moderate scoliosis.

In addition, the 2-way ANOVA confirmed no interactions between severity of scoliosis and age or years of treatment or number of scoliotic curves.

Conclusion

The severity of scoliosis but not the age nor the curve pattern demonstrated a direct statistically significant effect on the quality of life of patients with IS when evaluated using the PLSYQOL tool; that effect could not be detected when using the SRS-22.

Conflict of Interest Disclosure

"We have no Conflicts of Interest to disclose."

Is the Brace Treatment failures always an expression of the limitations of conservative treatment?

by Angelo Gabriele Aulisa | Marco Giordano | Francesco Falciglia | Renato Maria Toniolo | Lorenzo Aulisa | Unit of Orthopedics and Traumatology, Institute of Scientific Research, Bambino Gesù Children's Hospital, Rome, Italy; | Unit of Orthopedics and Traumatology, Institute of Scientific Research, Bambino Gesù Children's Hospital, Rome, Italy; | Unit of Orthopedics and Traumatology, Institute of Scientific Research, Bambino Gesù Children's Hospital, Rome, Italy; | Unit of Orthopedics and Traumatology, Institute of Scientific Research, Bambino Gesù Children's Hospital, Rome, Italy; | Sacred Heart Catholic University, Rome, Italy

Background

Brace treatment is the most common nonoperative treatment for the prevention of curve progression in adolescent idiopathic scoliosis.

Curve magnitude, compliance, type of brace and skeletal maturity are important factors in determining the efficacy of bracing, but to achieve the best possible outcome, conservative treatment should be delivered by an experienced therapeutic team including a physician, a physiotherapist and an orthotist.

Objective

The aim of the study is to understand the causes of conservative treatment failure by evaluating a group of patients who changed team during treatment because scoliosis worsening.

Methods

This study is based on database including 1,536 patients with idiopathic scoliosis. The patients studied had AIS with curves of 20° or more and have undergone to previous treatment from another therapeutic team. The minimum duration of follow-up was 24 months. X-rays were used to obtain Cobb degrees at the baseline (C0p) and at the end (C1p) of the previous treatment, at the baseline (C0n) and at the end (C1n) of the new treatment. Three outcomes were distinguished according to SRS-SOSORT criteria.

To achieve the aim, we study the compliance, the type of brace wearing, the correct prescription of the brace and its efficacy. Statistical analysis was performed.

Results

109 patients met the inclusion criteria. The results of our study showed that Cobb mean value was in the previous treatment at baseline 25.99 and at the time of abandonment 39.26 the mean progression was 14.22° Cobb. Instead, at the start of new treatment with our team the mean value was 39.81 and at follow up 25.72, the mean correction (Cm) was 13.27.

The difference in Cm between previous treatment and new treatment was significant (p<0.0001).

In the previous treatment 17 patients (15.6%) obtained a curve stabilization, a progression in 92 cases (84.4%); instead in the new treatment 104 patients (95%) obtained a curve correction and 5 (5%) a stabilization.

In the previous treatment there was Poor brace compliance in 39 patients (36%), 24 part time prescription (22%), 24 have brace with low efficacy (22%), wrong prescription in 49 (45%) and the patients were examined every 4 or 6 months, not always from the same physician.

Type of brace used from the first therapeutic team were Boston 14 (13%), Cheneau 24 (22%), Lyon brace 25 (23%), Milwaukee 42 (38%) and other 4 (4%). Our team changed the prescription in 48 P.A.S.B. (44%), 53 Lyon Brace (49%) and 8 Sforzesco (7%).

Conclusion

This study allows us to understand that the failure of conservative treatment is not always due to the ineffectiveness of the treatment itself but to a lack of knowledge about it (45% of wrong prescription).

The results confirm that, with the correct prescription, worsening curves can change trend, obtaining in many cases an improvement (95%).

To achieve the best possible outcome, an expert team is required, able to give the correct prescription and carry out checks every 2 months. They are very important because allow to increase compliance (from 64 to 89%) and to reduce the risk of an ineffective brace.

Conflict of Interest Disclosure

No Conflicts

Complication Rates of Vertebral Body Tethering Among Other Operative Treatments for Early Onset Scoliosis: A Meta-Analysis

by Vincent Yao | Zachariah Samuel | Chisom Madu | Aivi A. Rahman | CUNY School of Medicine | CUNYSchool of Medicine | CUNY School of Medicine | CUNY School of Medicine

Background

Operative treatment options for early-onset scoliosis (EOS) have grown in number but have persisted with very high complication rates. Current interest lies in anterior vertebral body tethering (VBT): a non-fusion, minimally invasive, compression-based procedure. This promising new approach takes advantage of the Hueter-Volkmann law to arrest vertebral wedging while preserving growth potential and mobility.

Objective

This meta-analysis compares the complication rates between VBT and traditional treatments for EOS to evaluate applications of VBT as a potentially safer procedure.

Methods

All articles used in this meta-analysis met the inclusion criteria of having a postoperative follow-up time of at least one year to monitor post-surgery complications. Complication rates per patient were determined and compared between VBT, traditional growing rods (TGR), magnetically controlled growing rods (MCGR), vertical expandable prosthetic titanium rib (VEPTR), Shilla growth guidance system (SGGS), modern Luque trolley (MTR), and osteotomy and short fusion (OSF). A one-way ANOVA was run to calculate statistical significance using SPSS, with $p \leq 0.05$ defined as statistically significant.

Results

For this meta-analysis, 17 out of 21 studies analyzed were included. Complications of EOS included infection, insufficient spine alignment, rod fractures, implant failures, and pain. VBT patients (n=176) had one of the lowest complication rates at 36.93% per patient compared with TGR (n=283; complication rate of 93.29%; $p \leq 0.001$), MCGR (n=20; complication rate of 60.00%; $p \leq 0.001$), VEPTR (n=65; complication rate of 56.92%; $p \leq 0.001$), and SGGS (n=135; complication rate of 91.68%; $p \leq 0.001$), and MTR (n=5; complication rate of 40.62%; $p > 0.05$). A comparably safe procedure to VBT is OSF, as there was a complication rate of 12.89% (n = 140, $p \leq 0.001$).

Discussion

The complication rate for VBT (36.93%) was the second lowest, following that of OSF (12.89%). OSF is considered the gold standard and is currently the most common form of treatment for EOS. A limitation of this study was lack of available retrospective data for certain types of procedures from other published studies. Specifically, MTR treatment was not found to be statistically significant compared to VBT due to the small sample size of MTR patients. Thus, long-term studies on MTR complications need to be further researched. Our meta-analysis

demonstrates VBT's low complication rate and supports VBT as a statistically safe method in the treatment of EOS.

Conclusion

VBT is a comparatively low-risk surgical procedure to treat for EOS with an average rate of 36.93% for postoperative complications

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Is Nighttime Bracing Effective in Adolescent Idiopathic Scoliosis? A Meta-analysis and Systematic Review

by Walter H. Truong | Abdul Fettah Buyuk | Sara Morgan | Daniel Miller | Kristine K. Nolin | Andrew J. Snyder | Kristin J. Smith | Gillette Children's Specialty Care | Gillette Children's Specialty Care | Gillette Children's Specialty Care | Gillette Children's Specialty Care | Gillette Children's Specialty Care | Gillette Children's Specialty Care | Gillette Children's Specialty Care

Background

The gold standard treatment of AIS (Adolescent Idiopathic Scoliosis) is full-time TLSO (Thoraco-Lumbo-Sacral-Orthosis) wear. For many patients, adherence to a full-time prescription, usually >18 h/d, can be challenging and the TLSO is often not worn as prescribed. Nighttime treatment using an over-corrective TLSO is an alternative option for scoliosis management with potentially better patient adherence; however, there is limited evidence in the literature to demonstrate effectiveness based on defined at-risk populations for progression. Thus, we performed a systematic review and meta-analysis of AIS patients treated with a Nighttime (NT) TLSO who met SRS (Scoliosis Research Society) criteria for bracing. Radiographic outcomes and possible predictive factors for NT bracing success were evaluated.

Objective

This systematic review and meta-analysis assesses the effectiveness of nighttime bracing in patients with AIS meeting SRS (Scoliosis Research Society) criteria.

Methods

A systematic review of studies reporting outcomes of NT TLSO treatment was conducted using PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Pubmed, Medline, Embase, CINAHL and the Cochrane library databases were searched from 1975 through March 2020 and articles were reviewed by two authors to assess eligibility. Articles were only included if reported outcome data could be extracted on patients who met SRS bracing criteria. The primary outcome measure was curve progression ≥6°. Pooled progression rates were calculated from random effects meta- analyses with inverse-variance weights; 95% CIs were calculated using the Knapp and Hartung method.

Results

Of the 372 articles reviewed, nine studies (595 patients) met the strict inclusion criteria and were included in the analysis. The overall pooled progression rate was 41% (95% CI: 30-52%). Thoracolumbar/Lumbar (TL/L) curves (5 studies) had a 25% pooled progression rate (95% CI: 15-37%). Risser 1 & 2 subjects (3 studies) had a 17% pooled progression rate (95% CI: 12-22%). Only univariate sub-analyses were possible due to sample sizes.

Conclusion

This analysis demonstrates that scoliosis treatment with a NT TLSO may be a viable option for patients who are Risser 1 & 2 and patients with TL/L curves. This data will inform the design

of future prospective studies comparing brace types using strict SRS criteria and controlling for curve type, curve magnitude and skeletal maturity.

Conflict of Interest Disclosure

Disclose Conflicts of Interest for all authors here or state "We have no Conflicts of Interest to disclose."

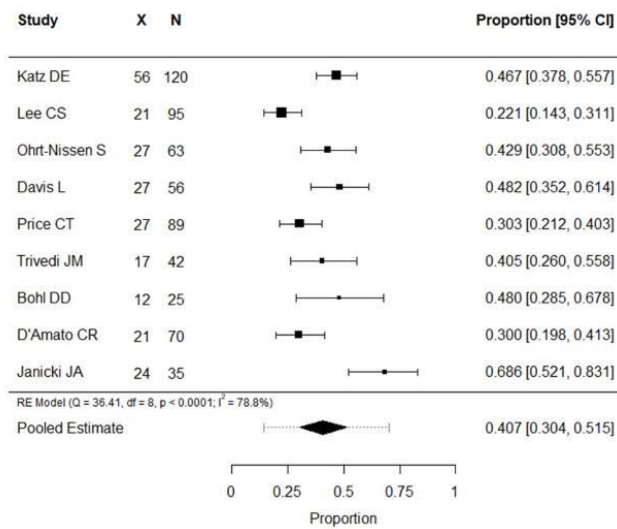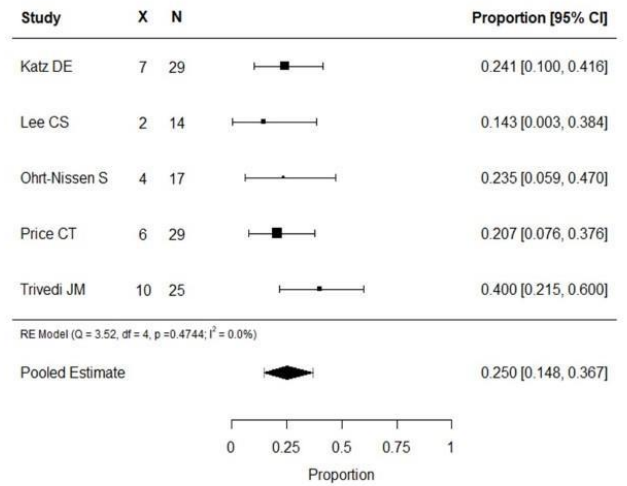## Figure 1.a. Forest plot of ≥6° progression with nighttime bracing in AIS

Study	X	N		Proportion [95% CI]
Katz DE	56	120		0.467 [0.378, 0.557]
Lee CS	21	95		0.221 [0.143, 0.311]
Ohrt-Nissen S	27	63		0.429 [0.308, 0.553]
Davis L	27	56		0.482 [0.352, 0.614]
Price CT	27	89		0.303 [0.212, 0.403]
Trivedi JM	17	42		0.405 [0.260, 0.558]
Bohl DD	12	25		0.480 [0.285, 0.678]
D'Amato CR	21	70		0.300 [0.198, 0.413]
Janicki JA	24	35		0.686 [0.521, 0.831]
RE Model (Q = 36.41, df = 8, p < 0.0001; I² = 78.8%)				
Pooled Estimate				0.407 [0.304, 0.515]

Proportion: 0 0.25 0.5 0.75 1

Figure 1.b. Forest plot of ≥6° progression in TL/L curves with nighttime bracing in AIS

Study	X	N		Proportion [95% CI]
Katz DE	7	29		0.241 [0.100, 0.416]
Lee CS	2	14		0.143 [0.003, 0.384]
Ohrt-Nissen S	4	17		0.235 [0.059, 0.470]
Price CT	6	29		0.207 [0.076, 0.376]
Trivedi JM	10	25		0.400 [0.215, 0.600]
RE Model (Q = 3.52, df = 4, p =0.4744; I² = 0.0%)				
Pooled Estimate				0.250 [0.148, 0.367]

Proportion: 0 0.25 0.5 0.75 1

Reliability of a Full-Body Topographic Scanner for Automated Analysis of Spinal Deformity

by Benjamin Groisser | Howard J. Hillstrom | Ankush Thakur | Kyle W. Morse | M. Timothy Hresko | Ron Kimmel | Alon Wolf | Roger F. Widmann | Technion-Israel Institute of Technology, Haifa, Israel | Hospital for Special Surgery, New York, NY | Hospital for Special Surgery, New York, NY | Hospital for Special Surgery, New York, NY | Boston Children's Hospital, Boston, MA | Technion-Israel Institute of   Technology, Haifa, Israel | Technion-Israel Institute of Technology, Haifa, Israel | Hospital for Special Surgery, New York, NY

Background

Adolescent Idiopathic Scoliosis (AIS) is a common health condition that presents as a complex malalignment of the spine in the frontal, transverse, and sagittal planes. Scoliosis may also present in a variety of externally visible characteristics including uneven shoulder height, waist crease and chest wall asymmetry. Standing radiographs of the spine are the gold standard for diagnosis of AIS, however not only does the repeated use of radiographs expose patients to radiation, they correlate poorly with external symmetric properties important for clinical outcomes. Surface topography is an alternative to the use of radiographs better suited for measuring external asymmetry. The 3dMD system captures 3D topographic data using 30 cameras in 1.8 msec. An automated algorithm enables objective, quantitative assessment of externally present asymmetry and malalignment without exposure to radiation.

Objective

The purpose of this study was to determine the intra-rater and inter-rater reliability of 3D topographic trunk parameters acquired for patients with spine deformities and controls.

Methods

Twenty controls and 26 spinal deformity patients participated in this study. Each individual was scanned in a 3D topographic scanner by two independent investigators in five relevant poses: A-Pose, Side Bend Left, Side Bend Right, EOS Posture, Forward Bend. An automated pipeline was developed to compute a series of topographic based measures. A semi- automated pipeline utilized anatomical markers placed before each scan while a fully automated pipeline did not. Measures included AC Angle, back surface rotation (BSR), BSR Max, Back Area, Q Angle, Spine Length, Torso Volume, C7 Angle, Centroid Deviation, and Trunk Axis. Intra-rater and inter-rater ICC values were computed for each parameter and pose. The central hypothesis was that intra-rater and inter-rater reliability would be good to excellent (ICC>0.7).

Results

Patients' Cobb angles had an average of 50.7° (+/- 36.2°). Intra-rater and inter-rater reliability were generally good to excellent (>0.7) with few exceptions. Confidence intervals were small, further supporting the estimate of each ICC value. EOS and A poses generally performed more reliably than the side to side bending poses. Table 1 shows mean ICC values for intra-rater and inter-rater reliability across all poses and measurements.

Conclusion

In this study we assessed the reliability of 10 clinically relevant topographic measurements obtained from a 3D scanner utilizing a fully automated methodology and we found that stereo photogrammetry-based trunk alignment parameters demonstrated good to excellent reliability (ICC >0.7) for patients with spinal deformities and controls. The automated analysis algorithms as well as the high reliability of the measurements provides the foundation for objective surface analysis and 3D measurements to be utilized during routine clinical analysis of spinal deformity.

Conflict of Interest Disclosure

	Intra-Rater 1		Intra-Rater 2		Inter-Rater
Analysis	Test-retest	Remove-replace	Test-retest	Remove-replace	
Semi-Automated	0.877	0.823	0.864	0.787	0.780
Automated	0.890	0.842	0.857	0.832	0.841

Image/Table Caption:
Table 1: Mean ICCs for all poses and measurements

Efficacy of brace treatment in patients with Scheuermann kyphosis

by Mohammad Reza Etemadifar | Masoud Mahdinezhad Yazdi | Department of Orthopedic Surgery, School of Medicine, Al-Zahra Hospital, Isfahan University of Medical Sciences | Department of Orthopedic Surgery, School of Medicine, Al-Zahra Hospital, Isfahan University of Medical Sciences

Background

In this study, we evaluated the beneficial effects of Kyphologic brace about treatment of Scheuermann's kyphosis patients.

Methods

This is a retrospective study of prospectively collected data that was performed on patients with Scheuermann kyphosis that were treated with Kyphologic brace within 7 years. Demographic data including age, gender, kyphosis cobb's angle and duration of treatments were evaluated. Kyphosis angle before treatments, one month after treatments and within 2 years were collected. The location of kyphosis apex was also noted and according to this, patients were classified into following groups: upper thoracic, mid thoracic, lower thoracic and thoracolumbar.

Results

48 patients with Scheuermann kyphosis enrolled in the present study. The mean age of the patients was 12.95± 1.4 years. The mean kyphosis angle before treatments was 63.66± 9.51° that decreased significantly within one month after treatments (to 43.33± 8.7°) and at the end of the study (to 37.6± 9.4°) compared to before treatments (P <0.001). The most common location of kyphosis apex was in mid-thoracic (77% frequency).

Conclusion

In this study, we showed that the use of Kyphologic brace was associated with significant reduction in kyphosis angle in patients. Our results emphasized the effectiveness of this brace in patients with Scheuermann kyphosis.

The effectiveness of combined bracing and specific exercise (S4D) in adolescent idiopathic scoliosis based on SRS and SOSORT criteria: a prospective study

by Rodrigo Mantelatto Andrande | Ariane V Schmidt | Milene E Callegari Ferreira | Carlos Eduardo Gonçalves Barsotti | Silvia Maria Amado João | Ana Paula Ribeiro | University of Sao Paulo, School of Medicine, Physical Therapy Department, Sao Paulo, Brazil. | Orthopaedic, Health Science Post-Graduate Department, University Santo Amaro, Sao Paulo, Brazil. | Clinical Rehabilitation Center in Scoliosis, Campinas, São Paulo, Brazil. | Hospital do Servidor Público Estadual (HSPE), Member of the Spine Group, São Paulo / SP, Brazil | University of Sao Paulo, School of Medicine, Physical Therapy Department, Sao Paulo, Brazil. | University of Sao Paulo, School of Medicine, Physical Therapy Department, Sao Paulo, Brazil.

Background

Various conservative interventions (exercise and brace) are available for treating adolescent idiopathic scoliosis (AIS), however, the disparities between them and the evidence of their efficacy and effectiveness is still unclear, especially on scoliosis-specific exercises combined with the brace.

Objective

Comparison of the effects of combined scoliosis-specific exercises (S4D) and bracing treatment after six months of the intervention in patients with moderate-high adolescent idiopathic scoliosis.

Methods

Prospective cohort study nested in a clinical database of all outpatients of a clinic specialized in scoliosis conservative treatment. Fifty-four females with adolescent idiopathic scoliosis (age 13.5±1.7 years, 1.58±0.2 cm, 49.8±7.6 kg and 19.8±3.0 kg/cm3), who have moderate-high curves (45°-60°), were evaluated pre and post six months of the conservative intervention. The outcome measures were based on Cobb angle, angle of thoracic and lumbar rotation and Risser sign. Braces were prescribed for 18-23 hours/day according to curves magnitude and actual international guidelines and scoliosis-specific exercises-S4D (6 session with 45 mint. during six months of the intervention). All patients performed exercises and were managed according to SOSORT criteria. Results in all patients were analyzed according to intent-to-treat at the end of the treatment.

Results

Overall 54 patients (81.4%) improved. Five patients (9.6%) worsened, of which progressed mean 5° in curves and was referred for surgery. The median adherence was 99.8% of the conservative treatment. Employing intent-to-treat analysis, there were failures in 5 patients (18,6%). The patients that improved had statistically significant reduction thoracic Cobb angle (pre=40.9±14.8; post=38.7±11.8, p<0.001), lumbar Cobb angle (pre=39.2±10.7; post=36.3±10.6, p<0.001) and lumbar rotation (pre=1.8±0.9; post=1.6±0.8, p=0.007), but showed no difference thoracic rotation (pre=1.5±0.8; post=1.4±0.7, p=0.127). The Risser sign showed increased after conservative intervention (pre=2.0±1.6; post=2.4±1.6, p=0.012).

Conclusion

These data confirm the effectiveness of scoliosis-specific exercises (S4D) combined bracing treatment in patients with moderate-high adolescent idiopathic scoliosis who are at high risk of progression.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Polymorphism in the FBN1 gene associated with the risk of developing adolescent idiopathic scoliosis

by Gustavo Borges Laurindo de Azevedo | Antônio Eulálio P Araújo Junior | Luis Antonio Medeiros Moliterno | Jessica Christinny Santos Rocha | Rodrigo Mantelatto Andrande | Helton Luiz Aparecido Defino | Jamila Alessandra Perini | National Institute of Traumatology and Orthopedics, Spine Surgery Center, Rio de Janeiro, RJ, Brazil | National Institute of Traumatology and Orthopedics, Spine Surgery Center, Rio de Janeiro, RJ, Brazil | National Institute of Traumatology and Orthopedics, Spine Surgery Center, Rio de Janeiro, RJ, Brazil | State University Center of the West Zone, Pharmacy Department, Rio   de Janeiro, RJ, Brazil. | University of Sao Paulo, School of Medicine, Physical Therapy Department, Sao Paulo, Brazil. | University of São Paulo, Faculty of Medicine of Ribeirão Preto, Department of Orthopedics and Traumatology Surgery, Ribeirão Preto, SP, Brazil. | University of São Paulo, Faculty of Medicine of Ribeirão Preto, Department of Orthopedics and Traumatology Surgery, Ribeirão Preto, SP, Brazil.

Background

Several genetic polymorphisms have already been described in cohorts of patients with adolescent idiopathic scoliosis (AIS), with varying frequency in different populations. The FBN1 gene encodes a protein present in the extracellular matrix, which participates in the regulation of the bioavailability of tissue growth factors. Polymorphisms in this gene are known in diseases where scoliosis is frequently present and have also recently been found in patients with AIS.

Objective

Evaluate the association of polymorphisms in the FBN1 gene with the development and severe forms of scoliosis.

Methods

An analytical case-control study was carried out involving patients with adolescent idiopathic scoliosis (n = 193) and individuals with a negative diagnosis of the disease (n = 378). Patients were evaluated with panoramic spine radiographs to determine the severity of the curve measured by the Cobb angle and the degree of skeletal maturity using the Risser scale.

Results

Among the 193 patients with adolescent idiopathic scoliosis, the vast majority were female (92.7%), aged under 18 years (63.9%) and with a BMI below 24.9 kg / m2 (90%). The vast majority (72.8%) had Risser IV and V, with 51.9% and 82.1%, respectively, having a Cobb angle above 45º in the main and lumbar thoracic curve. The frequency of the FBN1 rs12916536 polymorphism was significantly different between EIA cases and controls, with the FBN1 GG genotype being associated with the risk of developing EIA.

Conclusion

The wild genotype FBN1 rs12916536 GG was associated with the risk of developing the disease. Identifying the risk factors associated with the development and progression of

idiopathic scoliosis can contribute to the understanding of the etiology of the disease and contribute to optimizing the treatment of patients.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Comparison of Rasterstereography and Radiographic Measurements in Coronal Plane Deformities

by Pinar Taskin | Funda Ozdemir | Altug Yucekul | Irem Havlucu | Tais Zulemyan | Meral Bayramoglu | Caglar Yilgor | Ahmet Alanay | Comprehensive Spine Center, Acibadem Maslak Hospital, Istanbul, Turkey| Comprehensive Spine Center, Acibadem Maslak Hospital, Istanbul, Turkey | Department of Orthopedics and Traumatology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul Turkey | Comprehensive Spine Center, Acibadem Maslak Hospital, Istanbul, Turkey | Comprehensive Spine Center, Acibadem Maslak Hospital, Istanbul, Turkey | Department of Physical Medicine and Rehabilitation, Acıbadem Mehmet Ali Aydinlar University School of Medicine, Istanbul, Turkey | Department of Orthopedics and Traumatology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul Turkey | Department of Orthopedics and Traumatology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul Turkey

<u>Background</u>

Rasterstereography (RST) has been developed as an alternative to plain radiography to avoid repeated radiation doses. Previous studies reported moderate to high correlations between them for the various parameters examined in sagittal, coronal and axial planes.

<u>Objective</u>

The aim of this study was to compare RTS with bi-planar slot-scanning whole-body radiography system (EOS) in adolescent idiopathic scoliosis and determine its validation.

<u>Methods</u>

Patients, whose EOS radiographs and 4D-RTS scans were performed on the same day were retrospectively evaluated. 31 patients (26F, 5M) with a mean age of 17.4 years (10-56) were included. Demographic, clinical and radiographic data were collected. The examined parameters were; height (trunk height), pelvic parameters (pelvic obliquity, pelvic tilt, sacral slope, pelvic inclination) sagittal plane (thoracic kyphosis, lumbar lordosis, T1 slope, sagittal imbalance), coronal plane (main Cobb angle, apical deviation, T1 tilt) and axial plane (rotation). Paired samples t-test and Wilcoxon signed-rank test were used for analyses (Figure).

<u>Results</u>

In trunk length measurements, a high correlation was observed between RTS and EOS (r=0.940; p<0.001). For coronal Cobb angle, apex-midline distance, pelvic obliquity and coronal malalignment (r=0.628, r=0.832, r=0.815, r=0.577; p<0.001, respectively) moderate to high correlations were found. There were moderate correlations in thoracic kyphosis and sagittal malalignment (r=0.562, r=0.452; p=0,001); while there was no correlation in lumbar lordosis (r=-0.276; p>0.05). A weak correlation was found in vertebral rotation measurements (r=0.377; p=0.004).

Conclusion

4D-RST was successful in understanding the spinal shape and in coronal plane analysis. Further studies will determine its utility in the analysis of sagittal and axial planes. It is possible to use surface topography as a complement to radiography especially in the growing age to avoid repeated radiation exposure. Further studies are warranted to determine follow-up protocols.

Conflict of Interest Disclosure

Figure a)
1. TI tilt
2. Main Cobb Angle
3. Apica I Deviation
4. Rotation
5. Pelvic Obliquity
6. Coronal Imbalance
7. Coronal Trunk Height

Figure b)
1. TI slope
2. Thoracic Kyphosis
3. lumbar Lordosls
4. Sacral Slope
5. Sagittal Imbalance
6. Pelvic Inclinaiton
7. Sagittal Trunk Height
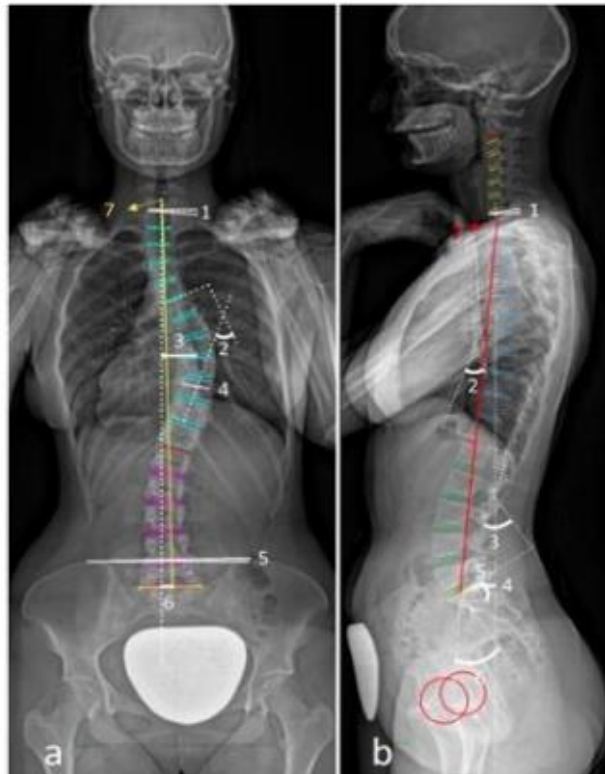
The Immediate Effects of Schroth Scoliosis-Specific Exercises on Kyphosis and Lordosis in Adolescent Idiopathic Scoliosis Measured with 3D Ultrasound Imaging

by Stefan Potgieter | Eric Parent | Alex Su | Kyle Stampe | Sarah Southon | Eric Huang | Kathleen Shearer | Marc Moreau | Jim Mahood | Edmond Lou | Department of Physical Therapy University of Alberta, Edmonton, Alberta, Canada | Department of Physical Therapy University of Alberta, Edmonton, Alberta, Canada | Department of Physical Therapy University of Alberta, Edmonton, Alberta, Canada | Department of Surgery, University of Alberta, Edmonton, Alberta Canada | Department of Surgery, University of Alberta, Edmonton, Alberta Canada | Department of Surgery, University of Alberta, Edmonton, Alberta Canada | Department of Surgery, University of Alberta, Edmonton, Alberta Canada | Department of Surgery, University of Alberta, Edmonton, Alberta Canada | Department of Surgery, University of Alberta, Edmonton, Alberta Canada | Department of Surgery, University of Alberta, Edmonton, Alberta Canada; Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Alberta, Canada

Background

Some concern exists over the potential for Schroth exercises to flatten the sagittal profile of the spine. We investigated the effect of the Schroth exercises on kyphosis and lordosis of the spine in people with adolescent idiopathic scoliosis (AIS), as these exercises often do not primarily place emphasis on these parameters.

Objective

To measure the immediate effects of the Schroth exercises on thoracic kyphosis and lumbar lordosis using 3D ultrasound (3DUS) imaging.

Methods

Thirty-six participants with AIS were scanned using 3DUS in 16 Schroth positions, consisting of natural positions (prone, side-lying, sitting, and standing) and similar exercise positions with passive, and active corrections with and without leg activation. Post-exercise effects were remeasured in natural standing position. Kyphosis and lordosis were measured using the center of lamina method on sagittal projections of 3DUS images. Kyphosis was measured using the T4-T5 to the T11-T12 vertebrae as this is often used in a clinical setting. Lordosis was measured from T11-T12 to the lowest pair of vertebrae available. To compare positions, repeated measure ANOVAs with Sidak pairwise comparisons were used with a significance threshold of 0.05. The side-lying and final standing positions were added later with only 24 participants for these comparisons.

Results

Participants were 15±3 years old, with Schroth curve types as follows: 22 4CP, 5 4C, 7 3CP, and 2 3C. Kyphosis and lordosis were largest in the natural standing position (29 ±3⁰, and 36⁰±3⁰ respectively). (table)

Overall, compared to natural standing:

The final standing, natural sitting, and fully corrected sitting positions were the only positions to not significantly reduce kyphosis (21o±3o to $23^{\circ}\pm3^{\circ}$).

The greatest reduction in kyphosis was observed in the passive prone position ($10^{\circ}\pm2^{\circ}$). Lordosis in final standing and active standing were not significantly reduced ($30^{\circ}\pm4^{\circ}$ and $29^{\circ}\pm3^{\circ}$ respectively).

The greatest reduction in lordosis was observed in active sitting without leg activation ($11^{\circ}\pm3^{\circ}$).

Comparing the prone positions, kyphosis in the passive prone position ($10^{\circ}\pm2^{\circ}$) was significantly lower than in other prone positions. Active without leg activation ($13^{\circ}\pm2^{\circ}$) was the only position to significantly reduce lordosis compared to natural prone ($20^{\circ}\pm2^{\circ}$).

Comparing among sitting positions, only kyphosis in active position without leg activation ($11^{\circ}\pm2^{\circ}$) was significantly reduced compared to natural sitting ($20^{\circ}\pm2^{\circ}$). Lordosis did not significantly differ among siting positions.

Kyphosis did not significantly differ among the maximally corrected Schroth positions (12°-20°). The standing exercise significantly increased the lordosis angle compared to the other Schroth exercises (30° vs 17°-18°).

Conclusion

All positions, except for the sitting Schroth exercise, significantly reduced kyphosis compared to natural standing. All positions except the standing Schroth exercise, significantly reduced lumbar lordosis. While the kyphosis did not differ significantly among fully corrected Schroth positions, they all significantly lowered kyphosis compared to natural standing. Consistent with our hypothesis, Schroth exercises tended to straighten the sagittal profile. Future investigation should explore if Schroth exercises can be modified to normalize the sagittal profile curvatures.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Kyphosis and Lordosis in AIS in 16 Schroth Exercise Positions

Positions	Kyphosis (T4-T5 to T11-T12) (°)		Lordosis (T11-T12 to Lowest L Pair) (°)	
	Mean ± SE	95% CI (LL; UL)	Mean ± SE	95% CI (LL; UL)
Natural Standing	28.5 ± 3.1	22.0; 35.1	35.7 ± 3.4	28.6; 42.8
Natural Prone	16.4 ± 2.1^a	11.9; 20.9	19.7 ± 2.3^a	14.8; 24.5
Passive Prone	10.3 ± 1.9^{a,b}	6.4; 14.2	14.5 ± 2.6^a	9.0; 20.0
Active Prone	13.0 ± 2.0^a	8.8; 17.1	12.9 ± 2.0^{a,c}	8.6; 17.2
Active Prone + P	15.8 ± 2.0^a	11.6; 20.0	17.7 ± 3.2^a	10.9; 24.5
Natural Side-Lying	14.3 ± 2.2^a	9.5; 19.0	16.2 ± 2.1^a	11.7; 20.7
Passive Side-Lying	11.1 ± 1.7^a	7.5; 14.7	16.0 ± 2.0^a	11.9; 20.1
Active Side-Lying	12.2 ± 1.9^a	8.3; 16.2	20.5 ± 2.8^a	14.7; 26.4
Active Side-Lying + P	13.3 ± 1.7^a	9.6; 16.9	17.4 ± 2.5^a	12.1; 22.8
Natural Sitting	20.7 ± 2.6	15.2; 26.3	15.5 ± 2.4^a	10.4; 20.6
Active Sitting	10.8 ± 1.8^{a,d}	7.0; 14.6	11.1 ± 2.8^a	5.2; 17.1
Active Sitting + P	21.8 ± 5.8	9.6; 33.9	17.6 ± 3.4^a	10.4; 24.8
Active Standing	15.0 ± 2.3^a	10.2; 19.8	29.3 ± 3.2^e	22.6; 36.0
Final Standing	23.1 ± 3.0	16.8; 29.4	30.4 ± 4.1	21.7; 39.2

Abbreviations: SE = Standard Error; CI = Confidence Interval; LL = Lower Limit; UL = Upper Limit; P = Psoas; a significantly lower than natural standing (p<0.05); b significantly lower than other prone positions (p<0.05); c significantly lower than natural prone (p<0.05); d significantly lower than natural sitting (p<0.05); e significantly greater than other Schroth exercise positions (p<0.05)

Increasing Brace Comfort, Durability and Sagittal Balance through Semi-rigid Pelvis Material does not change Short- Term Very-Rigid Sforzesco Brace Results. A Matched Case- Control Study of 436 High Degree AIS not previously braced

by Stefano Negrini | Fabrizio Tessadri | Francesco Negrini | Marta Tavernaro | Fabio Zaina | Andrea Zonta | Sabrina Donzelli | University of Milan - IRCCS Istituto Ortopedico Galeazzi, Milan | Orthotecnica, Trento | IRCCS Istituto Ortopedico Galeazzi, Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan

Background

Very-rigid braces, like the Sforzesco brace (VRB), have shown promising results also in high-degree surgical curves of Adolescents with Idiopathic Scoliosis (AIS). We recently introduced the "Free Pelvis" (FP) innovation, semi-rigid material (ethylene vinyl acetate) used in VRB to improve 1) comfort, reducing the hard contact with the pelvis, 2) sagittal balance, allowing the patient to achieve automatic pelvis positioning, and 3) brace adaptability, allowing to change the pelvis diameter with growth while keeping trunk correction. Nevertheless, these changes could also harm the corrective forces on the trunk.

Objective

To verify if the FP innovation impacts on the efficacy of the Sforzesco VRB for high-degree AIS.

Methods

We performed a matched Case-Control Study comparing the Sforzesco brace classical version (VRB) versus the Free Pelvis one (FPB). We extracted from our prospective database all FPB and VRB at first consultation in our Institute. Inclusion criteria were: AIS, age 10-16, VRB prescription 23 hours/day, standing full-spine x-rays available at first and second consultation, the primary curve between 36 and 65°, Angle of Trunk Rotation between 7 and 23° Bunnell. We matched for Risser (range 0 to 4), menarche age (10 to 15), weight (33.5 to 83), height (140 to 180), BMI (13.5 to 29), aesthetics (TRACE index 4 to 12), plumbline distances (S2: -60 to 35; C7+L3: -10 to 115), referred brace use (22 to 24). We excluded from VRB all AIS with parameters out of the FPB patients' range. Since we found a different distribution between the groups, post-hoc we also excluded previously braced patients. We checked in-brace radiographic results at one month, and short-term out-of-brace radiographic and clinical results. We used descriptive statistics according to the type of variables and their distribution. We used unpaired and paired t-test to check the differences between and within the groups, respectively.

Results

Out of a total of 4431 VRB and 96 FP, respected the inclusion criteria, 27% and 30%, respectively. Of the remaining, we matched 34% and 69%, resulting in 416 VRB (12% males, age 13±1, 46±7° Cobb) and 20 FP participants (10% males, age 13±1, 49±10° Cobb) (NS). At baseline, we found two statistically but not clinically significant differences: reported brace

use (+12'/day FP) and recorded compliance (+1% FP). All parameters improved statistically (p<0.001) and clinically, without differences among groups in-brace (FP -17±8° vs VRB -15±6° Cobb) and at short-term (5±2 months) for scoliosis (-8±6° vs -8±5° Cobb), ATR (-3±2° vs -4±4° Bunnell), aesthetics (-3±2 vs -3±2 points), S1 (-6±11 vs -4±15 mm) and C7+L3 (-8±17 vs -4±19).

Conclusion

FPB results were not different from those of the classical VRB in-brace and in the short- term. The FP innovation does not impair the mechanical correction of VRB.

Conflict of Interest Disclosure

SN has a stock of ISICO. The other authors have no Conflicts of Interest to disclose.

SOSORT Posters

Spinal deformities in patients with pectus excavatum

by Serdar Şirazi | Ahmed Majid Heydar | Private Avcilar Anadolu hospital | University of health sciences, Derince training and research hospital

Background

Although several investigators had shown the association between adolescent idiopathic scoliosis and pectus excavatum, the association between pectus excavatum and all types of spinal deformities has not been studied comprehensively. We examined patients with pectus excavatum for spinal deformities to determine the epidemiological character of the concomitant deformity and to plan patient evaluation and management.

Objective

The study aims to examine the incidence of all spinal deformities in patients with pectus excavatum

Methods

Radiological and physical examinations were performed for 418 pectus excavatum patients in Marmara university hospital/Turkey in the years between 2006 and 2013. The incidence of the spinal deformity was calculated. Spinal deformities were classified as scoliosis, kyphosis, kyphoscoliosis, thoracic hypokyphosis, and spinal asymmetry, whereas pectus excavatum were subdivided into symmetric and asymmetric subgroups. The relationship between spinal deformities and the symmetrical-asymmetric subtype of pectus excavatum was statistically analyzed Pearson chi-square test was used to compare the association of qualitative data. The significance level was accepted as $p < 0.05$. Lastly, the angular values of the deformities of scoliosis and kyphosis patients were measured using the Cobb method. In this way, the magnitude of the deformity was given as a numerical value.

Results

The spinal deformity was detected in 57 of 418 pectus excavatum patients, scoliosis and kyphosis were observed at a rate of 57.9% and 31.6%, respectively. Scoliosis was seen at a rate of 61.8% and kyphosis at a rate of 32.4% in symmetrical pectus excavatum. In asymmetric pectus excavatum, this rate was 52.2% for scoliosis and 30.4% for kyphosis (See Table 1). However, there were no statistically significant differences in the distribution of scoliosis and kyphosis in patients with a symmetrical and asymmetrical deformity in pectus excavatum patient groups. The average Cobb angle of scoliosis patients was 35.5°, and the mean T2-T12 kyphosis angle of these patients was 32°, while the average kyphosis angle of those with kyphosis deformity was 66°.

Conclusion

Patients with pectus excavatum have a higher incidence of spinal deformities than the normal population. Such high concomitant incidence should be taken under consideration in evaluating and treating patients presenting with either deformity.

Conflict of Interest Disclosure

"We have no Conflicts of Interest to disclose."

	Scoliosis	Kyphosis	Kyphoscoliosis	Thoracal Hypokyphosis	Spinal Asymmetry	Total
Symmetric Pectus Excavatum	21 (%61.8)	11 (%32.4)	0 (%0.0)	0 (%0.0)	2 (%5.9)	34 (%100)
Asymmetric Pectus Excavatum	12 (%52,2)	7 (%30,4)	2 (%8.7)	1 (%4.3)	1 (%4.3)	23 (%100)
Total	33	18	2	1	3	57

Are the scoliogenetic changes in spine primary or secondary? Study of the lateral spinal profile in mild and moderate idiopathic scoliosis

by Theodoros B. GRIVAS | Geogre VYNICHAKIS | Michail CHANDRINOS | Christina MAZIOTI | Despina PAPAGIANNI | Aristea MAMZERI | Department of Orthopedics & Traumatology, "Tzaneio" General Hospital of Piraeus, Piraeus, Greece | Department of Orthopedics & Traumatology, "Tzaneio" General Hospital of Piraeus, Piraeus, Greece | Department of Orthopedics & Traumatology, "Tzaneio" General Hospital of Piraeus, Piraeus, Greece | Health Visitor, MSc, "Tzaneio" General Hospital of Piraeus, Piraeus Greece. | School Nurse - Health Visitor, at the Special Primary School of Rafina, Attica, Greece | Health Visitor, TOMY at Attica Square, Athens, Greece.

Background

The question always arises as to whether the changes in the spine in scoliogenesis of idiopathic scoliosis (IS), are primary/inherent or secondary. There is limited information on this issue in the literature.

Objective

The aim is to address the above question, studying the sagittal profile of the spine in IS using surface topography.

Methods

After approval of the ethic committee of the hospital 45 children, 4 boys and 41 girls, with   an average age of 12.5 years (range 7.5 - 16.4 years), referred to the scoliosis clinic by our school screening program, were studied. The height and weight of children were measured. The Prujis scoliometer used in standing Adam test in thoracic (T), thoraco-lumbar (TL) & lumbar (L) region. All IS children had a ATR greater than or equal to 5 degrees. The Cobb angle was assessed in the posterio-anterior radiographs. The posterior truncal surface topogram, using the "Formetric 4" apparatus, was also done and the distance from the vertebra prominence (VP) to the apex of the kyphosis (KA), and similarly to the apex of the lumbar lordosis (LA) was calculated, see figure. The ratio of the distances (VP-KA) for (PV- LA) was calculated. The averages of the parameters were studied, and the correlation of the ratio of distances (VP-KA) to (VP-KA) with the scoliometer and Cobb angle measurements was assessed respectively (Pearson corr. Coeff. r).

Results

The average height was 1.58 meters (range 1.37-1.80), weight 48.57 kilograms (range 32-65). The IS children had right (Rt) T or TL curves. The mean T Cobb angle was 24 degrees and 26 in L. The (VP-KA) distance was 128.21mm (range 95-177) and the (VP-KA) distance was 327.71mm (range 278 - 417). The correlation of the ratio of distances (VP-KA) to (VP-KA) with the scoliometer and Cobb angle measurements was non-statistically significant (Pearson r = -0.2261 and -0.356238 respectively).

Conclusion

The lateral profile of the spine was considered to be a primary aetiological factor of IS due to the fact that the kyphotic thoracic apex in IS is located in a higher thoracic vertebra (more vertebrae are posteriorly inclined), thus creating conditions of greater rotational instability and therefore greater vulnerability for IS development. Our findings do not confirm this hypothesis, since the correlation of the (VP-KA) to (VP-KA) ratio with the truncal asymmetry, assessed with the scoliometer and Cobb angle measurements, is non- statistically significant. It is clear that hypokyphosis is not a primary aetiological factor for the commencing, mild or moderate scoliotic curve, as published elsewhere. We consider that the small thoracic hypokyphosis on the developing scoliosis adds to the view that the reduced kyphosis, facilitating the axial rotation, could be considered as a permissive factor rather than an aetiological one, in the pathogenesis of IS. This view is consistent with previously published views (see RG Burwell 1992) and it is obviously the result of gravity, growth and muscle tone, Schlosser et al 2013, Smit 2020.

Conflict of Interest Disclosure

All the co-authors have nothing to declare.
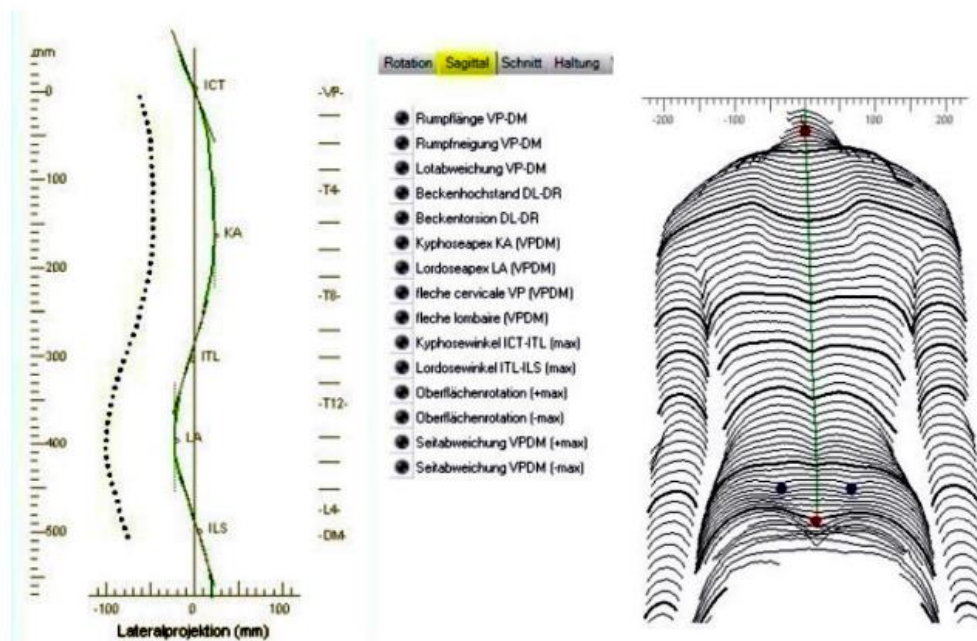
Figure: VP= Vertebra prominence, this corresponds to ICT (zero 0 mm), KA = Kyphotic Apex, LA = Lordotic apex. If the (VP-KA) distance is shorter, that is, if the IS thoracic vertebra corresponding to KA is higher at the thoracic spine, then the value of the distances' ratio (VP-KA)/(VP-LA) turns smaller, because the nominator of the fraction is smaller, (shorter VP-KA) distance. If this ratio were statistically significantly correlated with the Cobb angle and the truncal asymmetry, this would imply that this morphology (higher KA in IS) would be a primary aetiological factor for the commencement of IS. But this is not the case!

Effect of Physiotherapy Scoliosis-Specific Exercises on Lumbar Spine Joint Position Sense in Adolescent Idiopathic Scoliosis.

by Elcin AKYUREK | Ayse ZENGIN ALPOZGEN | Turgut AKGUL | Begüm Kara KAYA | Istanbul University-Cerrahpasa, Institute of Graduate Studies, Department of Physiotherapy and Rehabilitation, Istanbul, Turkey | b Istanbul University-Cerrahpasa, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Turkey. | Istanbul University, Istanbul Faculty of Medicine, Department of Orthopedics and Traumatology, Istanbul, Turkey | Biruni University, Faculty of Health Science, Department of Physiotherapy and Rehabilitation, Istanbul, Turkey.

Background

It has been observed that there are difficulties in maintaining spinal harmony in the absence of proprioceptive information, which has an important role in achieving postural control in scoliosis. One of the tests used to evaluate proprioceptive mechanisms is joint position reproduction.

Objective

The main aim of our study was to investigate the effect of Physiotherapy Scoliosis-Specific Exercises (PSSE) on lumbar spine joint reposition sense. Second aim was to determine the effects of PSSE on vertebral rotation, pain, and body image in Adolescent Idiopathic Scoliosis (AIS).

Methods

Twenty-seven patients with AIS were randomly allocated to two groups. 'Schroth' exercises were applied to the PSSE group for 8 weeks (16 sessions). The control group was placed on the waiting list. Patients' spinal rotation (scoliometer), pain (Visual Analogue Scale), cosmetic perception (Walter Reed Visual Evaluation Scale-WRVAS), and joint reposition sensations (dual-inclinometer) were assessed at the first session and at the end of 8 weeks.

Results

The initial demographic characteristics, Cobb and rotation (°) and clinical test parameters of the groups were similar ($p > 0.05$). According to the findings, differences between the means (Δ) of rotation (thoracic $\Delta = 2.50 \pm 1.28°$; $p = 0.001$; lumbar $\Delta = 2.42 \pm 1.74°$; $p = 0.003$), VAS (motion $\Delta = 2.38 \pm 3.88$; $p = 0.034$, rest $\Delta = 2.23 \pm 3.05$; $p = 0.048$), WRVAS ($\Delta = 2.07 \pm 3.40$; $p = 0.049$) scores and, reposition error values of lumbar spine (flexion $\Delta = 4.15 \pm 1.95°$; $p = 0.001$, extension $\Delta = 2.44 \pm 2.20°$; $p = 0.003$, lateral flexion-right $\Delta = 2.21 \pm 0.83°$; $p = 0.001$, lateral flexion-left $\Delta = 2.07 \pm 1.35°$; $p = 0.005$) were significantly improved in the PSSE group. Besides when the groups were compared, a significant difference was found in favor of PSSE except body perception ($p < 0.005$).

Conclusion

As a result, PSSE have effect on joint reposition of lumbar spine and body perception. Besides it is an effective method for improving vertebral rotation and posture.

<u>Conflict of Interest Disclosure</u>

We have no Conflicts of Interest to disclose.

Is the Adolescent Idiopathic Scoliosis a result of developmental instabilities during growth?

by José María González Ruiz | Vimolab, MNCN (CSIC)

Background

Adolescent Idiopathic Scoliosis (AIS) is the most frequent type of scoliosis and many etiopathological theories have been postulated and synthesized. The developmental instability during growth is responsible of directional asymmetry in target phenotype of patients with AIS, with almost the 80% of cases showing right thoracic convexity. But fluctuating asymmetry has never been evidenced in AIS despite of being the gold standard in developmental studies.

Objective

To test the previous developmental instability theories based on the asymmetry of bilateral traits instead of the asymmetries of the spine.
To investigate if fluctuating asymmetry is a feature of AIS and its correlation with the Cobb angle and the 2D shape of patients with AIS.

Methods

2D shape data acquisition were obtained after the digitization of the 40 X-rays composing the baseline and the 6 months observation state. Then, linear measurements of the total lenght of the spine and Cobb angles were measured and used in further analysis of correlation.

A principal component analysis (PCA) was done to study the shape variability of the sample, then, a Procrustes ANOVA analysis was carried out to test for the directional asymmetry and the fluctuating asymmetry effects on the sample.

Finally, multivariate multiple regressions were made to test the Cobb angle and the 2D shape variable´s dependence on fluctuating asymmetry and size, as independent variables.

Results

Differences in shape variability were observed between both sexes, showing females higher extreme ranges of variation than males.

There are significant effects of directional and fluctuating asymmetry in the sample, in the case of the directional asymmetry effect congruent with the most prevalent shape pattern of AIS reported in literature. Contrarily, the fluctuating asymmetry effect shows a mean shape opposite to directional asymmetry. Further, fluctuating asymmetry is a significant predictor   of the Cobb angle and the 2D shape.

Conclusion

AIS could be a result of developmental instabilities due to the presence of fluctuating asymmetry in the sample. Thus, estimating the intensity of this effect in our patients could improve our clinical assessments because of its correlation with the magnitude of the deformity and the 2D

shape of the spine. Finally, this effect seems to be related to females only, with a shape pattern opposite to the most prevalent observed in AIS.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Effect of Physiotherapy Scoliosis-Specific Exercises on posture and perceived body image of Adolescent Idiopathic Scoliosis.

by Ayse Zengin Alpozgen | Elcin Akyurek | Turgut Akgul | Asst. Prof. PT | MSc. PT | Assoc. Prof. MD

Background

The use of systems including photography and software analysis for the evaluating of postural changes in scoliosis is increasing. Studies have shown that these systems are valid and reliable for use in patients with Adolescent Idiopathic Scoliosis (AIS).

Objective

The aim of our study was to investigate the effect of Physiotherapy Scoliosis-Specific Exercises (PSSE) on posture and body image perception in AIS.

Methods

Patients with AIS were included in the study. PSSE was applied to the exercise group (n=12) for 2 days/week for 2 months, while no intervention was performed to the control group (n=12). "PostureScreen Mobile" (PSM), Posterior Trunk Asymmetry Index (POTSI), and Anterior Trunk Asymmetry Index (ATSI) were used for frontal-sagittal plane posture assessment; the difference between the physiotherapist and child's Walter Reed Visual Evaluation Scale (WRVAS) score was used for child's body image perception assessment.

Results

The baseline and end of treatment PSM scores in the PSSE vs control group were 5.16±1.58, 2.60±1.37 (p=0.001) vs 5.65±1.31, 5.08±1.34 (p=0.844) for total anterior displacement; 6.69±2.50, 4.48±1.45 (p=0.004) vs 6.98±1.30, 6.90±2.57 (p=0.638) for total posterior displacement; 13.22±3.15, 5.58±2.28 (p=0.001) vs 12.33±2.89, 10.31±2.79 (p=0.209) for total lateral displacement (right); and 12.80±2.11, 6.73±2.60 (p=0.001) vs 12.02±3.52, 11.31±4.33 (p=0.182) for total lateral displacement (left), respectively. Also, significant improvement was observed in POTSI (p=0.001) and ATSI (p=0.001) scores in the PSSE group at the end of the treatment, while no significant change was observed for both in the control group (p=0.117, p=0.060). The WRVAS score difference was 3.92±3.50, 1.42±1.83 (p=0.023) in the PSSE group and 3.15±3.40, 3.00±3.58 (p=0.565) in the control group for baseline and end of treatment, respectively.

Conclusion

Based on the findings, it was concluded that PSSE is an effective method to improve postural symmetry and have positive contributions to the child's body perception.

Conflict of Interest Disclosure

"We have no Conflicts of Interest to disclose."

Effectiveness of traditional Chinese and Western Scoliosis- specific Exercises and Practices for Treating Adult Idiopathic Scoliosis: A Systematic Review and Meta-analysis

by Peter Zhu | Andy Jin | Fastuts Canada | University of New Brunswick

Background

Non-surgical treatments for adult idiopathic scoliosis is sometimes prescribed for patients as an alternative to surgical interventions, but their effectiveness is uncertain.

Objective

To evaluate the effectiveness of the Schroth method, SEAS, and TCM on reducing Cobb angle in adult idiopathic scoliosis.

Study Design

Systematic review and meta-analysis.

Methods

Database indexing services were used to search for applicable studies. Studies are eligible if their subjects are adults, used Schroth, SEAS, or TCM, and reported pre- and post-treatment Cobb angles. Meta-analysis was performed to determine effectiveness and compare the methods.

Results

With support from select, low-quality articles with unclear to high risk of bias, Schroth, SEAS, and TCM are effective in reducing Cobb angle for adult patients with idiopathic scoliosis.

Conclusion

Alternate, non-surgical methods for treating adult idiopathic may be effective   in reducing Cobb angle. However, further high-quality research must be conducted to validate the effectiveness.

Conflict of Interest Disclosure
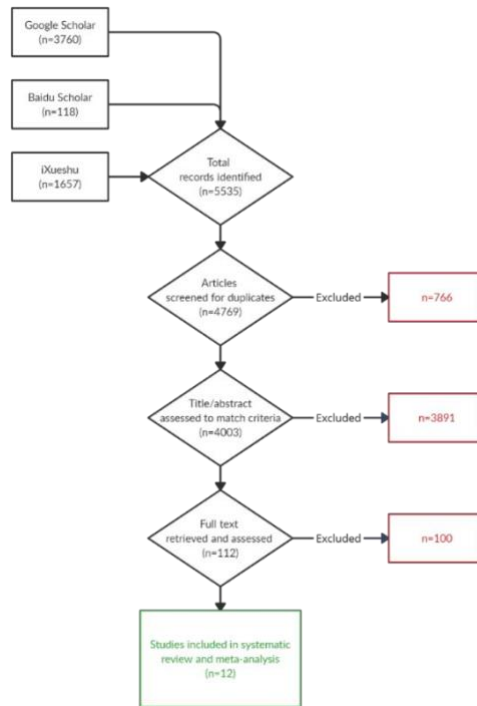
We have no Conflicts of Interest to disclose.

Fig. 1 Flowchart depicting the selection process for studies.

Legend
Low risk: +
High risk: -
Unclear risk: ?

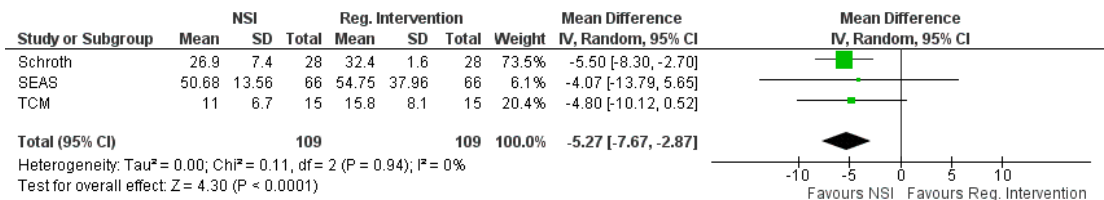**Fig. 2** Risk of bias ratings adapted from Cochrane Risk-of-Bias Tool.

Fig. 3 Forest plot depicting the mean differences in Cobb angle between non-surgical intervention (NSI) and regular intervention arms. SD, standard deviation; IV, instrumental variable; CI, confidence interval; I^2, inconsistency test.

Content validity of the PHYS-IS questionnaire for patients treated with Physiotherapeutic Scoliosis-Specific Exercises (PSSE)

by Laura Bastianel | Isis Juliene Leite Navarro | Grazielle Martins Gelain | Cláudia Tarragô Candotti | Universidade Federal do Rio Grande do Sul / Brazil | Universidade Federal do Rio Grande do Sul / Brazil | Universidade Federal do Rio Grande do Sul / Brazil | Universidade Federal do Rio Grande do Sul / Brazil

Background

Existing questionnaires for assessing patients with idiopathic scoliosis (IS) do not encompass questions about some of the elements of the treatment with physiotherapeutic scoliosis-specific exercises (PSSE), such as the training on the maintenance of self- correction during activities of daily life, patient's dedication and engagement with this treatment, perception on the stabilization of the corrected posture, and patients' education   on his/her spinal condition.

Objective

To assess the content validity of the Phys-IS questionnaire, which proposes to evaluate quality of life, body perception and satisfaction of patients treated with PSSE.

Methods

Six experts in IS were invited to participate in this study (5 physiotherapists and 1 physician). All experts had done at least one training in one of the seven schools which are certified in PSSE. They received the first version of the Phys-IS questionnaire and another questionnaire for assessing content validity. For the questionnaire to be valid, there should   be 80% or better agreement among experts rating the items as 3 (relevant but requiring minor revision) or 4 (highly relevant and concise).

Results

Three rounds of assessment were performed. In round 3, the experts rated 100% of the assessed items as "3" or "4", which determined the final version of the Phys-IS questionnaire.

Conclusion

The Phys-IS questionnaire demonstrated excellent agreement among the experts and showed adequate content validity. Currently, reproducibility and internal consistency of the Phys-IS questionnaire are being assessed. We hope that a valid and reliable tool will soon be available for evaluating the patient treated with PSSE.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Investigation Of The Relationship Between Severity Of Scoliosis With Pain, Quality Of Life And Depression Level In Patients With Adolescent Idiopathic Scoliosis

by Öznur BÜYÜKTURAN | Mehmet Hanifi KAYA | Hikmet Kocaman | Buket BÜYÜKTURAN | Kırşehir Ahi Evran Unıversıty | Kırşehir Ahi Evran Unıversıty | Karamanoğlu Mehmet Bey Unıversıty | Kırşehir Ahi Evran Unıversıty

Background

Adolescent idiopathic scoliosis (AIS) is a three-dimensional spine deformity involving the lateral deviation and axial rotation of the spine and changed physiologic sagittal curves. Because of its three-dimensional characteristic the trunk distortion affects not only the thoracic part of the body but also the whole body and abnormal loadings due to the trunk distortion may also cause pain and affect the quality of life.

Objective

The aim of this study was to evaluate the relationship between the curve magnitude with pain, quality of life, and depression level in patients with AIS.

Methods

Sixty-nine adolescent (female:51, male: 18) AIS patients aged between 10-18 years were included in this study. The patients' scoliosis severity was determined by Cobb method, pain assessment Visual Analog Scale, quality of life Scoliosis Research Society-22 (SRS-22) questionnaire, and depression level Children's Depression Scale (CDS) was determined. Data obtained from individuals were analyzed by Spearman correlation coefficient.

Results

The mean age of the patients included in the study was 14 ± 2.67; Cobb angles were 21.08±4.11; CDS results were 10.58±5.43; SRS-22 results were found to be 3.47±0.18. It was found that moderate correlation between Cobb angle with depression level ($p < 0.05$ r=.396), and pain ($p < 0.05$ r= .405). İn addition weak correlation was found between Cobb angle and quality of life scores ($p < 0.05$, r= -.366).

Conclusion

Correction of the curvature is generally aimed in the treatment of AIS. However, in this study, it was found that in addition to affecting the vertebral alignment, AIS affects quality of life, psychological state and pain. Improvement of these parameters should also be considered in the treatments of AIS.

Conflict of Interest Disclosure

"We have no Conflicts of Interest to disclose."

A Comparison Of Posterior Intercostal Arterial Blood Flow Between Concave And Convex Side In Adolescent Idiopathic Scoliosis Patients

by Erman ULU | Akif Albayrak | Fatma Serap YÜCEL | Adem Reyhancan | Mehmet COŞKUN | Furkan Yapıcı | Van Erciş State Hospital | M.S. Baltalimani Bone Diseases Education and Research Hospital | M.S. Baltalimani Bone Diseases Education and Research Hospital | Istanbul Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Education and Research Hospital | Van Education and Research Hospital | Erzincan University Mengucek Gazi Training and Reseach Hospital

Background

Many abnormalities have been described in the etiology of adolescent idiopathic scoliosis; genetic, neurological, connective tissue anomalies, biochemical anomalies, vascular anomalies. Asymmetrical growth of the vertebrae is thought to be a possible etiologic factor in the pathogenesis of adolescent idiopathic scoliosis. Proliferation and apoptosis index were reported to be higher on the convex side of the vertebra. It is assumed that vascular asymmetry is responsible for the development of adolescent idiopathic scoliosis.

Objective

In our study, the anatomical and hemodynamic flow parameters of the posterior intercostal artery providing blood supply to the posterior chest wall in adolescent idiopathic scoliosis patients were measured by color doppler ultrasound and compared between convex and concave sides.

Methods

The patients who were admitted to the outpatient clinic with the diagnosis of AIS and comparable volunteer individuals without spine deformity were prospectively reviewed. All ultrasound measurements were performed by an experienced radiologist. Toshiba Aplio 300 Ultrasound device was used. When the adolescent idiopathic scoliosis patients were in the prone position, measurements were made bilaterally from the apex of the deformity where the intercostal artery was closest to the vertebra. In healthy volunteers, measurement was performed bilaterally from thoracic 7-8 regions. The parameters were measured in all individuals included anatomic arterial lumen diameter, and arterial cross sectional area and hemodynamic flow parameters. Blood Flow Volume per minute calculated from Volume flow = Cross-sectional Area × Time-averaged velocity*60sWrite the Methods here

Results

The median flow velocity of scoliosis patients measured by concave was 20.5 (17.0-33.0), whereas it was 32.5 (28.0-54.3) measured from the convex side. The flow velocity on the concave side is significantly less than on the convex side (p<0.001). In addition, cross sectional area, Time-averaged velocity and lumen diameter in the concave is significantly lower than that of the convex side. The mean flow velocity in the control group was 22.4 ± 9.4 on the left side and 22.8 ± 9.5 on the right. There is no statistically significant difference between the flow

velocity of the left and right sides (p=677). When the cross sectional area, Time-averaged velocity and lumen diameter measurements of both sides were compared, no significant difference was found in terms of these parameters. There was no significant relationship between Cobb angle and cross sectional area, Time-averaged velocity and lumen diameter.

Conclusion

In our study, it was observed that the concave side flow parameters were lower than the convex side. It supports the blood flow asymmetry in the etiology of scoliosis. However, in order to understand whether this change is the primary cause or secondary outcome of the disease, studies in larger patient groups and studies in experimental models such as animal experiments will help to clarify the etiology of the disease.

Conflict of Interest Disclosure

"We have no Conflicts of Interest to disclose."

The Effectiveness of Schroth Exercises and Core Stabilization Exercises on Cobb Angle, Pedobarographic Parameters and Peripheral Muscle Strength in Adolescent Idiopathic Scoliosis: A Single-Blind, Randomized-Controlled Trial

by Öznur BÜYÜKTURAN | Hikmet KOCAMAN | Nilgün BEK | Mehmet Hanifi KAYA | Buket BÜYÜKTURAN | Kırşehir Ahi Evran Unıversıty | Karaman Oğlu Mehmet Bey Unıversıty | Hacettepe Unıversıty | Kırşehir Ahi Evran Unıversıty | Kırşehir Ahi Evran Unıversıty

Background

In scoliosis rehabilitation different exercises are used, including scoliosis-specific exercises or general physiotherapeutic exercises. Comparative studies on the effectiveness of different exercise approaches may help to choose convenient exercises for the conservatif treatment of adolescent idiopathic scoliosis.

Objective

The purpose of this study was to compare the efficacy of two different types of exercise methods on Cobb angle, pedobarographic parameters and peripheral muscle strength in patients with adolescent idiopathic scoliosis (AIS).

Methods

Twenty eight patients with AIS, who had mild curve magnitude (10°–26°) meeting the inclusion criteria, were included study. The patients were randomly divided into two groups: Schroth group (n = 14) and Core group (n = 14). The Schroth group received Schroth exercises, and the Core group received Core stabilization exercises for 3 days per week for a total of 10 weeks. Both groups received traditional exercises in addition to Schroth or Core stabilization exercises. The outcome measures included Cobb's angle on radiograph, static- dynamic pedobarographic parameters (DIASU Digital Analysis System and Milletrix software), and peripheral muscle strength (Biodex System 4-Pro). A mixed design repeated measures analysis of variance was used to statistical analysis.

Results

It was found that Cobb angles improvement was greater in the Schroth group compared to the Core group (p<0.05). Static-dynamic plantar contact area increases were greater in Schroth group compared to the Core group (p<0.05). Peripheral muscle strength improvement was greater in the Core group compared to the Schroth group (p<0.05).

Conclusion

The Schroth exercises were more effective than Core stabilization exercises on decreasing Cobb angle and increasing the plantar contact area in the mild AIS. In addition, Core stabilization exercises were more effective than the Schroth exercises in the improvement of peripheral muscle strength. These results may be helpful in determining appropriate exercises according to the purpose in rehabilitation programs in AIS.

<u>Conflict of Interest Disclosure</u>

"We have no Conflicts of Interest to disclose."

Different Concepts of Bracing in Adolescent Idiopathic Scoliosis (AIS), a systematic review and meta-analysis.

by Lorenzo Costa | UMC Utrecht, the Netherlands

Background

AIS mostly progress during adolescent and brace therapy is generally applied to prevent progression of the curve. Multiple concepts of bracing have been developed, however it is currently not fully known whether there is a difference in effectiveness.

Objective

The primary aim is to compare, wherever possible, the effectiveness of the different brace concepts. Effectiveness is defined as the effect on curve magnitude and/or prevention of the need of surgery. The secondary aim is to define the influence of skeletal maturity on brace effectiveness.

Methods

This systematic review and meta-analysis was performed according to the PRISMA statement. All original studies on brace treatment for AIS were systematically searched for in PubMed and EMBASE up to December 2019. Articles that did not report on any maturity parameter of the study population were excluded. Critical appraisal was performed using MINORS. Brace concepts were distinguished based on prescribed wearing time and rigidity of the brace: full-time, part-time and night-time, rigid braces and soft braces. In the meta- analysis, success was defined as ≤5° curve progression during follow-up, and success rates were compared to untreated scoliosis patients.

Results

31 out of 2487 articles were included. 19 papers showed high risk of bias and 12 medium risk of bias. In the meta-analysis, rigid full-time brace had on average a success rate of 76%, night-time of 73%, soft braces of 63%, observation only of 51%. There was insufficient evidence on part-time, rigid braces for the meta-analysis.

Conclusion

The majority of studies focusing bracing of AIS have significant risk of bias. No significant difference between the night-time, or full-time concepts could be identified. Soft braces have a lower success rate compared to rigid braces. Reported success rates are dependent on skeletal maturity at initiation of the treatment.

Conflict of Interest Disclosure

Disclose Conflicts of Interest for all authors here or state "We have no Conflicts of Interest to disclose."

Ossification and Fusion of the Vertebral Ring Apophysis during growth

by Lorenzo Costa | UMC Utrecht, the Netherlands

Background

During growth ring apophyses encircle the inferior and superior surfaces of the vertebral bodies and they ossify and fuse to the vertebrae. Nevertheless, this process is still not fully known and this study might help on a better knowledge of spine development resulting in a better management of spine related diseases.

Objective

During growth many spine diseases appear due to a higher weakness of the structures of the spine and the ring apophysis can be involved in these processes. The aim is to describe the maturation pattern of the ring apophyses in the thoracic and lumbar spine during normal growth.

Methods

High-resolution CT-scans of the thorax and/or abdomen acquired in a tertiary pediatric hospital for indications not related to this study, nor the spine were included. Ossification   and fusion of each superior and inferior ring apophysis from T1 to the sacrum was classified on midsagittal and midcoronal images (4 points per ring) by two observers. The ring apophysis maturation scale (RAMS) was compared between different ages, sexes and spinal levels.

Results

The RAMS strongly correlated with age (R= 0.892, p<0.001). Ossification occurred from age 9-15 years in males and 7-15 in females, fusion from 14-19 and 13-19 (p=0.002). The anterior and posterior parts, compared to the lateral parts, ossified half year earlier and fused at the same time (median 12 yo and 18 yo) and the high thoracic and low lumbar levels (median 12 yo and 18 yo p= 0.031 for ossification and p=0.251).

Conclusion

This study describes the maturation of the ring apophyses. It shows that ossification and fusion start later in males and in the thoracolumbar spine. This needs further exploration for understanding its relevance in the pathogenesis of spinal deformities.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Assessment of Segmental Vertebral Motion During Walking Using Surface Topography

by Danielle Klotz, PA-S | Daniel Drzewiecki, MPH, PA-S | Shefali Ferguson, PA-S | Allison Miller, PA-S | Patrick Knott, PhD, PA-C | Rosalind Franklin University, Chicago USA

Background

Surface Topography has proven to be an accurate and reliable tool for measuring static posture in patients with most spinal conditions. The technique can also be used to measure dynamic motion of the spine during treadmill walking and can produce measurements of individual vertebral motion.

Objective

This study aims to assess the reproducibility of those vertebral measurements in a series of normal volunteers.

Methods

Seventeen subjects were measured three times during normal walking at a comfortable speed chosen by the subject. Motion capture was for 5 seconds yielding 4 to 5 gait cycles for each capture. Vertebral body motion at each segment between T1 and L4 was recorded. The minimum and maximum value for each measurement during each gait cycle was recorded for comparison of repeated measures.

Results

Cronbach's Alpha was calculated to be 0.926 across all segments, showing high consistency. When the comparison was done by region, the thoracic vertebrae had a similar value of 0.930 and the lumbar vertebrae had a value of 0.912.

Conclusion

Our conclusion is that the measurements of segmental motion of the spine during walking are consistent and reproducible. Surface Topography can be a useful tool to study spinal motion in patients with musculoskeletal conditions.

Conflict of Interest Disclosure

Does Proximity to a Wall Influence the Measurement of Patient Posture?

by Courtney Leonard, BS, PA-S | Christina Wang, BS, PA-S | Craig Ward, BA, PA-S | Ashley Watson, MS, PA-S | Patrick Knott, PhD, PA-C | Rosalind Franklin University, Chicago, USA

Background

When measuring a patient's posture using imaging, some theorize that the measurement should be done in the middle of the room so that proximity to a wall does not influence the posture.

Objective

Our hypothesis was that standing too close to a wall in front of the body would cause the patient to lean backwards, increasing lumbar lordosis and decreasing thoracic kyphosis, causing sagittal balance to shift backwards. Also, standing too close to a wall on the side of the body would cause the patient to lean away, causing a shift in the coronal balance.

Methods

Surface topography was used to obtain repeated measurements of 16 healthy volunteer subjects. Three posture measurements were taken with the patient positioned in the center of the room, and then this was repeated with the patient ten centimeters from the wall on the right side, and ten centimeters from the wall in front of them. Thoracic Kyphosis, Lumbar Lordosis, Sagittal Imbalance, Coronal Imbalance, and Vertebral Rotation were all compared for the 3 sets of measurements on each patient.

Results

The average change in posture was not statistically significant nor clinically significant for any of the measurements. Our hypotheses were disproven, and patient location in proximity to a wall was not found to influence the postural measurement.

Conclusion

When measuring posture in a small clinical space, the clinician should not be concerned that this influences clinical assessment.

Conflict of Interest Disclosure

P Knott: R&D Consultant for DIERS Medical Systems, Inc.
C Leonard, C Wang, C Ward, A Watson: Nothing to disclose

Evaluation of the Effects of Pandemic Process on Physical Activity and Health Related Quality of Life in Individuals with Idiopathic Scoliosis: A Pilot Study

by Gozde Yagci | Merve Karatel | Gokhan Demirkiran | Yavuz Yakut | Hacettepe University | Hasan Kalyoncu University | Hacettepe University | Hasan Kalyoncu University

Background

COVID-19 has affected Turkey seriously, as well as worldwide and isolation recommendations and the provision of health services for pandemic may have a negative impact on rehabilitation of patients with Idiopathic scoliosis (IS).

Objective

The research was conducted to assess the effects of pandemic period on physical activity and health related quality of life in individuals with IS.

Methods

The population was IS patients who began conservative treatment (bracing and/or exercise) before pandemic process and still undergoing conservative treatment in pandemic period. The mean age of participants was 14.7 ± 1.6 and the mean Cobb angle was 29.3 ± 11.7 and 25.3 ± 9.0 for the thoracic and lumbar curves, respectively. International Physical Activity Questionnaire (IPAQ) was used to measure the level of physical activity and Scoliosis Research Society-22 (SRS-22) instrument was used to examine scoliosis-specific quality of life of the participants. Scales were sent online and patients were asked to complete for the two-time period: before and during pandemic process. The results were analyzed with Wilcoxon signed-ranks tests.

Results

Total treatment time was 25.8 ± 18.2 (six months to sixty months). Results showed a significant decrease in moderate physical activity (by a net from 2.4 to 1.4 day/a week)(p= 0.003) but not in vigorous physical activity with pandemic. The participants significantly decreased their walking (by a net from 58 to 41 min/a day) (p=0.002) and increased their sitting (by a net from 6.4 to 9.8 hours/a day) (p<0.001) during pandemic period. They decreased total physical activity in pandemic period, when compared to before (p=0.002). Total quality of life (p=0.020) and mental health (p=0.026) decreased during pandemic period. However, no statistically significant differences were detected in pain, self-image, function and treatment satisfaction domains of SRS-22 instrument between the two-time points.

Conclusion

In the pandemic period, the decrease in physical activity seems to affect overall quality of life and specifically mental health negatively in patients with IS. Rehabilitation programs is suggested to focus on increasing physical activity for optimum treatment success in IS.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose

What a stranded whale with scoliosis can teach us about human idiopathic scoliosis

by Steven de Reuver | Lonneke L. IJsseldijk | Jelle F. Homans | Dorien S. Willems | Stefanie Veraa | Marijn van Stralen | Marja J.L. Kik | Moyo C. Kruyt | Andrea Gröne | René M. Castelein | Department of Orthopaedic Surgery, University Medical Center Utrecht, Utrecht, the Netherlands. | Division of Pathology, Department of Biomolecular Health Sciences, Faculty of Veterinary Medicine, Utrecht University, Utrecht, the Netherlands. | Department of Orthopaedic Surgery, University Medical Center Utrecht, Utrecht, the Netherlands. | Division of Diagnostic Imaging, Department of Clinical Sciences, Faculty of Veterinary Medicine, Utrecht University, Utrecht, the Netherlands. | Division of Diagnostic Imaging, Department of Clinical Sciences, Faculty of Veterinary Medicine, Utrecht University, Utrecht, the Netherlands. | Imaging Division, University Medical Center Utrecht, Utrecht, the Netherlands. | Division of Pathology, Department of Biomolecular Health Sciences, Faculty of Veterinary Medicine, Utrecht University, Utrecht, the Netherlands. | Department of Orthopaedic Surgery, University Medical Center Utrecht, Utrecht, the Netherlands. | Division of Pathology, Department of Biomolecular Health Sciences, Faculty of Veterinary Medicine, Utrecht University, Utrecht, the Netherlands. | Department of Orthopaedic Surgery, University Medical Center Utrecht, Utrecht, the Netherlands.

Background

Scoliosis is a deformation of the spine that may have several known causes, but only humans can develop scoliosis without any obvious underlying cause. This is called 'idiopathic' scoliosis and is the most common type. Recent observations showed that human scoliosis, regardless of its cause, has a uniform three-dimensional anatomy. We hypothesize that scoliosis is a universal compensatory mechanism of the spine, independent of cause and/or species.

Methods

We had the opportunity to study the rare occurrence of scoliosis in a whale that stranded in July 2019 in the Netherlands. A multidisciplinary team of biologists, pathologists, veterinarians, taxidermists, radiologists and orthopedic surgeons conducted necropsy and CT-imaging analysis. In areas of the spine that did not show underlying anatomical changes, we analyzed the compensatory curves in 3D and compared the morphology with the non-scoliotic spine of 10 control whales.

Results

The stranded animal was a common minke whale (Balaenoptera acutorostrata) and was a 403 cm long, 530 kg female juvenile, with an estimated age between 0.5-4 years. The most likely cause of death was considered to be acute recent blunt trauma. Visual inspection showed epiphysiolysis at the left-side of the lower endplate of vertebra L3, a burst upper endplate at the right-side of vertebra L4, fractured spinous processes of vertebrae L1 to L6, severely wedged vertebrae T11 and T12 and detachment of the transverse processes at multiple levels. Two traumatically deformed vertebrae had led to an acute post-traumatic scoliosis, which had initiated the development of compensatory curves in regions of the spine without anatomical abnormalities. The 3D analysis of the compensatory curves showed a rotation of the vertebral bodies in the transverse plane into the convexity of the curve. The mean anterior-posterior length discrepancy (AP%) of the total compensatory curvature was +9.4% in the whale, indicating a lordosis. This is significantly different from the kyphosis in the same part of the

spine in the non-scoliotic control group, with a total AP% of -2.1±0.4% (p < 0.001). On the contrary, the bony morphology of the vertebral bodies was similar to the controls; the vertebral body AP% of the whale was -2.5%, which was comparable to the kyphotic shape of the vertebral bodies in controls with -1.8±0.8% (p= 0.429). Almost all anterior lengthening was present in the intervertebral discs, as the disc AP% in the compensatory curvature of the whale was +99.5%, which meant a lordotic shape of the intervertebral discs with an anterior length almost twice the posterior length. This is in sharp contrast to the kyphosis in the discs of controls with -4.6±5.0% (p < 0.001).

Conclusion

Three-dimensional analysis of these compensatory curves showed strong resemblance with different types of human scoliosis. This indicates that any decompensation of spinal equilibrium can lead to a uniform response, regardless of underlying cause or species. The unique biomechanics of the upright human spine, with significantly decreased rotational stability, explains why only in humans this universal mechanism of scoliosis can occur in an 'idiopathic' way.

Conflict of Interest Disclosure

N/A

Posterior view from the CT-scan of level C1 to L7. The suspected site of traumatic injury at level L3/L4 (indicated with an asterisk) initiated a double compensatory curve cranially and a single compensatory curve caudally.

The effect of 3D postural correction and abdominal muscle contraction on the symmetry in transverse abdominis and the spinal alignment among patients with idiopathic scoliosis

by Sungyoung Yoon | Sangyeol Lee | General Fitness Inc., South Korea | Department of Physical Therapy, Kyungsung University, South Korea

Background

Idiopathic scoliosis (IS) refers not only to the deformities in which the spine and torso are laterally curved, but also to the three-dimensional deformation in which the normal curvature is lost on the sagittal plane as rotation is accompanied. Abnormal structural changes in the vertebral body and disc can cause secondary problems. Such changes gradually alter the interactions of the torso leading to increased body instability, thereby creating asymmetry of the musculoskeletal system including rib and trunk shape, and muscle thickness. However, there is a lack of the studies that examine the symmetry of muscles in real time during 3D postural correction (3DPC) which is the most important element to PSSE.

Objective

To investigate the effect of 3DPC using corrective cushions (CC) and abdominal muscle contraction (AMC) on the symmetry of the thickness of transversus abdominis (TrA) and the spine alignment in patients with IS. Two experiments were conducted.

Methods

In the primary experiment, 11 subjects (9 females, 2 males; 3 3C, 5 4C, 1 N3N4, 2 Single L/TL) with IS underwent ultrasound measurement of the thickness of TrA on convex and concave side of lumbar curve in supine position during AMC/non-AMC without 3DPC and during AMC/non-AMC with 3DPC using CC positioned according to Rigo classification. Two- way ANOVA was used to for data analysis. Paired t-test was used to analyze the relationship between variables and the symmetry of the thickness of TrA. Three evaluators performed sonographic measurements for inter-evaluator reliability analysis.

In the following experiment, 37 subjects (31 females, 6 males; 13 3C, 12 4C, 5 N3N4, 7 Single L/TL) with IS performed 3DPC exercise program for 4 weeks. 3DPC exercises program, which focus on maintaining the symmetry of the thickness of TrA based on the primary experiment results consisted of semi-hanging, and auto-correction in sitting and standing position (60min/time; 2times/week). Outcomes included the Cobb angle, angle of trunk rotation (ATR) and trunk expansion (TE). Paired t-test was used to compare pre- and post- exercise results.

Results

The symmetry of the thickness of TrA significantly increased following 3DPC using CC and following AMC ($p<0.05$), while there was no statistically significant interaction between 3DPC and AMC ($p>0.05$). The measurements of ultrasound examinations in all conditions showed excellent inter-evaluator reliability (intraclass correlation coefficient, ICC3,1=.986). The Cobb angle, ATR, and TE showed statistically significant increase following the application of 3DPC exercise program for four weeks ($p<0.05$).

Conclusion

We found that using 3DPC and AMC simultaneously generates the greatest symmetry of the thickness of TrA. Therefore, when applying exercise interventions to patients with IS, 3DPC and AMC should be included as the key elements. This study provides clinical data to set the direction of scoliosis treatment.

Conflict of Interest Disclosure

Disclose Conflicts of Interest for all authors here or state "We have no Conflicts of Interest   to disclose."
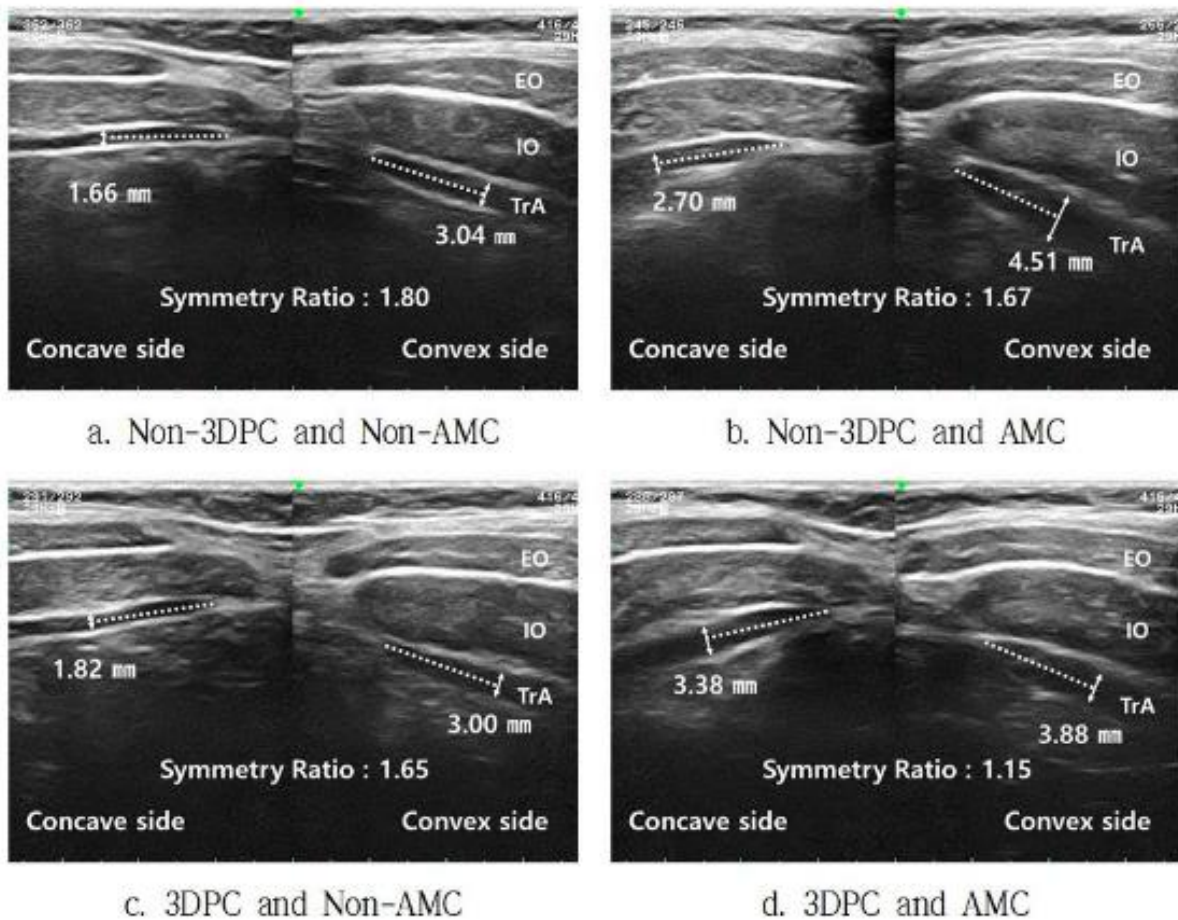

Figure 1. Results of ultrasonography imaging measurement.

Distinct Pattern of Muscle and Bone Parameters in Adolescent Idiopathic Scoliosis (AIS) Girls

by Rufina Wing Lum Lau | Ka Yee Cheuk | Vivian Wing Yin Hung | Fiona Wai Ping Yu | Elisa Man Shan Tam | Lyn Lee Ning Wong | Jiajun Zhang | Franco Tsz Fung Cheung | Wing Sze Yu | Wayne Yuk Wai Lee | Jack Chun Yiu Cheng | Tsz Ping Lam | School of Medical Health Sciences, Tung Wah College, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China | SH Ho Scoliosis Research Lab, Joint Scoliosis Research Center of the Chinese University of Hong Kong and Nanjing University, Department of Orthopaedics & Traumatology, The Chinese University of Hong Kong, Hong Kong SAR, China

Background

Adolescent Idiopathic Scoliosis (AIS) patients are found to have low bone mass, deranged bone qualities, low bone mechanical properties, low lean mass and muscle imbalance in previous studies. The correlation between muscle and bone qualities in AIS are remained undefined.

Objective

This case-control study aimed to investigate the correlation between bone qualities, lean mass and handgrip strength in both AIS and controls.

Methods

126 AIS girls and 194 healthy controls aged 12-14 years old were recruited. Maximum handgrip strength at both hands was measured with a standard dynamometer, lean mass at arm, leg and trunk was measured by body impedance analysis, and bone qualities and bone mechanical properties of non-dominant distal radius were measured by high-resolution peripheral quantitative computed tomography (HR-pQCT). T-test was used to compare the baseline characteristics, and partial correlation was used to study the correlation between the bone and muscle parameters in AIS and controls.

Results

AIS had similar age, body height and sitting height compared with the controls but they had delayed onset of menarche and lower body weight ($p<0.01$). AIS also had less skeletal muscle mass (5.9%, $p< 0.05$) and lean mass at both trunk, arm and leg (4.5% - 12%, $p<0.05$), reduced bone stiffness (6.8%, $p<0.01$) and estimated failure load (7.9%, $p<0.01$). After adjustment for cofounders, trunk lean mass in the controls had the highest correlation with bone mechanical properties in terms of stiffness ($R=0.424$) and estimated failure load ($R=0.406$), while dominant handgrip strength in AIS had the highest correlation with bone stiffness ($R=0.452$) and estimated failure load ($R=0.455$).

Conclusion

This study found the derangement of muscle and bone parameters in AIS which showed a distinct correlation pattern from controls. The response of biomechanical interaction between muscle and bone tissues in AIS may reflect impaired muscle-bone cross talk. Further studies will be necessary to evaluate the muscle-bone relationship in AIS progression and its response to exercise intervention.

Conflict of Interest Disclosure

Study of the mid-term results of conservative treatment of idiopathic scoliosis using the dynamic derotation brace

by Chandrinos Michail | Vynichakis Georgios | Lykouris Dimitrios | Mazioti Christina | Papagianni Despoina | Mamzeri Aristea | Grivas Theodoros B. | Department of Orthopedics & Traumatology,"Tzaneio" General Hospital of Piraeus, Piraeus, Greece. | General Hospital of Argolis-N.M Nafplio | Department of Orthopedics & Traumatology, "Tzaneio" General Hospital of Piraeus, Piraeus, Greece. | Department of Orthopedics & Traumatology,"Tzaneio" General Hospital of Piraeus, Piraeus, Greece. | School Nurse - Health Visitor, at the Special Primary School of Rafina, Attica, Greece | Health Visitor, TOMY Attica Square, Athens, Greece | Department of Orthopedics & Traumatology,"Tzaneio" General Hospital of Piraeus, Piraeus, Greece.

Objective

The aim of this study is to present the short and mid-term results of conservative treatment of idiopathic scoliosis (IS) using the Dynamic Derotation Brace (DDB), in terms of radiological image and body asymmetry.

Methods

A total of 45 children with IS, 4 boys and 41 girls, were retrospectively studied. Mean age   was 12,9 (range 7,5-16,4) years at first examination and 14,8 (range 9-16) years at final examination. Major curves recorded were: 19 Thoracic (T) (16 right and 3 left), 25 Thoraco-Lumbar (TL) (9 right and 16 left), and 1 Lumbar (L) (right). Height, the weight and handedness (13,64% left-handed and 86,36% right-handed) data were recorded. Cobb angle was assessed in the posterio-anterior spinal radiographs. Body asymmetry was assessed by means of the Prujis scoliometer, in standing forward bending position (Adam test) in T (T4- T8), TL (T12-L1) and L (L2-L5) levels. The DDB was applied according to the indications of SRS and SOSORT.

Results

Mean weight was 48.57 kg (range 32.2-65) at first examination and 53.54 kg (range 35-74) at final examination. Mean height was 158.04 cm (range 137-180) at first examination and   cm (range 140-180) at the final one.

Average Cobb angle measurements at the first and the last examination were: a) T 27.27° (18°-38°) and 19.38° (0°-43°) respectively, thus a 28.93% improvement was recorded, b) TL 26.26° (20°-57°) and 24.29° (12°-40°) respectively, thus a 7.5% improvement was recorded and c) L31° and 24° respectively, thus a 22.58% improvement was recorded. During the mean time of 22 months of treatment, improvement occurred in 11 T curves, deterioration in 3 and 6 remained stable. In TL curves, 16 improved, 4 deteriorated and 4 remained stable. L curve also improved.

Scoliometer measurements are referred to the compensation curves as well. Mean scoliometer measurements at the first and last examination were respectively: a) in T right, 7.29° (3°-15°) and 6.95° (3°-12°), that is 4.66% improvement and in T left, 5.62° (2°-12°) and 6.57° (2°-12°), that is 16,90 deterioration, b) In TL right, 7.31° (2°-5°) and 6.68° (2°-20°), that is 8.61% improvement and in TL left, 7.06° (3°-15°) and 7.18° (4°-12°), that is

1.69% deterioration respectively, and finally c) in L right, 4.58° (2°-10°) and 4° (2°-7°), that is 12.66% improvement and L left, 4.9° (2°-10°) and 2.71° (2°-4°), that is 44.80% improvement.

Conclusion

The application of DDB over a period of 22 months stabilized the curves and only 6.6% of the major T and 8.8% of TL deteriorated. Improvement of the body asymmetry (hump) was deemed satisfactory, especially in all the right curves. It is noted that compliance of brace use in children was based on the verbal reports of the parents, which is not always fully reliable. Correction rates appear to be comparable with other frequently described published reports. Thus, DDB brace is considered effective and its application is recommended.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Characteristics of scoliosis patients submitted to a clinical review service from primary care clinics in Australia between 2018 and 2021

by Jeb McAviney | Juan Du Plesis | Azharuddin Fazalbhoy | Roger Engel | Alex Boakes | Benjamin Brown | William Vuong | Justine Carson | Sean Candler | Robert Cheung | ScoliCare, Kogarah Australia Suite 2, Level 4/15 Kensington St, Kogarah NSW 2217 | ScoliCare, Kogarah Australia Suite 2, Level 4/15 Kensington St, Kogarah NSW 2217 | ScoliCare, Kogarah Australia Suite 2, Level 4/15 Kensington St, Kogarah NSW 2217 | Department of Chiropractic, Faculty of Medicine, Health and Human Sciences, Macquarie University, Australia | Department of Chiropractic, Faculty of Medicine, Health and Human Sciences, Macquarie University, Australia | Department of Chiropractic, Faculty of Medicine, Health and Human Sciences, Macquarie University, Australia | Department of Chiropractic, Faculty of Medicine, Health and Human Sciences, Macquarie University, Australia | Department of Chiropractic, Faculty of Medicine, Health and Human Sciences, Macquarie University, Australia | Department of Chiropractic, Faculty of Medicine, Health and Human Sciences, Macquarie University, Australia | Department of Chiropractic, Faculty of Medicine, Health and Human Sciences, Macquarie University, Australia

Background

Scoliosis can present at any point across the lifespan. The condition may be picked-up during dedicated school screening programs, or via patient/parent-initiated consultations with primary care providers. Very little is known about the characteristics of scoliosis patients who present within primary care settings in Australia. ScoliCare (Australia) is a private clinical network that offers a free, clinical review service for practitioners who are managing patients with scoliosis. Practitioners upload clinical and imaging data through an online portal. Staff from this network then review the data and provide clinical recommendations.

Objective

The aim of this retrospective review was to describe the demographic and clinical characteristics of scoliosis patients from Australian primary care settings that were submitted for review between August 2018 and April 2021. Characteristics of the referring practitioners, and the type of information provided for each review was also evaluated.

Methods

All consecutive scoliosis cases (Cobb angle ≥10°) submitted by Australian practitioners to the online review portal during the review period were eligible for inclusion. Patient and practitioner data were de-identified, collated, cleaned and analyzed. Basic descriptive statistics were provided for all continuous and categorical variables. A content analysis was performed on data from free text fields. Ethics approval for this project was provided by Macquarie University's Human Research Ethics Committee (Approval number: 52020640714737).

Results

There were 190 cases that were eligible for review, submitted by 92 unique practitioners (52% female) from a variety of different professions (86% Chiropractors, 9% Osteopaths, 4% Physiotherapists, 1% General Practitioners). The majority (91%) of cases were submitted from

the three most populated Australian states. Imaging data were included in almost all (98%) submissions, and typically comprised of sectional (56%) or full spine (44%) coronal and sagittal plane x-ray views. Patient clinical data accompanied the review request in 88% of cases.

The majority (70%) of patients were female, with a median age of 16.5 years (interquartile range = 14). Pain was present in 82% of cases and was most commonly located in the lower back or pelvic region. Scoliosis was the main deformity in 92% of cases, with primary curves typically located in the thoracic spine (49%). The median primary curve Cobb angle measurement was 26.5° (Interquartile Range = 20). Twenty eight percent of patients were skeletally immature (Risser 0-2) at the time of review. Sinister curves (primary left thoracic or primary right lumbar curve) were present in 17% of cases.

Conclusion

The results of this study highlight the demographic and clinical characteristics of patients presenting to primary care settings in Australia and the associated practitioner profiles. This provides practitioners from primary through to tertiary care settings, and stakeholders from public and private health and educational bodies some insight into this important subgroup of the population.

Conflict of Interest Disclosure

The clinical review service described in this study is operated by a company that provides treatment for patients with scoliosis and educational products for practitioners. JM is the owner and director of the company, and BTB, JDP and AF are employees of the company. No other conflicts to declare.

Real-time 3D reconstruction of the scoliotic ribcage of adolescents with major thoracic curves during angular breathing exercises: a proof of concept study

by Charlene Yunli Fan | Jason PY Cheung | Michael KT To | Eric HK Yeung | Zhuman Xu | Zhidong Yang |Jianbin Wu | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong | The University of Hong Kong | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong - Shenzhen Hospital | The University of Hong Kong - Shenzhen Hospital

Background

Adolescent idiopathic scoliosis (AIS) is characterized by lateral deviated spine with axial rotation and an abnormal sagittal curvature, which leads a side-shift of trunk and an asymmetrical hump back in children with AIS. Angular breathing exercise (ABE), emphasized inhalation in the concave ribcage, was applied especially for major thoracic scoliosis to expand curve concavity, thus, to improve asymmetrical hump back.

Objective

This study reconstructed scoliotic ribcages using a 3D motion analysis system, aimed to investigate kinematics of a scoliotic ribcage during quiet, deep and ABE. We hypothesized a real-time expansion of the curve concavity could be observed during ABE.

Methods

A total, 16 participants with major thoracic scoliosis (age: 12 to 16 years, 2 males and 14 females, Cobb angles between T5 to T12: 33° to 48°, Thoracic kyphotic angles between T4 to T12: 18° to 25°) participated in this study between March and December 2020. Before commencing the main study, all participants attended one week of an in-patient exercise program to learn how to perform ABE correctly. A pilot study with 4 participants showed the optimal distance between each two markers on the rib level were 3cm for females and 4cm for males. This was performed to check repeatability of the motion capture system and limited false images during the signal capturing. Sixty-eight markers were allocated on the participants' body surface to construct scoliotic ribcages by a consultant spine surgeon, in which 18 markers were located on spinal process, acromial process and sternum; 50 markers were aligned on the 3 pairs of ribs (ring 1, ring 2 and ring 3) attached to upper end vertebrae (UEV), apical vertebrae (AV) and lower end vertebrae (LEV) levels, respectively. Dynamic motions of thoracic ribcage and spine during the quiet, deep and angular breathing were captured in a standard standing-exercise position. Surface of the front ventral flat zone and back concavity in the horizontal plane, as well as the spinal flexion angles during exercises were compared and analyzed for each breathing pattern.

Results

Participants with the major thoracic curves showed a significant, larger expansion of the ribcage during either deep breathing (1.8 ± 0.8 vs 1.0 ± 0.27, $p < 0.001$) or ABE (1.74 ± 0.7 vs 1.0 ± 0.27, $p < 0.001$). A prominent expansion on the ventral flat zone was observed during the ABE ([Ventral flat zone: 1.6 ± 0.2] vs [Back concavity:1.3 ± 0.6], $p < 0.01$). The ABE significantly increased spinal flexion angles (ABE: $28 \pm 2.1°$ vs Quiet: $23 \pm 6.2°$, $p<0.01$). A significant

improvement of asymmetrical trunk rotation (ATR: 15° ± 4.2 vs 9° ± 1.7) was observed after one week of in-patient SSE training.

Conclusion

ABE showed a real-time effect in expanding curve concavity and increasing thoracic kyphotic angles. This study formed a rationale of how ABE works on a scoliotic ribcage. However, the effect in de-rotating vertebrae requires future study with radiographic measurements to evaluate.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Screening for scoliosis using computer vision and machine learning allows high throughput screening: a proof of concept study

by Tian Ye | Charlene Yunli Fan | Michael KT To | Cheung KMC | AI Lab of Tencent Comapny | The University of Hong Kong - Shenzhen Hospital | The UIniversity of Kong Kong | The UIniversity of Kong Kong

Background

It is known that the gait of scoliosis subjects is asymmetric with abnormalities in shoulder, pelvis and hip motion. However, use of conventional gait analysis for screening is time consuming and not practical. A mobile phone-based gait analysis system has been developed which uses computer vision to detect shoulder, pelvis and limb motion, without the need to place trackers or to undress. The present study aims to assess the ability of this system combined with machine learning to differentiate between scoliosis and non-scoliosis subjects.

Objective

Gait abnormalities in adolescent idiopathic scoliosis can be detected using computer vision.

Methods

This was a prospective case control study. Videos of the gait of subjects walking along a 5-meter straight line were taken. Deep learning-based pose estimation technique was used to calculate the human postures from the recorded videos. Temporal analysis is then applied to reduce the noise and constraint the joints locations. Gait parameters including Acromion Pelvis Angle were calculated based on the 3D joint locations. With proper assembling method, the resulting high dimensional features will be able to represent the gait of this subject. Advanced machine learning algorithms including Random Forest were used to learn the pattern of the gait features of patients and controls and used to discriminate the two groups.

Results

Before commencing the main study, a pilot study on 10 subjects was conducted to assess   the reliability of the measurements and calculate the required sample size. Intraclass correlation coefficient (ICC) was conducted and the results showed satisfactory reliability of the Acromion Pelvis Angle (APA) in horizontal (ICC3,3 = 1.00), APA in vertical (ICC3,3 = 0.98), and Acromion Foot Angle (ICC3,3 = 0.99). A total of 129 subjects were captured: 84 have scoliosis (70 females, 14 males) and 45 were controls (37 females and 8 males). Of those with scoliosis, the distribution by Lenke curves were as follows: I = 27%; II = 2%; V=13%; VI=8%, with a mean Cobb angle of major curve of 30 deg (Min 21; Max 41). The rest (52%) were under 20 deg and could not be classified. With machine learning, we were able to achieve an accuracy of 0.83, a positive predictive value of 0.84, a sensitivity of 0.90   and specificity of 0.71.

Conclusion

This proof of concept study shows that smartphone-based videos combined with computer vision and machine learning allow us to discriminate the gait of scoliosis and non-scoliosis subjects. This can form the basis for future high throughput screening as subjects do not need to undress. Future studies will need to increase sample size and how curve pattern and magnitude may affect the accuracy of diagnosis.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

The role of hissing in the stabilization phase of Schroth exercises

by Avis Leung | Swansea Mo | Spinelinerehab Inc | University of Minnesota

Background

During the practice of Schroth exercise program, there is occasional reluctance among patients to breathe out with hissing at the stabilization phase of the Schroth exercise. Patients generally lack knowledge of the importance of this breathing technique, which may lead to a decrease in compliance during their self-monitored home program.

Objective

To study the change in transverse abdominal muscle thickness during the exhalation phase of Schroth exercise.

Methods

During corrective breathing training among adolescent idiopathic scoliosis (AIS) patients, real time ultrasound imaging is obtained on the lateral abdominal wall. Patients are asked to perform a series of breathing without hissing during exhalation, followed by a series of breathing with hissing during exhalation. Comparison between the thickness of the transverse abdominal muscle is made at the following:

1. Baseline measurement during inhalation
2. during exhalation without hissing
3. during exhalation with hissing, as instructed in the Schroth program.

The percentage change in muscle thickness is compared in these two different types of breathing pattern.

Patient inclusion criteria: AIS with Cobb angle >10°, who is skeletally immature and actively participating in a Schroth program.

Sample Size: 10 patients

Results

Patients who practice hissing show activation of transverse abdominal muscle with increase   in muscle thickness in the ultrasound image.

Conclusion

Activation of transverse abdominal muscle is noted when patients practice hissing during the stabilization phase of Schroth exercise. As transverse abdominal is an important local   core muscle in spinal stabilization, activation during Schroth exercises will possibly advance spinal stabilization.

There is potential use of diagnostic ultrasound as a training tool during corrective breathing.

<u>Conflict of Interest Disclosure</u>

We have no conflicts of interest to disclose.

The Effects of Schroth-Based and Postural Corrective Exercise Programs on Thoracic Kyphosis, Lumbar Lordosis, Quality of Life and Foot Load Distribution

by Sena ÖZDEMİR GÖRGÜ | Istanbul Medipol University, Faculty of Health Sciences, Department of Orthotics and Prosthetics, Istanbul, Turkey.

Background

Postural kyphosis is a common spinal deformity characterized by a poor and hunched posture. Increased TKA increases flexion posture with forward tilt of the trunk; as a result, postural balance is adversely affected by the forward displacement of the gravity line on the sagittal plane of the spine. Since individuals with postural kyphosis have postural disorders, it is thought that plantar pressure and load distribution may differ in these patients.

Objective

The aim of this study is to investigate the effect of postural corrective and schroth-based exercises on thoracic kyphosis angle (TKA), lumbar lordosis angle (LLA), quality of life and foot load distribution in individuals with postural kyphosis.

Methods

The data of this study were collected from the individuals who participated in kyphosis screening at Istanbul Medipol University Healthy Living Center between January and October 2019. 18-25 years old individuals who meet the inclusion criteria, have TKA 400 and not treated for postural kyphosis in the last 6 months were included to the study. 24 participants (5 men,19 women) who met the criteria were randomly divided into two as the postural corrective exercise group (PCEG; n=12) and the Schroth-based exercise group (SBEG; n=12). Exercise program having 16 sessions was conducted 2 times a week for 8 weeks with the study participants. The Valedo®Shape "Spinal Mouse" was used to measure TKA and LLA in the participants, baropodometric pressure platform (Software FreeSTEP Footprint) was used to static plantar pressure analysis, and the Scoliosis Research Society-22 (SRS-22) questionnaire was used to assess quality of life.

Results

No statistically significant differences baseline measurement values of the participants included in the study (p>0.05). Following Schroth-based exercise program, statistically significant differences in the pre-test and post-test TKA, LLA, SRS-22, static plantar pressure measurements have been detected on the left forefoot and right rearfoot loading, along with the total right foot pressure values (p<0.001; p=0.014; p=0.002; p=0.020; p=0.019; p=0.019; respectively). There were no statistically significant changes in the right forefoot, left rearfoot, total left and right foot loading, along with the total left foot pressure values (p>0.05). After the postural correction exercise program, statistically significant changes were observed in the pre-test and post-test THA and SRS-22 total score results (p<0.001; p=0.009; respectively), yet no significant change was found in LLA and static plantar pressure measurements (p>0.05). When the post-test comparison between the groups was performed, no significant difference was observed in THA, LLA, SRS-22 and static plantar pressure values (p>0.05).

Conclusion

A decrease in thoracic kyphosis angle and a positive change in quality of life were detected following 8-week postural correction exercise program and Schroth-based exercise programs. While a positive change was observed in distribution of the load transferred to foot and LLA following Schroth-based exercise, no significant change was detected in the postural correction exercise group.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

In-Brace Alterations of Coronal Spinal Alignment and Thoracic Cage Parameters in Patients with Idiopathic Scoliosis: A Retrospectively Pilot Study

by Zilan Bazancir | Ezgi Tarhan-Altınok | Cansu Bayramoğlu | Mehmet Hanifi Kaya | Adalet Çilmetek |Gökhan Demirkıran | Yavuz Yakut | Gozde Yagci | Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey | Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey | Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey | Ahi Evran University, Faculty of Medicine, Kırşehir, Turkey | Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey | Hacettepe University, Faculty of Medicine, Department of Orthopedics and Traumatology, Ankara, Turkey | Hasan Kalyoncu University, Faculty of Health Science, Department of Physiotherapy and Rehabilitation, Gaziantep, Turkey | Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey

Background

The most common conservative treatment for progressive moderate to severe curves is bracing, which aims to stop or slow down the progression. A brace with correction in the frontal plane, according to the current literature, should be regarded as an appropriate treatment in patients with idiopathic scoliosis (IS). Although the effects of brace treatment in the frontal plane have been well documented by several studies, its effect on the other planes of deformity and thoracic cage have not been clearly identified. The hypothesis of this study is that how bracing acts on the thoracic cage parameter when correcting the frontal plane.

Objective

The aim of the study was to retrospectively evaluate correction of coronal alignment and thoracic cage in patients treated with a kind of modified Boston brace.

Methods

Forty-two patients (36 Female, 6 Male) with idiopathic scoliosis were included. Pre-brace (at first diagnose of scoliosis) and in-brace radiographs (while wearing a modification of Boston brace) were collected. Coronal spinal (axial vertebral rotation, lateral trunk shift, pelvic asymmetry, biacromial slope, coronal alignment) and thoracic cage parameters (T1–12 height, C7-S1 height, thoracic transverse diameter, diameter ratio of concave and convex thorax) were measured with Surgimap software (version 2.3.2.1, Nemaris, Inc., New York, USA). Comparisons were made between in-brace and pre-brace conditions.

Results

The mean age of the patients in the study was 13.09 ± 2 years. Average pre-brace cobb angle was $29.5 \pm 5.5°$, in-brace cobb angle was $19.5 \pm 7.1°$ and correction percent of braces for thoracic curve and lumbar / thoracolumbar curve was $35.8 \pm 20.3\%$, $48.1 \pm 24.6\%$, respectively. Cobb angle, axial vertebral rotation and lateral trunk shift decreased significantly in-brace condition ($p < 0.001$). The vertical parameters of thoracic cage including T1–12 height ($p = 0.002$), C7-S1 height ($p < 0.001$), thoracic transverse diameter ($p < 0.001$) increased and diameter ratio of concave and convex thorax decreased ($p < 0.001$) in-brace condition. No statistically significant

difference was found for pelvic asymmetry, biacromial slope and coronal alignment between the two condition (p>0.05).

Conclusion

This study showed that, the usage modified Boston brace in idiopathic scoliosis treatment can be improved thoracic transverse diameter, increased thoracic height and trunk height, and decreased ratio diameter of concave-convex. In addition, cobb angle, axial trunk rotation and lateral trunk shift can be improved with modified Boston Brace in the coronal plane. While the brace corrected the coronal plane, thoracic cage parameter can be improved without creating rib cage disorder.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Polish Adaptation of Italian Spine Youth Quality of Life (ISYQOL) questionnaire

by KRZYSZTOF KORBEL | EDYTA KINEL | PIOTR JANUSZ | MATEUSZ KOZINOGA | DARIUSZ CZAPROWSKI | TOMASZ KOTWICKI | Department of Rehabilitation and Physiotherapy, Physiotherapy Unit, University of Medical Sciences Poznan, Poland | Department of Rehabilitation and Physiotherapy, Clinic of Rehabilitation, University of Medical Sciences Poznan, Poland | Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland | 1. Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland 2. Rehasport Clinic, Poznan, Poland | 1. Department of Rehabilitation and Physiotherapy, Physiotherapy Unit, University of Medical Sciences Poznan, Poland 2. Olsztyn University, Olsztyn, Poland | Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland

Background

The negative impact of spinal deformities on health-related quality of life (QoL) is well known. The SRS-22 questionnaire is commonly used for the assessment of the QoL in children with scoliosis. However, it was developed for surgical treatment and shows high ceiling effects in conservative care. The Italian Spine Youth Quality-of-Life Questionnaire (ISYQOL) was shown to be appropriate in patients with Adolescent Idiopathic Scoliosis (AIS) and Scheuermann's juvenile kyphosis (SJK) treated non-surgically.

Objective

The aim of the study was to carry on the process of cultural adaptation of the Italian Spine Youth Quality of Life ISYQOL Questionnaire into Polish.

Methods

Thirty four adolescents with idiopathic scoliosis and two with Scheuermann's juvenile kyphosis were enrolled to the study. The sample included 31 girls and 5 boys, mean age 14.3 years (±1.8), Cobb angle mean 30.1 degree (± 10.1) range 12 to 59 degree. All patients have been wearing the brace with an average duration of 2.2 years (±1.7). The Institutional Review Board approved the study.

The process of cross-cultural adaptation of the ISYQOL Questionnaire was performed in accordance with the guidelines set up by the International Quality of Life Assessment (IQOLA) Project, including the following steps: (1) forward translation, (2) expert panel back-translation, (3) pre-testing and cognitive interviewing, and (4) development of final version.

The reliability (internal consistency, test-retest reliability), floor, and ceiling effects of the Polish version of the ISYQOL were calculated. Internal consistency was assessed using the Cronbach's alpha coefficient. Test–retest reliability was evaluated using Spearman correlation coefficient.

Results

The internal consistency was satisfactory: Cronbach's alpha coefficient was 0.8. Test- retest study revealed high reliability with the Spearman correlation coefficient value of 0.97. There was neither floor nor ceiling effects for the ISYQOL overall score.

Conclusion

Polish version of the ISYQOL is reliable and can be used in adolescents with spinal deformity.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Brace Wear Adherence for Adolescent Idiopathic Scoliosis (AIS): Initial Adherence Predicts Future Brace Wear

by Gabriel S. Linden, BA | John B. Emans, MD | Nora P. O'Neill, BA | Lawrence I. Karlin, MD | Kathryn A. Williams, MS | Michael T. Hresko, MD | Boston Children's Hospital | Boston Children's Hospital | Boston Children's Hospital | Boston Children's Hospital | Boston Children's Hospital | Boston Children's Hospital

Background

Bracing for moderate AIS is an effective treatment when patients are adherent to prescribed wear time. However, many patients are non-adherent and identified too late, ultimately progressing to surgery. Our retrospective study analyzed whether adherence to prescribed wear time during the initial brace wean-in period predicts future adherence, serving as a potential benchmark for early identification of treatment failures. We hypothesized that individuals who were adherent to prescribed wear time during the end of the wean-in period may be more likely to be adherent in the future, leading to improvements in clinical outcomes.

Objective

The objective of this study was to assess whether future adherence to brace wear can be predicted by brace wear adherence during the initial wean-in period. Furthermore, this study sought to measure differences in scoliosis clinical outcomes based on initial adherence to wear time.

Methods

AIS patients braced over a five year period (2015-2019) at a single center were reviewed for inclusion. Inclusion criteria were the age at first brace fit (10-17 years old), a diagnosis of AIS, and prescription of a scoliosis brace worn for a range of 10-18 hours per day depending on the prescribing physician. Brace wear was assessed by a validated imbedded temperature sensor with readings at 4-6 weeks, 6 months and 12 months after first brace fitting. The ratio of hours worn per day to prescribed daily brace hours was calculated as a percentage, where adherence was defined as > 80%. Statistical analysis included Fisher's exact tests, t-tests and logistic regression providing odds ratios with confidence intervals (CI).

Results

63 AIS brace patients (mean ±sd age 12.6±1.3 years) were included in the study. The majority were female (85.7%, n=54). Of the 38 patients (60%) who were adherent during the final stage of the wean-in period, 31 (81.6%) were adherent at the six-month visit. This relationship can also be reported as the odds of adherence at 6-months were 11.4 (95% CI 3.4, 37.7) times greater for patients who were adherent at the end of the wean-in period compared to those who were non-adherent. The odds of adherence at 12-months were 5.6 (95% CI 1.8, 16.9) times greater for patients who were adherent compared to those who were non-adherent at the end of the wean-in period. Furthermore, patients who were adherent at the end of the wean-in period also had a greater improvement in their out-of- brace Cobb angle at the 12-month visit (5.6±6.6 degrees) compared to those who were non- adherent (0.9±8.4, p < 0.019). For the 60 patients

with both Cobb angle measurements, the Cobb angle at the first-fit was 32.2±7.8 and 28.3±11.2 at the 12-month visit (p < 0.001).

Conclusion

Adherence at the end of the wean-in period may serve as key benchmark for prediction of a patient's future success with the AIS bracing regimen. If a patient is non-adherent at this point, supportive interventions should be considered, or a different treatment plan may be necessary.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

The effect of Schroth exercises on balance in children with postural thoracic hyperkyphosis: a pilot randomized controlled trial.

by Ayse Zengin Alpozgen | Nazli Elif Nacar | Turgut Akgul | Asst. Prof. PT | MSc. PT | Assoc. Prof. MD

Background

Schroth exercise method is used usually in the conservative management of spinal deformities. Schroth exercises are typically prescribed in thoracic hyperkyphosis due to corrective effect on thoracic kyphosis angle; however, the role of these exercises on balance is not clear yet.

Objective

Thus, we aimed to investigate the role of Schroth exercises on balance in children with postural hyperkyphosis.

Methods

Twenty participants (age between 9 and 18 years) with postural hyperkyphosis met the inclusion criteria were assigned into two groups. One of the groups received Schroth exercises (SE) and the other group received traditional exercises (TE) for 12-week. The exercises were given as a home program, controlled by telephone interview bi-weekly in both the groups, and progressed at the 6th week. Outcomes measures were static balance with open-closed eyes as assessed with the Biodex Balance System (Overall Stability Index- OSI; Anteroposterior Stability Index; Mediolateral Stability Index-MLSI) and stability of limits as assessed with the Functional Reach Test (FRT). All outcomes were measured baseline and at the 6th and 12th weeks. The repeated measures ANOVA was used for statistical analysis.

Results

The baseline characteristics of the groups were similar. The mean Cobb angles for the SE and TE group were 59.70°, 60.80° respectively. It was seen that balance with eyes open and closed mean scores worsened at 6th week and then improved at 12th week in the Schroth group. However, no significant difference was found between measurements in both groups for static balance with eyes-open (OSI: F=0.746, p=0.488; F=0.663, p=0.528; ASI: F=0.531, p=0.597; F=1.448, p=0.261; MLSI: F=0.094, p=0.911; F=0.167, p=0.848 respectively). It was found a significant difference between measurements only in OSI scores in the Schroth group for static balance with eyes-closed (OSI: F=5.173, p=0.017; F=1.612, p=0.227; ASI: F=2.105, p=0.151; F=2.883, p=0.082; MLSI: F=2.766, p=0.090; F=0.786, p=0.471 respectively). While the scores for the FRT worsened at the 6th week and improved at the 12th week in the Schroth group, it remained the at 6th week and improved at the 12th week in the TE group. Also, the results of repeated-measures analyses of variance revealed a significant group-by-time interaction on stability-of-limits in forward in both groups (F=7.023, p=0.006; F=5.175, p=0.017 respectively).

Conclusion

This pilot study suggests that stability index parameters are not affected by TE, but stability limits can be improved due to changes in strength and flexibility. On the other hand, the Schroth method may disrupt the existing adaptation due to the correction and negatively affects these parameters in the early period. However, it was concluded that re- improvement could be achieved in the following process and new balance adaptations could occur.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Loss of body height due to severe thoracic curvature does impact pulmonary testing results in adolescents with idiopathic scoliosis

by Katarzyna Politarczyk | Łukasz Stępniak | Mateusz Kozionga | Tomasz Kotwicki | Department of Spine Disorders and Pediatric Orthopaedics, University of Medical Sciences, Poznań, Poland; Rehasport Clinic, Poznan, Poland | Department of Spine Disorders and Pediatric Orthopaedics, University of Medical Sciences, Poznań, Poland | Department of Spine Disorders and Pediatric Orthopaedics, University of Medical Sciences, Poznań, Poland; Rehasport Clinic, Poznan, Poland | Department of Spine Disorders and Pediatric Orthopaedics, University of Medical Sciences, Poznań, Poland

Background

Body height measured in standing position is a variable used to calculate pulmonary parameters during spirometry examination. The loss of body height is observed in adolescents with idiopathic scoliosis (IS), and it may influence the results of pulmonary testing.

Objective

The study aimed to analyze pulmonary parameters in adolescents with IS concerning the measured (MBH) versus the corrected body height (CBH).

Methods

The study consisted of 74 children (44 females and 30 males) aged 13-18 years, mean 15.4±1.5.

CBH was calculated as a sum of the MBH, and the height loss calculated according to Stokes' formula.

Forced vital capacity (FVC) and forced expiratory volume in one second (FEV1) were measured 3 times using the spirometer.

Percentages of the predicted FVC (%FVC) and FEV1 (%FEV1) values for the MBH and the CBH were calculated.

The subgroup analysis was performed for the subjects with curves 58°-74° (N=51) versus the subjects with curves 75°-102° (N=23).

Results

The mean thoracic Cobb angle was 68.9°±13.2 (58-102).

The mean MBH was 167.0cm ±8.0 (149-185). The mean CBH was 171.3cm ±8.0 (155.6-186). The mean height loss was 4.3cm±1.7 (2-9).

The %FVC obtained for the CBH was significantly lower than the one obtained for the MBH: 75.1% ±16.7 (37.0-132.4) vs. 79.8% ±16.8 (39.9-138.8), $p < 0.001$.

The %FEV1 obtained for the CBH was significantly lower than the one obtained for the MBH: 72.1 ±15.9 (37.8-114.2) vs. 76.5% ±16.8 (40.2-117.5), p<0.001.

Patients with 58°-74° scoliosis revealed %FVC 81.7%±16.9 (50.8-138.3) for the MBH while 77.7%±16.1 (46.7-132.4) for the CBH, p<0.001.

Patients with 75°-102° scoliosis revealed %FVC 75.36%±18.4 (39.9-116.3) for the MBH while 69.5% ±17.0 (37-108.4) for the CBH, p<0.001.

Conclusion

The use of corrected body height (CBH) versus the measured body height (MBH) significantly influences the interpretation of pulmonary parameters measurement results.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

2016 SOSORT clinical practice guidelines on orthopaedic and rehabilitation treatment of adolescent idiopathic scoliosis: methodological quality appraisal and applicability to the chiropractic profession

by Isabelle Pagé | Marie-Joëlle Doré | Chantale Doucet | Department of Chiropractic, Université du Québec à Trois-Rivières, Trois-Rivières, Canada; Center for Interdisciplinary Research in Rehabilitation and Social Integration (Cirris) - Centre intégré universitaire de santé et de services sociaux de la Capitale-Nationale (CIUSSS-CN), Quebec City (Quebec), Canada | Department of Chiropractic, Université du Québec à Trois-Rivières, Trois-Rivières, Canada | Department of Chiropractic, Université du Québec à Trois-Rivières, Trois-Rivières, Canada

Background

Conservative management is the gold standard for most patients presenting with adolescent idiopathic scoliosis (AIS). Patients with AIS commonly consult evidence-based health-care professionals such as chiropractors. The most recent SOSORT clinical practice guidelines on AIS detection and clinical management has not been evaluated within the chiropractic context.

Objective

To appraise, by an international panel representing the chiropractic profession, the methodological quality of the 2016 SOSORT guidelines.

Methods

Between April and July 2020, experts were recruited using a snowball sampling method. Experts from different countries and from various background were invited: practicing chiropractors, chiropractors holding a Diplomate by American Chiropractic Board of radiology (DACBR), chiropractors holding a PhD degree (researchers), and chiropractors teaching in a chiropractic program (e.g. full-time lecturers or non-researcher professors).

Experts independently appraised the guideline using the Appraisal of Guidelines for Research & Evaluation II (AGREE II) tool. A scale domain score was calculated for each of the six domains and methodological quality was considered insufficient (<60%), sufficient (60-80%) or good (≥80%).

Results

A total of 32 potential experts were invited, 5 did not respond and 3 declined to participate. Of the 24 included experts (6 clinicians, 4 DACBR, 6 PhD and 3 lecturers/non-researcher professors; 11 females), 19 completed the study. Experts represented 10 different countries. Domain quality ranged from 38 to 90%: ¨applicability¨ (38%); ¨Stakeholder involvement¨ (70%); ¨rigour of development¨ and ¨clarity and presentation¨ (78%); ¨independence editorial¨ (85%); and ¨scope and purpose¨ (90%). Applicability domain sub-items (n=4) scored between 26 and 45%. Scale score of the guideline overall quality was rated at 68 %.

Conclusion

With the exception of the ¨applicability¨ domain, the methodological quality of the 2016 SOSORT clinical practice guidelines is sufficient. Greater emphasis should be dedicated to recommendations from the applicability domain. This could be achieved by including a more diverse representation of health-professions in the development of future guidelines.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Table 1. AGREE II tool score by item and scale domain scores.

Domains	Items	AGREE II tool score				
		All experts (n=19)	Clinicians (n=6)	Researchers (n=6)	DACBR (n=4)	Lecturers / non-researcher professors (n=3)
Domain 1: Scope and purpose	1. The overall objective(s) of the guideline is (are) specifically described.	93%	97%	86%	100%	89%
	2. The health question(s) covered by the guideline is (are) specifically described.	92%	94%	86%	96%	94%
	3. The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.	86%	78%	89%	96%	83%
	Scale domain score	**90%**	**90%**	**87%**	**97%**	**89%**
Domain 2: Stakeholder involvement	4. The guideline development group includes individuals from all relevant professional groups.	68%	69%	53%	79%	83%
	5. The views and preferences of the target population (patients, public, etc.) have been sought.	62%	72%	44%	71%	67%
	6. The target users of the guideline are clearly defined.	80%	94%	64%	71%	94%
	Scale domain score	**70%**	**79%**	**54%**	**74%**	**81%**
Domain 3: Rigour of development	7. Systematic methods were used to search for evidence.	82%	81%	67%	100%	89%
	8. The criteria for selecting the evidence are clearly described.	85%	89%	69%	200%	89%
	9. The strengths and limitations of the body of evidence are clearly described.	65%	64%	47%	79%	83%
	10. The methods for formulating the recommendations are clearly described.	89%	92%	81%	92%	94%
	11. The health benefits, side effects, and risks have been considered in formulating the recommendations.	67%	72%	42%	75%	94%
	12. There is an explicit link between the recommendations and the supporting evidence.	87%	83%	94%	79%	89%

Patient's group analysis, in 3-5 years after Cheneau brace treatment had been finished

by Ivan Pavlov | Phd

Background

Scoliosis treatment with Cheneau brace has a rich experience, but the description of the patient's condition after the treatment is rarely stated in literature.

Analysis of the given thesis is about scoliosis curve being presented as Cobb degrees variables, and about scoliosis form changes according to M. Rigo's classification from the moment of first visit to the moment of termination of treatment. A survey was conducted among patients aimed to find out the quality of life in 3-5 years after the treatment, according to survey SRS-22.

Objective

Our objective was to estimate therapy results in 3-5 years after Cheneau brace treatment and to estimate patient's satisfaction about their treatment. Write the Objective here

Methods

Object of the research were the patients who had finished the scoliosis treatment using

Cheneau brace in 2016 – 2018. Out of 2532 people, 768 were selected with the needed data for the research using the method of retrospective analysis. 572 patients agreed to participate in the survey.

Value of the scoliosis curve was graded by X-Ray images of the spinal curve in standing position in frontal projection at the time of first and last visits. Also, the evolution of scoliosis curve was evaluated by X-Ray images, according to M. Rigo classification. X-Ray image calculation was done using a program in order to get more specific and defined result.

Life quality evaluation was conducted with the help of online SRS-22 survey, followed by blind result's processing by compiling tables and descriptions. Statistical result analysis.

Results

During the treatment the curve changes according to M. Rigo's classification and the maximum angle value of this change is presented in Kobb degrees. Averaging result is the decrease of the curve value less than 30% and evolution C1, C2 according to M. Rigo's classification.

Most relevant conclusions from the SRS-22 survey were made: 84% thought that brace usage was correct. 67% felt more attractive with their current back conditions. 83% said that they would use the brace again, if they were at the start of treatment.

Conclusion

The aesthetic appearance of the back post treatment satisfies the majority of respondents. Patients think they were correct in choosing the Cheneau brace treatment and would be ready to repeat the treatment if they were given a choice.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Serial Elongation-Derotational-Flexion Casting Treatment of Early-Onset Progressive Scoliosis in Skeletal Dysplasia

by Armağan Can Ulusaloglu | Ali Asma | Colleen Ditro | Kenneth J. Rogers | William Mackenzie | Stuart Mackenzie | Nemours Alfred duPont Children Hospital | Nemours Alfred duPont Children Hospital | Nemours Alfred duPont Children Hospital | Nemours Alfred duPont Children Hospital | Nemours Alfred duPont Children Hospital | Nemours Alfred duPont Children Hospital

Background

The serial elongation-derotational-flexion (EDF) casting technique was introduced to treat infantile scoliosis, and the efficacy has been confirmed in this condition. However, efficacy has not been confirmed in children with skeletal dysplasia in which progressive scoliosis in addition to spinal growth dysplasia may result in severe progressive irreversible cardio- pulmonary restrictive disease.

Objective

The goal of this study is to determine the efficacy EDF casting in a consecutive group of children with skeletal dysplasia. Our aim is to determine beneficial or detrimental effects of the treatment. Our hypothesis is EDF casting can be safely utilized in young children with skeletal dysplasia with specific cautions thereby allowing spinal growth until operative growing rod/definitive fusion is indicated.

Methods

Criteria for inclusion consist of the following: cases under 7 years age at first casting, diagnosis of skeletal dysplasia or syndromic skeletal dysplasia, curves greater than 25 degrees, and applied EDF sequential serial casting. Exclusion criteria consist of the following: spine surgery prior to casting, non-sequential casting (> 6 months interval of no cast), or loss to follow-up. Gender, age, diagnosis, and ages were recorded during serial casting. From radiographs taken pre-casting (K1), intra-operative initial casting (K2), in last casting (K3), and out of last casting (K4), the following parameters were obtained: coronal curve parameters for the major and minor curve (cobb angles), thoracic height (T1-T12), thoracolumbar height (T1-S1), space available lung (%) for convex/concave side) and rib vertebra angle difference (RVAD). Peak inspiratory pressure (PIP) was recorded during casting at three intervals.(PIP-1 (before casting),PIP-2 (casting applied during traction before trimmed), PIP-3 (end of the casting,no-traction,after trimmed)).

Results

The average of Cobb Angle of the "major curve" is 53.8±10.4 (38.2-75.1), 30.4±7.6 (20.2-40.7), 37.4±13.8 (16.1-63.9), 48.8±11.9 (range, 35.1-73.5) at K1, K2, K3 and K4 respectively (K1 to K2 and K1 to K3, p<0.001 p=0.007). The average of Cobb Angle of the 8 "minor curves" is 34.8±8.8 (22.1-47.3), 24.5±10.1 (3.3-34.5), 33±8.6 (14.7-43.9) 50.8±22.5 (19.7-84.7) at K1, K2, K3 and K4 respectively (p>0.05)The average length of T1-T12 and T1- S1 are respectively 130.4±23.9mm (93.5-166.8), 241.9±39.8 mm (189.2-320.9) at K1, 154.8±16.5(135-182.5), 281.4±41.7 (21-353.4) at K2, 173±18.5 (151-213.), 317.8±32.2 (range, 273.8 to 377.2) at K3, 159.5±17.5 (128.1-190.9), 283.7±36.4 (216.7-333.4) at K4.(K1 toK2,K2 to K3,K3 to K4

(p=0.025,p<0.001,p=0.006 for T1-T12).The average of space available for lung in convex(%) and concave(%) side of deformity is respectively 84±5.3 (75.8-91.6), 86.3±7.2 (70.8-94.9) at K1, 88.9±5.3 (79.5-95.9), 89.5±4.6 (81.1-95.1) at K2, 89.6±3.6 (85.-95.9), 91±6.1 (81.4-99.3) at K3, 82.7±5.8 (72.1-90.3), 82.7±10 (58.1-93.7) at K4 (p<0.05).PIP-1,PIP-2, and PIP-3 average values are 15.1±3.6 (2-25), 27.1±8.7 (3-50), 18±2.8 (2-28) respectively (p<0.001).The average of Rvad measurement for major curve at K1,K2,K3,K4 respectively 7.3±27.1 (-44-44),12±19.9 (-37-32), 15.7±16.6 (-19-41),16.5±29.4 (-48-52) (p>0.05).

Conclusion

Serial EDF casting should consider initial treatment for skeletal dysplasia with scoliosis, prevent progression of scoliosis, allow to expand lungs and decrease the surgical complication due to early spinal fusion.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Average Cobb Angle
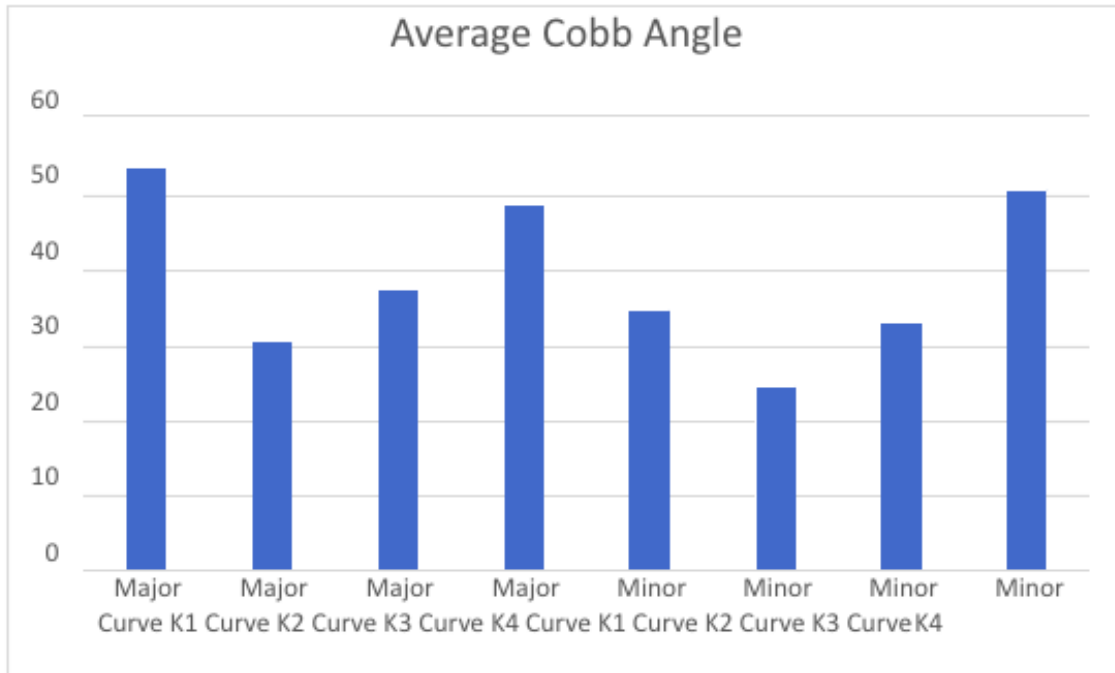
Pulmonary parameters in adolescents surgically treated for idiopathic scoliosis: comparison boys versus girls

by Katarzyna Politarczyk | Mateusz Kozinoga | Tomasz Kotwicki | Department of Spine Disorders and Pediatric Orthopaedics, University of Medical Sciences, Poznan, Poland; Rehasport Clinic, Poznan, Poland | Department of Spine Disorders and Pediatric Orthopaedics, University of Medical Sciences, Poznan, Poland; Rehasport Clinic, Poznan, Poland | Department of Spine Disorders and Pediatric Orthopaedics, University of Medical Sciences, Poznan, Poland

Background

Thoracic spine deformity in adolescents with idiopathic scoliosis (IS) impacts pulmonary function.

Objective

The study aimed to analyze pulmonary parameters in boys versus girls with IS.

Methods

Boys (N=31) treated surgically for IS (Lenke 1 or 2) between 2005 and 2020 and fulfilling the inclusion criteria of age 14-18 years old were included. The group of girls (consecutive recruitments) operated for IS (Lenke 1 or 2) was formed using the same age and Cobb angle.

Forced vital capacity (FVC) and forced expiratory volume in one second (FEV1) were measured 3 times in a sitting position using the spirometer. The single best effort was analyzed. Percentages of the predicted FVC (%FVC) and FEV1 (%FEV1) values were calculated. The Global Lung Function Initiative (GLI 2012) data were used as reference values.

Results

The mean thoracic Cobb angle was 69.5°±14.7 (48-102) in boys versus 68.5°±13.1 (50-95) in girls, p=0.81.

The mean measured body height was 172.3cm±7.0 (158-185) in boys versus 164.1cm±5.8 (153-180) in girls, p=0.000005.

The mean FVC was 3.5L±0.9 (2.1-5.2) in boys versus 3.1L±0.6 (1.8-4.8) in girls, p=0.01.

The mean FEV1 was 2.9L± 0.7 (1.8-3.9) in boys versus 2.6± 0.5 (1.5-3.8) in girls, p=0.04.

The mean %FVC was 76.6%±16.9 (48.5-111.5) in boys versus 83.8±18.6 (52.9-138.3) in girls, p=0.11.

The mean %FEV1 was 73.8%±17.7 (40.2-117.5) in boys versus 78.7%± 16.5 (45.9-114.8) in girls, p=0.25.

Conclusion

Pulmonary parameters (%FVC, %FEV1) seem to be more affected in boys than in girls with severe thoracic idiopathic scoliosis.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Comparison of levels of physical activity among children and adolescents with and without idiopathic scoliosis.

by Anna Amélia Pereira da Motta Oishi | Rodrigo Mantelatto Andrade | Camila Casemiro Rosa | Ana Paula Ribeiro | Diego G.D Christofaro | Department of Physical Education, School of Technology and Sciences, São Paulo State University (UNESP), Presidente Prudente, Brazil | Clinical Rehabilitation Center in Scoliosis, Campinas, São Paula, Brasil | Department of Physical Education, School of Technology and Sciences, São Paulo State University (UNESP), Presidente Prudente, Brazil | University of Sao Paulo, School of Medicine, Sao Paulo, Brazil. Orthopaedic, Health Science Post-Graduate Department, University Santo Amaro, Sao Paulo, Brazil. | Department of Physical Education, School of Technology and Sciences, São Paulo State University (UNESP), Presidente Prudente, Brazil

Background

Low level of physical activity is a risk factor for the development of several health problems. In addition, levels of physical activity in children and adolescents are currently decreasing. Children and adolescents with idiopathic scoliosis may have skeletal and respiratory muscle complications that can interfere with their level of physical activity.

Objective

Compare the levels of different types of physical activity (in school, sports and commuting activities) in children and adolescents with and without idiopathic scoliosis.

Methods

128 participants of two Brazilian cities [67 participants with idiopathic scoliosis (scoliosis group) and 61 control (no scoliosis)] aged from 9 to 17 were recruited and physical activity level were assessed by Baecke physical activity questionnaire. The statistical analysis used Covariance Analysis (ANCOVA) adjusted for sex and age in the comparison of different domains of physical and total activity among adolescents with and without scoliosis (values presented as mean and standard errors). The adopted significance was 5%.

Results

When compared the different domains of physical activity in control and scoliosis group, there was no statistically significant difference for physical activity at school ($p = 0.274$) and physical activity of locomotion ($p = 0.274$). However, the control group has presented a higher average score in sports activities (2.72 ± 0.09 versus 2.37 ± 0.09) when compared to scoliosis group. Similar findings were observed for the practice of total physical activity (8.06 ± 0.20 versus 7.44 ± 0.19).

Conclusion

Results of the control group have indicated a higher score for sports and total physical activity when compared to those of the scoliosis group.

Does Vertebral Body Tethering Cause Disc and Facet Joint Degeneration? An MRI Study with Minimum 2-years Follow- up

by Altug Yucekul | Burcu Akpunarli | Atahan Durbas | Tais Zulemyan | Irem Havlucu | Gokhan Ergene | Sahin Senay | Pinar Yalinay Dikmen | Sule Turgut Balci | Ercan Karaarslan | Yasemin Yavuz | Caglar Yilgor | Ahmet Alanay | Department of Orthopedics and Traumatology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul Turkey | Urla State Hospital, Izmir, Turkey | Acibadem Mehmet   Ali Aydinlar University School of Medicine, İstanbul, Turkey | Comprehensive Spine Center, Acibadem Maslak Hospital, Istanbul, Turkey | Acibadem Maslak Hospital, Comprehensive Spine Center, Istanbul, Turkey | Department of Operating Room Services, Acibadem Mehmet Ali Aydinlar University Vocational School of Health Sciences, Istanbul, Turkey | Department of Cardiovascular Surgery, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul, Turkey | Department of Neurology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul, Turkey | Anesthesiology Service, Acibadem University Maslak Hospital, Istanbul, Turkey | Department of Radiology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul, Turkey | Department of Biostatistics, Ankara University School of Medicine, Ankara, Turkey | Department of Orthopedics and Traumatology, Acibadem Mehmet Ali   Aydinlar University School of Medicine, Istanbul, Turkey | Department of Orthopedics and Traumatology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul, Turkey

Background

Disc health after various growth modulation techniques have been assessed in animal models, and tethering was claimed to prevent degeneration due to its less rigid nature compared to other growth-friendly techniques. Yet, the results of animal studies wherein tethering is applied on healthy spines to create a deformity cannot be extrapolated to humans, in which tethering is used for deformity correction. As biomechanical properties are different, effects of VBT surgery on discs and facet joints in clinical series are not precisely acknowledged. There are concerns that VBT surgery may cause degeneration at both intermediate and adjacent levels.

Objective

Our aim was to investigate the integrity of discs and facet joints that are subject to compressive forces and relative stabilization during growth modulation.

Methods

Demographic, perioperative and radiographic data were collected. Overcorrection, mechanical and pulmonary complications, and reoperations were recorded. MRIs taken before surgery and at a minimum of 2 years follow-up were evaluated for degeneration at the intermediate and adjacent segment intervertebral discs and facet joints by a blinded senior radiologist and compared. Discs were assessed using Pfirrmann grade. Facet joint degeneration was graded on a scale of 0-3. Changes from preop to follow-up MRIs were analyzed using McNemar's Test and Related Samples Marginal Homogeneity Test.

Results

25 (23F, 2M) consecutive Adolescent Idiopathic Scoliosis (AIS) patients with a mean follow- up of 29 (24-62) months who underwent thoracoscopic VBT surgery between 2014 and 2017 were included. The mean age at surgery was 12.2 (10–14) years and median Sanders stage was 3 (1-7). A mean of 7.7±1.1 (6-11) levels were tethered. Preoperative mean height of 155.3 (130-178) cm was increased to 163.4 (149-187) cm at latest follow-up. The mean preoperative MT curve magnitude of $46^0\pm7.7^0$ was corrected to $23.3^0\pm5.9^0$ at first erect, which was modulated to $12^0\pm11.5^0$ during follow-up. There was 1 (4%) broken tether, 5 (20%) overcorrected curves, 3 (12%) implant-related complications and 1 (4%) reoperation for a thoracoscopic tether release before the follow-up MRI was obtained. A total of 217 levels of discs and bilateral facet joints, were evaluated in the preoperative and follow-up MRI images. Analyses of disc and facet joint scores revealed no significant differences between patients. One case (4%) that had an increase in disc scores, already had multi-level moderate degeneration preoperatively, while another case (4%) displayed a single-level new-onset grade-2 bilateral facet degeneration.

Conclusion

Radiographic degeneration was not observed in discs and facet joints at a mean of 29 months after growth modulation with VBT surgery. Studies with longer follow-up are warranted to further analyze the effects of relative stabilization and altered biomechanical loads.

Conflict of Interest Disclosure

Ahmet Alanay: Research Grant/Research Support from Medtronic and Depuy Synthes Spine; Consultancy from Globus Medical

The rest of the authors have no conflict of interest to declare.

	Before Follow-up MRI n (%)	After Follow-up MRI n (%)	Total n (%)
Broken Tether	1 (4%)	5 (20%)	6 (24%)
Overcorrection	5 (20%)	1 (4%)	6 (24%)
Implant-related complications	3 (12%)	0	3 (12%)
Tether Release	1 (4%)	1 (4%)	2 (8%)
Conversion to fusion	0	2 (8%)	2 (8%)

Two to Five Year Follow-up Results After Thoracoscopic VBT: A Single Surgeon's Experience

by Ahmet Alanay | Altug Yucekul | Kadir Abul | Ilkay Karaman | Atahan Durbas | Tais Zulemyan | Gokhan Ergene | Sahin Senay | Sule Turgut Balci | Pinar Yalinay Dikmen | Yasemin Yavuz | Caglar Yilgor | Department of Orthopedics and Traumatology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul Turkey | Department of Orthopedics and Traumatology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul Turkey | Istanbul Basaksehir City Hospital, Clinic of Orthopedics and Traumatology, Istanbul, Turkey | Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul, Turkey | Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul, Turkey | Comprehensive Spine Center, Acibadem Maslak Hopsital, Istanbul, Turkey | Department of Operating Room Services, Acibadem Mehmet Ali Aydinlar University Vocational School of Health Sciences, Istanbul, Turkey | Department of Cardiovascular Surgery, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul, Turkey | Anesthesiology Service, Acibadem University Maslak Hospital, Istanbul, Turkey | Department of Neurology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul, Turkey | Department of Biostatistics, Ankara University School of Medicine, Ankara, Turkey | Department of Orthopedics and Traumatology, Acibadem Mehmet Ali Aydinlar University School of Medicine, Istanbul Turkey

Background

There is a paucity of information on clinical and radiographical outcomes of Vertebral Body Tethering (VBT) surgery. Current information is not yet strong enough to convince surgeons to include this surgical technique to their armamentarium.

Objective

The aim of the study was to report clinical and radiographic outcomes of thoracoscopic thoracic-only anterior VBT surgery.

Methods

Data were collected preoperatively, at 6-weeks, 1-year, 2-years and latest follow-up. Demographic, perioperative, clinical, radiographic data and complications were analyzed. Curve sizes at each follow-up were compared using repeated measures ANOVA. Respiratory function was compared between preop, 1-year and 2-years postop. Clinical outcome was assessed by SRS-22r.

Results

42 (40F, 2M) consecutive Adolescent Idiopathic Scoliosis (AIS) patients with a mean age of 12.1±1.5 years at surgery, and a mean follow-up of 33 (24-62) months who underwent thoracoscopic VBT surgery between 2014 and 2018 were included. 95% of the patients showed Lenke 1 curve pattern (21 A, 4 Ar, 11 B and 1 C modifier) and 5% were Lenke 2. Preoperatively, 25 (62.5%) patients were premenarchal (median Sanders: 3 (1-7), median Risser: 1 (0-5)). A median of 7 (6-9) levels were tethered. Mean surgical time was 240±70 (123-360) minutes. Patients grew 8 cm on average; height measurements showing significant increase at each follow-up time point (p<0.001). 88% of the patients reached skeletal maturity at

final follow-up. Upper Thoracic (UT), Main Thoracic (MT) and Thoracolumbar/lumbar (TLL) curves showed significant decrease at each follow-up time point. No significant changes were noted in kyphosis and lordosis (p<0.05). FVC% and FEV1% showed significant increase from preop to 1 year, as well as from 1 to 2 years (Mean FVC% 80.5, 85.2 and 87.6, respectively; mean FEV1% 80.5, 87.8 and 90.4, respectively, p<0.001). Pulmonary, mechanical and curve behavior complications rates were 12%, 19% and 33%, respectively. 2 (4.8%) patients were converted to fusion. At final follow-up, 92% patients had ≤30° residual curve. SRS-22 mental health, self-image and subtotal scores increased significantly.

Conclusion

This study reports a single European center experience on 42 consecutive patients with ≥2-years follow-up who had undergone thoracic-only VBT surgery. Surgical correction was followed by growth-dependent correction attained during follow-up. Spontaneous correction was also noted in the non-operated upper thoracic and thoracolumbar levels. Pulmonary function showed a gradual increase. Thoracoscopic VBT surgery prevented fusion in 95% of patients of whom 92% had good radiographic (≤30° residual curve) and clinical outcomes; however, it is not without complications. Overall pulmonary, mechanical and curve behavior complications rates were 12%, 19% and 33%, respectively. Some complications may be avoided with a better understanding of the growth modulation and advancement of technical skills and technology.

Conflict of Interest Disclosure

Ahmet Alanay: Research Grant/Research Support from Medtronic and Depuy Synthes Spine; Consultancy from Globus Medical

The rest of the authors have no conflict of interest to declare.

	Pre-Operative		6 weeks		12 months		24 months		Last follow-up	
	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD	n	Mean ± SD
Height, cm	42	154.6 ± 8.6	42	156 ± 8.5	42	160 ± 7.6	42	161.8 ± 7	42	162.5 ± 7.3

	Pre-Operative		6 weeks		12 months		24 months		Last follow-up	
	Mean ± SD	Min-Max	Mean ± SD	Min - Max	Mean ± SD	Min - Max	Mean ± SD	Min - Max	Mean ± SD	Min -Max
UT, Degree	28.1 ± 8.4	14 – 55	19.5 ± 7.3	8 – 37	16.5 ± 6.9	3 – 33	15.3 ± 7.1	1 – 36	16.1 ± 9.0	1 – 49
TLL, Degree	30 ± 7.9	12 – 48	18.4 ± 8.4	3 – 39	15 ± 9.9	0 – 43	12.6 ± 10.9	-10 – 44	13.5 ± 11.4	-14 – 44
MT, Degree	48.4 ± 8.9	35 – 73	25.9 ± 6.8	13 – 40	19.9 ± 7.7	0 – 35	17.7 ± 10.1	-16 – 36	20.0 ± 10.9	-11 – 49
Kyphosis, Degree	29 ± 9.5	15 – 59	26.8 ± 9.5	6 – 47	28.3 ± 8	9 – 41	28.9 ± 8.6	13 – 48	29.3 ± 8.3	13 – 52
Lordosis, Degree	60.3 ± 10.9	37 – 91	55.3 ± 10.3	35 – 90	57.6 ± 10.3	34 – 88	56 ± 8.6	39 – 74	55.5 ± 8.9	36 – 75

	Pre-Operative		6 weeks		12 months		24 months	
	n	Mean ± SD	n/a	n/a	n	Mean ± SD	n	Mean ± SD
FVC% Predicted	41	80.5 ± 13.6			38	85.2 ± 15.3	23	90.4 ± 10.4
FEV1% Predicted	41	80.5 ± 12.4			38	87.8 ± 15.5	23	90.4 ± 10.4
FEV1 / FVC	41	85.5 ± 5.3			38	88.8 ± 5.7	23	88.7 ± 6.6

	Pre-Operative		6 weeks		12 months		24 months		Last follow-up	
	n	Mean ± SD	n/a	n/a	n	Mean ± SD	n/a	n/a	n	Mean ± SD
SRS-22r, F	35	4.5 ± 0.6			38	4.6 ± 0.4			42	4.6 ± 0.4
SRS-22r, P	35	4.4 ± 0.7			38	4.6 ± 0.5			41	4.5 ± 0.6
SRS-22r, SI	35	3.4 ± 0.6			38	4.2 ± 0.7			41	4.1 ± 0.7
SRS-22r, MH	35	3.7 ± 0.5			38	4.0 ± 0.7			41	3.9 ± 0.8
SRS-22r, Subtotal	35	4.0 ± 0.4			38	4.3 ± 0.5			41	4.3 ± 0.5
SRS-22r, Satisfaction	n/a	n/a			38	4.7 ± 0.5			41	4.7 ± 0.6

	n (%)		n (%)		n (%)		n (%)
Curve Behavior Complications	14 (33.3)	Overcorrection	9 (21.4)	Distal adding on	4 (9.5)	Worsening	1 (2.4)
Mechanical Complications	8 (19)	Broken Tether	5 (11.9)	UIV migration	3 (7.1)	LIV Migration	1 (2.4)
Pulmonary Complications	5 (11.9)	Atelectasis	3 (2.4)	Pleural Effusion	1 (2.4)	Chylothorax	1 (2.4)
Readmission	1 (2.4)						
Revised Patients	3 (7.1)						
Reoperations	4 (11.9)	Tether Release	2 (4.8)	Conversion to Fusion	2 (4.8)		

Investigation of Ultrasound Parameters to Predict Progression of Idiopathic Scoliosis in Observation and Conservative Treatment Groups – A Pilot study

by Mahdieh Khodaei | Eric Parent | Lawrence H. Le | Sarah Southon | Doug Hill | Kyle Stampe | Eric Huang | Edmond Lou | Department of Radiology and Diagnostic Imaging, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, AB, Canada | Department of Physical Therapy, Faculty of Rehabilitation Medicine, University of Alberta, Edmonton, AB, Canada | Department of Radiology and Diagnostic Imaging, Faculty of Medicine and Dentistry, University of Alberta, Edmonton, AB, Canada | Department of Surgery, University of Alberta, Edmonton, Canada | Senior Consultant of Research and Technology, Glenrose Rehabilitation Hospital, Edmonton, Alberta, Canada | Department of Surgery, University of Alberta, Edmonton, Canada | Department of Surgery, University of Alberta, Edmonton, Canada | Department of Electrical & Computer Engineering, Faculty of Engineering, University of Alberta, Edmonton, AB, Canada

Background

Curve progression only occurs in 15% of children with adolescent idiopathic scoliosis (AIS). However, radiographs are taken at every scoliosis clinic visit but most of these radiographs are retrospectively unnecessary. Studies have been conducted to identify predictors of the risk of curve progression to minimize ionizing radiation exposure. Previously reported risk factors mainly include demographic and radiographic measurements. Our systematic review reported that only Cobb angle >25° and pre-menarche status for females were strongly supported by evidence to predict progression. Recently, ultrasonography has demonstrated it can diagnose and monitor scoliosis. An ultrasound (US) scan of the spine captures 3D information plus bone properties. It is worth investigating if ultrasound parameters can be used to predict progression of scoliosis.

Objective

This pilot study aimed to investigate if spinal US parameters could be used to predict progression of idiopathic scoliosis at a follow-up between 6-12-months later in groups under observation or receiving conservative treatment.

Methods

Eighty-five consecutive consenting participants with AIS were recruited (75F, 10M, aged 13.6±1.7 yrs). Forty-one were under observation (Cobb 27.2±9.4, 10 to 44°) and 44 received conservative treatment (Cobb 26.5±9.4, 14 to 50°). Cobb angle measured on radiographs increasing >5o between 2 consecutive visits was considered curve progression. The average follow-up interval for all participants was 8.8±5.5 months. The numbers with no progression versus progression in the observation and treatment groups were 24 vs 17 and 24 vs 20, respectively. Each participant was scanned in standing position at the baseline visit. The US images and raw data were recorded. Four US parameters were investigated: the Cobb angle of the major curve, the maximum axial vertebral rotation (AVR), the kyphotic angle (KA) from T1 to T12 and the reflection coefficient (RC) which relates to bone quality. Cobb, AVR and KA were measured using the center of laminae (COL) method. The KA used spinous processes as additional information. The RC value is a unitless ratio extracted from the US raw data. The average RC value at the L5 lumbar lamina was used. Univariate associations were tested and prediction models for curve progression were developed using logistic regression.

Results

For the observation group, only the RC value was found to predict progression. The average RC value was 0.08±0.02 for non-progression and 0.06±0.02 for progression, respectively. The predictive logistic regression model was: Logit(p)= -1.09 + 1.70RC.

For the conservative treatment group, the KA and the RC parameters were significantly different between non-progression (31.4±12.2°; 0.08±0.02) and progression (38.3±8.5°; 0.05±0.02) groups (p<0.05). However, only the RC was retained as predictor in the logistic regression model, logit(p)= -1.45 + 2.27RC. When both models classified patients below the threshold RC value of 0.065 as at risk of progression (Figure 1), the prediction accuracy was 71% and 75%, respectively.

Conclusion

In both observation and conservative treatment groups, the RC value was the only US parameter that predicted the progression of scoliosis. Further studies are recommended to validate the models and investigate other parameters.

Conflict of Interest Disclosure

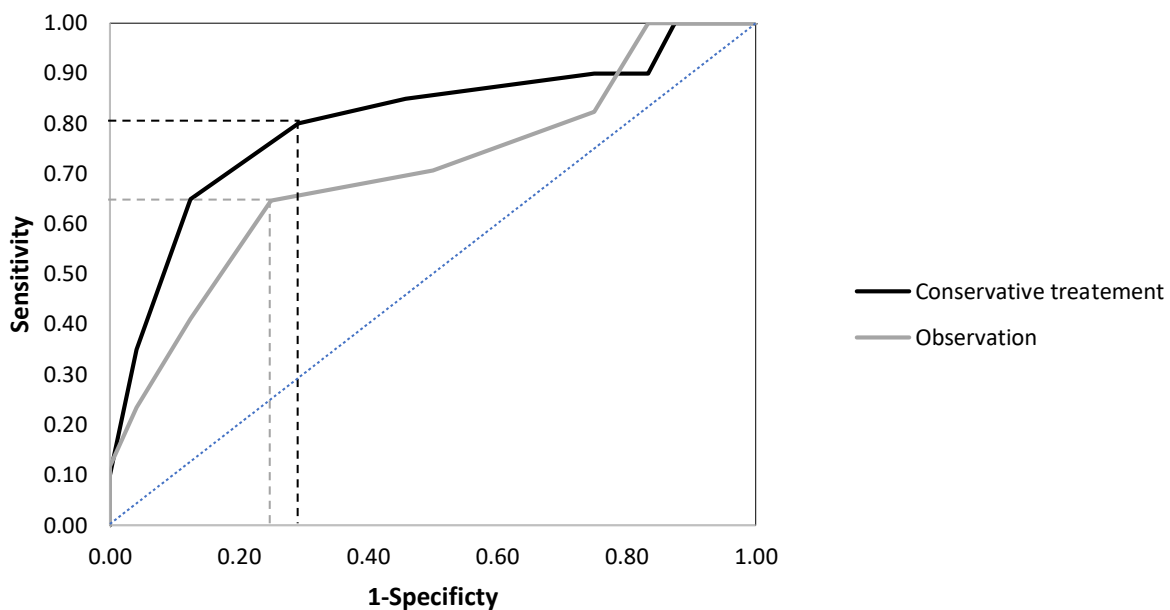Authors have no conflicts of interests to disclose.

Figure 1. ROC curve analysis to determine the best threshold in RC value to predict progression in the conservative treatment and observation groups.

The Awareness of Adolescent Idiopathic Scoliosis among Primary Care Physicians in Turkey

by Aynur Metin Terzibasioglu | Kadir Abul | Okcan Basat | Zehra Ayça Aydın Demir | University of Health Sciences, Gaziosmanpaşa Training and Research Hospital, Department of Physical Medicine and Rehabilitation, İstanbul | University of Health Sciences, Başakşehir Pine and Sakura City Hospital, Department Orthopedics and Traumatology, İstanbul | University of Health Sciences, Gaziosmanpaşa Training and Research Hospital, Department of Family Medicine, İstanbul | University of Health   Sciences, Gaziosmanpaşa Training and Research Hospital, Department of Family Medicine, İstanbul

Background

Primary care physicians (PCP) are likely to encounter adolescent idiopathic scoliosis (AIS) in their daily routine practice.

Objective

The purpose of this study is to assess the awareness of adolescent idiopathic scoliosis(AIS) in PCP and identify areas for the lack of scoliosis knowledge and improvement in training.

Methods

The questionnaire form consisting of 21 questions with multiple options including diagnostic, conservative (exercise and brace) and surgery treatment approaches, risk factors and recommended sports in scoliosis is prepared in a survey program called SurveyMonkey, and is delivered to the PCP via mail or social media link. The survey used 21 questions developed and agreed upon by an experienced physiatrist, orthopedic surgeon and two PCP. In the descriptive statistics of the data, mean, standard deviation, median, lowest, highest, frequency, and ratio values are calculated. For the analysis of quantitative data, the Mann-Whitney U test and independent sampling T-test were used. The Chi-square test is used for the analysis of qualitative data.

Results

Responses are received from 207 PCP. More than half of them, 59% performed posture examination in cases of doubt while 34% examined at school screenings. 55% of them pointed that they don't know the threshold cobb degree to diagnose scoliosis. More than half of them referred their patients to orthopedic surgeons or physiatrists. The most seen complaint among AIS was back pain. Most of the physicians assessed posture asymmetry by inspection besides Adam's forward test. Most of the 78% took care to use gonad protection in X-ray shots. Most of them stated that a bigger curve magnitude at presentation is the major risk factor in the case of planning treatment. Most of the specialists 65% used the Tanner stage to assess the growth potential. As a physical activity, 91% recommended swimming. Most of the 78% stated that they have training expectations to be a part of early diagnosis, conservative treatment, and follow-up approaches.

Conclusion

PCP should be made re-aware of AIS via including routine examination screenings in their daily practice for prevention and early diagnosis of the disease. The training needs that PCP working in the field for prevention and early diagnosis of AIS, which they frequently encounter, should be included in both specialist training and post-specialty training course.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose

The Awareness of Idiopathic Scoliosis Among Physiotherapists in Turkey

by Aynur Metin Terzibasioglu | Deniz Aktan | University of Health Sciences, Gaziosmanpaşa Training and Research Hospital, Department of Physical Medicine and Rehabilitation, İstanbul | Private practice, Physiotherapist

Background

Idiopathic scoliosis (IS) is a common musculoskeletal condition with a multi-factorial aetiology characterized by a three-dimensional rotational deformity of the spine.

Objective

The purpose of this study was to assess the awareness of IS among physiotherapists and identify areas for the lack of IS knowledge and improvement in training.

Methods

The questionnaire, consisting of 20 questions with multiple options including definition, diagnostic, conservative (exercise and brace) treatment approaches, related to idiopathic scoliosis is prepared in a survey program called SurveyMonkey, and was delivered to the physiotherapists via mail or social media link. The survey used 20 questions developed and agreed upon by an experienced physiatrist and a physiotherapist specially trained in spine deformities. In the descriptive statistics of the data, mean, standard deviation, median, lowest, highest, frequency and ratio values were calculated. The analysis of quantitative data were calculated with Mann-Whitney U test and independent sampling T-test, for the qualitative data Chi-square test was used.

Results

Responses were received from 167 physiotherapists. A total of 146 (88%) answered the question ''What is IS?'' as being a three dimensional rotational deformity of the spine correctly. More than half of them 61%, answered the question for diagnosis of IS correctly as a Cobb angle is ≥ 10° and axial rotation can be recognized and confirmed by X-rays, 25% of the participants incorrectly suggested that the diagnosis is based in the iliac crest levels. The mean number of patient they rehabilitate was 45% < 5 cases/month and 43% of physiotherapists stated that physiatrists refer these patients for rehabilitation. The most seen complaint was poor posture. The results showed that most of the physiotherapists 75% answered this question correctly by indicating that bracing should be recommended for patients with IS when the curve is 20° (± 5) Cobb angle and also when the patient has a high risk of progression. Three quarters of the physiotherapists knew Milwaukee, while 67% knew Boston brace. Most of them were using scoliosis exercises, which were taught during their undergraduate training. The second very known technique was International Schroth 3 Dimensional Scoliosis Therapy (ISST)-(Germany) (46%), the third, Barcelona Scoliosis Physical Therapy School (BSPTS)-(Spain) (%14). Other treatment techniques were mobilization (86%) and kinesiotaping (51%). Physical exercise recommendations among physiotherapist were pilates (89%) and swimming (58%). More than half of them (57%) experienced that their knowledge is insufficient, beside this 53% of them stated that they are looking for more detailed training programs.

<u>Conclusion</u>

IS patients frequently refer to physiotherapists for conservative treatment of the disease. Physiotherapists, who are a part of a multidisciplinary team in IS treatment, should be informed about the diagnosis and treatment approaches during their undergraduate and postgraduate training course.

<u>Conflict of Interest Disclosure</u>

We have no Conflicts of Interest to disclose

The Awareness of Idiopathic Scoliosis Among Orthotic- prosthetic Technicians in Turkey

by Aynur Metin Terzibasioglu | Filiz Yıldız Aydın | University of Health Sciences, Gaziosmanpaşa Training and Research Hospital, Department of Physical Medicine and Rehabilitation, İstanbul | University of Health Sciences, Bakırköy Dr. Sadi Konuk Training and Research Hospital, Departmant of Physical Medicine and Rehabilitation, İstanbul

Background

Idiopathic scoliosis (IS) is a musculoskeletal condition with a multi-factorial etiology characterized by a three-dimensional rotational deformity of the spine. Although o orthotic –prosthetic technicians (OPT) often deal with the orthosis construction of spine problems in their specialty, it is observed that OPT do not show a common approach in following an algorithm for the brace construction techniques, brace follow-up protocols of idiopathic scoliosis.

Objective

The purpose of this study is to assess the awareness of IS among OPT and identify areas for the lack of idiopathic scoliosis knowledge and improvement in their training and postgraduate training course

Methods

The questionnaire form, consisting of 21 questions with multiple options including demography of OPT, definition, diagnosis, brace construction techniques, brace types, presence of brace follow-up protocols, most seen complaints and difficulties besides brace treatment, problems encountered in brace repayment from the insurance institution related to idiopathic scoliosis is prepared in a survey program called SurveyMonkey, and was delivered to the OPT via link or social media link. The survey used 21 questions developed and agreed upon by two experienced physiatrists, specially trained in spine deformities. In the descriptive statistics of the data, mean, standard deviation, median, lowest, highest, frequency and ratio values were calculated. The analysis of quantitative data were calculated with Mann-Whitney U test and independent sampling T-test, for the qualitative data Chi-square test was used.

Results

Responses were received from 56 OPT. A total of 37 (69%) answered the question ''What is IS?'' correctly as scoliosis being a three dimensional rotational deformity of the spine. The mean number of brace constructed was 60% <5 cases/month. Lots of the patients 85% were referred from orthopaedic surgeons and 70% of the OPT worked with a team. Most of them 89% made the brace classification according X-Ray respectively, 58% physicians' brace prescription, 53% according to body image. We asked which techniques they use while constructing brace. Lots of them 80% of all answered using cast application, 58% using CAD / cam technique (computer aided design-manufacturing), 35% by measuring body with a tape measure. Most of them 69% used a brace follow-up protocol. The most seen complaint after brace was aesthetic concern. The known braces were respectively 89% Boston, 84% Milwaukee, 62% Cheneau, 55% Gensingen. 98% of OPT found brace repayments insufficient, and 57% had problems in back payments besides 80% encountered payment difficulties. Most of them 73% didn't know the Society on Scoliosis Orthopaedic and Rehabilitation Treatment (SOSORT) 's brace practice

guidelines for orthotic technicians. More than half of them 62% thought that their knowledge is insufficient, besides this 67 % of them stated that they have training expectations in the future.

Conclusion

Patients with IS frequently refer to orthotic-prosthetic technicians for brace construction of the disease. The training needs for brace construction which they frequently encounter, should be included in training and postgraduate training course.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose

Health-Related Quality of life addressed by means of postural support: for those at risk of developing scoliosis and windswept distortion who cannot perform exercises.

by Esther De Ru | Sarah Clayton |

by Esther De Ru | Sarah Clayton |

Background

Individuals with extremely limited movement are at high risk of developing changes in body shape. The link between unsupported supine lying and the development of postural asymmetry was first identified in 1976. These changes are highly predictable and should be preventable. A recent scoping review of current practice on postural care acknowledges "Poor postural care can have severe and life-threatening complications." The Confidential Inquiry into Premature Death of People with Learning Disabilities highlights more than 40% of premature deaths being caused by pneumonia and aspiration pneumonia. Many children and adolescents with a neuromuscular scoliosis are at risk for curve progression and structural changes.

Objective

To introduce the use of therapeutic night-time positioning and the assessment of body symmetry for patients with neurological or syndromic disorders at risk of developing scoliosis and a windswept position due to the inability to actively change body position.

Methods

We searched for relevant literature, reports and acknowledgment of use in all mayor Databases and online. We specifically looked for information regarding the harmful effects of gravity and the positive effects of postural support and positioning on the Quality of Life.

Results

Results In a recent study of 67 children with four scoliosis subgroups, differences in Quality-of-Life scores were found among all subgroups: neuromuscular scoliosis being the most effected. Reduced scores in both physical and psychosocial domains were found in the neuromuscular scoliosis, followed by Syndromic Scoliosis, Idiopathic Scoliosis and Congenital Scoliosis.

Neuromuscular scoliosis patients have diverse and high complication rates after scoliosis surgery and many need surgeries early in life. Surgery is not without risk. Syndromic scoliosis patients have been found to have syndrome specific complications, rates and findings. High rates of wound infections, pulmonary complications, dural tears, implant and pseudarthrosis were found.

We propose the use of postural support throughout the 24- hour period for those who cannot perform exercises or change position, for patients at risk of developing scoliosis and windswept position and those with serious cognitive challenges and learning disabilities. Specifically supported positioning in the supine position, should be seriously considered.

Conclusion

Interest is most focused on the spine but we need to protect the chest shape also. Acknowledged in numerous United Kingdom NHS policy documents is that a 24-hour approach to postural care provision is required in order to protect individuals at risk of changes caused by gravity.

Objective and validated outcome measures of body symmetry are available and gradually being implemented. We need to raise awareness of these preventative therapeutic possibilities.

Conflict of Interest Disclosure

Declaration of interest

Sarah Clayton BSC (Hons) PGCE. CEO Simple Stuff Works Associates Ltd. CPD training provider, MHRA regulated manufacturer of equipment to measure The Goldsmith Indices of Body Symmetry and therapeutic night time positioning equipment

Esther de Ru PT, PPT, OMT,SEAS No Conflicts of Interest to disclose

INVESTIGATION OF THE EFFECT OF SATISFACTION FROM BRACES ON QUALITY OF LIFE OF PATIENT WITH ADOLESCENT IDIOPATHIC SCOLIOSIS

by Hasan İşçi | Sena ÖZDEMİR GÖRGÜ | Medipol University | Medipol University

Background

Adolescent Idiopathic Scoliosis (AIS) is a three-dimensional deformity that is seen on the spine between the ages of 10-17. Conservative and surgical interventions are possible for treatment. Brace treatment, which is one of the conservative methods, used commonly. Brace treatment is a application that lasts hours. Curative results of scoliosis brace is dependent on usage. However, the fact that it's a lengthy application and that adolescent individuals have hard time accepting the usage of a brace effects the efficiency, wear length and quality of life negatively.

Objective

The aim of this study is to analyze the effect of satisfaction from braces on quality of life of patient with AIS.

Methods

The data of the study consists of individuals who applied to İstanbul Hedef Spine and Ankara Bilim Ortopedi, both located in Turkey, between the dates December 2020-February 2021. The study includes 20 people (18 female, 2 male) who meet the studies criteria, who are between the ages of 10-17 and had been wearing brace for at least 6 months. The following are applied for their respective purposes: Scoliosis Research Society 23 (SRS-23) in order to evaluate the participants' quality of life; Brace Questionnaire (BrQ) in order to evaluate the orthosis usage satisfaction; a numeric value scale in order to determine the satisfaction from brace; and the opinions of users and their parents in order to determine problems with brace usage.

Results

Scoliosis type of the participants as follows: 4 (20%) single curvature, 16 (80%) double curvature Average length of brace usage of the participants are 20 months (min:6, max:72) and the average daily planned period of brace usage is 21 hours (min:18, max:23). Orthosis satisfaction score is determined to be at 6.85±2.08 (min= 4, max= 10). Positive relation is found between BrQ and SRS-23 as the result of the applied statistical analysis ($p=0.000$; $r=0.811$). The regression analysis which is applied in order to see the effect of orthosis usage on quality of life is found to be meaningful ($F=34.633$; $p=0.000$). 63.9% of the total variance in SRS-23 is explained by BrQ ($R2=0.639$).

No statistically meaningful difference detected in the Cobb angle values that were measured before and after brace treatment ($p>0.05$). When the "conformity to daily brace usage" is questioned, 5% answered "sometimes", 40% "mostly" and 55% "always". When the "enthusiasm to wear the brace" is questioned in the survey given to the parents, 5% answered "almost never", 25% "sometimes", 45% "sometimes", 25% "always".

Conclusion

As a result of this study, it's determined that as satisfaction from orthosis usage increases, so does the quality of life, and that satisfaction from orthosis usage is an important variable in explaining the quality of life. No meaningful difference is detected between the participants' angles before and after braces usage. It's also observed that the participants used their braces as planned lengths, and that this data is supported by the parents' data as well.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose

Can the tilt-differences of limiting vertebrae be a prognostic factor for the worsening of the scoliosis curves treated with specific exercises? A pilot study using a series of matched patients.

by Michele Romano | Alessandra Negrini | ISICO (Italian Scientific Spine Institute | ISICO (Italian Scientific Spine Institute)

Background

A hypothetical factor for the increase of Cobb° could be the percentage difference of the limiting vertebrae tilts.

A big difference of this value ideally suggests a potentially more unstable situation comparing two curves with the same Cobb° but with a substantial difference of the limiting vertebrae tilts.

Objective

The objective of the study is to check this hypothesis.

Methods

From a sample of 2179 subjects undergoing treatment for scoliosis, nine matched pairs of patients were selected with the following specific characteristics:

- Same gender

- Same Risser

- Maximum one year of age-difference at Risser 0

- One single thoracic or thoracolumbar curve

- Cobb at baseline less than 20 °

- Two subsequent radiographs of approximately one year

- At least, one year of physiotherapeutic treatment with, at least, three sessions between two x-rays

- No brace prescription.

Patients were paired according to the following criteria:

- Scoliosis with a relative tilt of the limiting vertebrae less than 10% of total Cobb ° compared to scoliosis with a tilt of the two limiting vertebrae more than 30% total Cobb °.

The modification of Cobb° was compared by calculating the averages of the improvements and worsening. Linear regression of the data was performed.

Results

The data analysis show that the mean increase or decrease of the Cobb° is similarly distributed in both groups.

Conclusion

The relative difference of the two limiting vertebrae tilts is not a reliable prognostic factor.
The prescription of braces, in case of a worsening of the curve, was the same in both groups.

Conflict of Interest Disclosure

"We have no Conflicts of Interest to disclose."

Bracing for Infantile Scoliosis: 2-Year Outcome Data

by Stephanie Wong BA | Daniel Hedequist MD | Lawrence Karlin MD | Danielle Cook MA | M Timothy Hresko MD | Boston Children's Hospital

Background

In patients with infantile scoliosis, the favored form of treatment is serial Mehta casting, a procedure that requires patients to undergo repeated rounds of general anesthesia during the first few years of life. A 2016 FDA safety communication states that exposure to anesthesia in children under three years of age may affect the development of children's brains.

Objective

This study aims to expand our understanding of the efficacy of customized bracing as an alternative form of treatment for infantile scoliosis.

Methods

A retrospective case series of infantile idiopathic scoliosis patients who have undergone at least two years of custom brace treatment was reviewed. Radiographs were taken out of the brace, with the exception of the in-brace first visit x-ray. Brace wear compliance to the prescription of 16-22 hours per day minimum was assessed based on periodic readings taken from the iButton sensor within the brace, and compliance was defined as adherence to at least 80% of the in-brace hours prescribed. Descriptive analysis was done on the curve magnitude, compliance, and brace-related complication data.

Results

This cohort was comprised of nine patients (average age 1.9 years, 56% female). The median treatment time was 32 months (range, 24.0-46.0 months). The median pre-treatment curve magnitude was 36 degrees (range, 30.0-67.0 degrees), and the median two year follow-up curve magnitude was 18 degrees (range, 10.0 to 35.0 degrees). There was a significant difference in the 2 year follow-up curve magnitude compared to the pre- treatment curve magnitude ($p=0.008$), and the resulting median change in curve magnitude was a decrease of 23 degrees. Seven of the nine patients had a 2-year follow-up curve of less than 20 degrees. The median compliance of the cohort stayed above 80% for all four follow- up appointments. At the 6-month follow up, the median brace wear time was 21.3 hours per day, and at 1 year it was 17.7 hours. The median remained at 17.7 hours at the 18-month follow-up, before rising again to 20.3 hours at the 2-year follow-up visit (Table 1). Eight of the nine patients experienced at least one complication while wearing their custom brace. Skin breakdown was the leading complication, experienced by six patients (67%), followed by rib constriction or breathing difficulty (5/9; 56%). There were no significant associations between type of complication and brace compliance ($p>0.05$).

Conclusion

These preliminary results, which show successful reduction in curve magnitude following a two- year period of compliant brace wear, were similar to results of Mehta casting and may support

the use of customized braces as a safe and effective alternative to serial casting for infantile scoliosis provided the physician works with the patient's caregivers to ensure a high rate of compliance. Though complications were noted, they did not affect patients' ability to adhere to the prescribed number of hours. This study can aid in informing caregivers of treatment outcomes from bracing and the importance of brace wear compliance.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

The Awareness of Scoliosis Among Orthopedic Surgeons in Turkey

by Aynur Metin Terzibasioglu | Kadir Abul | Filiz Yıldız Aydın | Akif Albayrak | University of Health Sciences, Gaziosmanpaşa Training and Research Hospital, Department of Physical Medicine and Rehabilitation, İstanbul | University of Health Sciences, Başakşehir Pine and Sakura City Hospital, Department of Orthopedics and Traumatology, İstanbul | University of Health Sciences, Bakırköy Dr. Sadi Konuk Training, and Research Hospital, Department of Physical Medicine and Rehabilitation, İstanbul | Private Clinic, Orthopedic Surgeon

<u>Background</u>

Scoliosis is the lateral curvature of the spine that measures greater than 10 degrees on X- ray. Orthopedic surgeons often deal with spine problems in their specialty, it is observed that physicians don't show a common approach in following an algorithm for the diagnosis, follow-up, conservative and surgical treatment approaches of scoliosis.

<u>Objective</u>

The purpose of this study is to assess the awareness of scoliosis among orthopedics and identify areas for the lack of scoliosis knowledge and improvement in their training course.

<u>Methods</u>

The questionnaire, consisting of 17 questions with multiple options including diagnostic, conservative (exercise and brace) and surgery treatment approaches, surgical methods and complications of surgery related to scoliosis is prepared in a survey program called SurveyMonkey and is delivered to the orthopedic surgeons via mail or social media link. The survey used 17 questions developed and agreed upon by an experienced physiatrist and two spinal deformity surgeons. In the descriptive statistics of the data, mean, standard deviation, median, lowest, highest, frequency, and ratio values were calculated. For the analysis of quantitative data, the Mann-Whitney U test and independent sampling T-test were used. The Chi-square test was used for the analysis of qualitative data.

<u>Results</u>

Responses were received from 163 orthopedic surgeons. All the physicians who participated in the survey were male .The mean number of scoliosis patient per month examined was respectively 56% ≤5 cases, 20% 6-10 cases, 10% 11-20 case, 8% >30 cases, 6% 21-30 cases The ratio of using gonad protection in X-ray shots was 46% and those who prefer EOS graphic was 21%. Most of the specialists 94% used the Risser stage to assess the growth age and residual growth potential. While 36% of the specialists referred patients to the physiotherapist by suggesting exercise, 34% of them direct the patients to the physiotherapist and orthotic technician by prescribing exercise and brace. Most of the specialists 64% refer patients to a spine surgeon and 23% of the specialists plan their surgery with their own team. As a physical activity, 94% recommended swimming. Most of the 81% had brief knowledge about the Schroth method (Germany), 64% used Milwaukee brace, and 61% Boston brace. More than half of specialists offered pre and post-operative rehabilitation. The operation methods they performed were 94% posterior instrumentation and fusion technique, 40% selective fusion, 35% growing

rod, 17% Shilla, 11% anterior surgery, 10% MAGEC, 9% vertebral body tethering technique. The most seen complication they reported was infection.

Conclusion

Patients with scoliosis frequently refer to orthopedic surgeons for diagnosis and treatment. The training for physicians working in the field needs to be improved for the diagnosis and treatment of scoliosis, which they frequently encounter, should be included in both specialty training and post-specialty training courses.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Part time brace wearing – can it be sufficient?

by KORBEL KRZYSZTOF | CZAPROWSKI DARIUSZ | KOZINOGA MATEUSZ | JANUSZ PIOTR | POLITARCZYK KATARZYNA | KOTWICKI TOMASZ | Department of Physiotherapy, University of Medical Sciences, Poznan, Poland | 1. Department of Physiotherapy, University of Medical Sciences, Poznan, Poland 2. Olsztyn University, Olsztyn, Poland | 1. Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland 2. Rehasport Clinic, Poznan, Poland | Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland | 1. Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland 2. Rehasport Clinic, Poznan, Poland | Department of Spine Disorders and Pediatric Orthopedics, University of Medical Sciences, Poznan, Poland

Background

Rigid brace combined with specific physiotherapy is accepted as a standard treatment for moderate idiopathic scoliosis (IS). Treatment outcome depends on proper indication, brace quality and patient`s compliance.

Objective

Analysis of the results of Cheneau brace treatment in part time brace wearing patients.

Methods

Twenty-nine IS girls, fulfilling SRS brace study inclusion criteria, were consecutively recruited. In all patients the brace wearing time was 50% of the day, corresponding to minimum 12h per day, outside the school hours. Two patient categories were separately analyzed: subgroup A: patients receiving recommendation for part time wearing and compliant (N=12) versus subgroup B: patients receiving recommendation for full time wearing but non-compliant (did not wear the brace at school), N=17. At the beginning of treatment, the subgroups A vs. B were slightly different: age (13.0 yo vs. 12.1 yo), age of menarche (13.2 yo vs. 12.8 yo), primary curve Cobb angle (28.9⁰ vs. 32.2⁰ p=0.07), angle of trunk rotation (ATR) at the primary curve level: 10.3⁰ vs. 8.8⁰, age at the end of the brace wearing (16.0 y. vs. 16.1 yo), brace wearing time (3.0 years vs. 4.0 years), respectively.

Results

The subgroups were compared at the final follow-up of minimum 2 years after complete brace weaning. ATR was 10.1° vs. 10.6°, Cobb angle value was significantly lower in the part-time compliant patients (30.0⁰ vs. 42.2⁰, p=0.0028). The Cobb angle progression was 1.0⁰ vs. 10.0⁰. Cobb angle progression >5⁰ was observed in 17.0% vs. 58.8% of patients, respectively. No surgery was recommended in the part-time subgroup A however, surgery was recommended in 35.3% of treated patients in full-time subgroup B.

Conclusion

Small differences observed in scoliosis parameters at baseline were the reasons for different recommendations concerning brace wearing time. Adherence to physician's recommendations and compliance revealed key factors in final success of brace treatment.

Part time brace wearing becomes a reality in contemporary adolescents. In selected cases it may result in sufficient therapeutic effect however, the patients and parents should be informed about the importance of respecting the brace wearing hours.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

The Awareness of Adolescent Idiopathic Scoliosis Among Pediatricians In Turkey

by Aynur Metin Terzibasioglu | Filiz Yıldız Aydın | Seda Geylani Güleç | University of Health Sciences, Gaziosmanpaşa Training and Research Hospital, Department of Physical Medicine and Rehabilitation, İstanbul | University of Health Sciences, Bakırköy Dr. Sadi Konuk Training, and Research Hospital, Department of Physical Medicine and Rehabilitation, İstanbul | University of Health Sciences, Gaziosmanpaşa Training and Research Hospital, Department of Pediatrics, İstanbul

Background

Pediatricians are likely to encounter adolescent idiopathic scoliosis (AIS) in their daily routine practices and have a lot of work to do in AIS. It is observed that pediatricians do not show a common approach in following an algorithm for the early diagnosis, conservative treatment and referral to the relevant specialist.

Objective

The purpose of this study is to assess the awareness of AIS in pediatricians and identify areas for the lack of scoliosis knowledge and improvement in training.

Methods

The questionnaire form consisting of 21 questions with multiple options including diagnostic, conservative (exercise and brace) and surgery treatment approaches, risk factors and recommended sports in AIS is prepared in a survey program called SurveyMonkey, and is delivered to the pediatricians via mail or social media link. The survey used 21 questions developed and agreed upon by an experienced physiatrist and pediatrician. In the descriptive statistics of the data, mean, standard deviation, median, lowest, highest, frequency and ratio values are calculated. For the analysis of quantitative data, Mann-Whitney U test and independent sampling T-test were used. Chi-square test is used for the analysis of qualitative data.

Results

Responses are received from 102 pediatricians. Most of them, 75% performed posture examination in cases of doubt while none of them examined at school screenings. 42% of them pointed that they don't know the threshold cobb degree to diagnose scoliosis. Most of them 75% referred their patients to orthopedic surgeons and 37% to physiatrists. The most seen complaint among AIS was back pain. Most of the physicians assessed Adam's forward test by physical examination besides posture asymmetry. Most of the 76% took care to use gonad protection in X-ray shots. Most of them stated that a bigger curve magnitude at presentation is the major risk factor in the case of planning treatment. Most of the specialists 78% used the Tanner stage to assess the growth potential. As a physical activity, 90% recommended swimming. In diagnosis and conservative treatment of scoliosis, while 61.39% (62) of them think they are insufficient, 53.47% (54) stated that they have training expectations to be a part of early diagnosis, conservative treatment and follow-up approaches

Conclusion

Pediatricians should be made aware of AIS via including routine examination screenings in their daily practice for prevention and early diagnosis of the disease. The training needs that pediatricians working in the field for prevention and early diagnosis of AIS, which they frequently encounter, should be included in both specialist training and post-specialty training course.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Effect of central stabilization exercises in adolescent idiopathic scoliosis: a systematic review

by Pablo Pérez-Cabello | Faculty of health sciences. Physiotherapy Department

Background

Adolescent idiopathic scoliosis (AIS) is one of the most common alterations in the morphology of the spine among adolescents. The conservative approach includes a brace and / or physiotherapy scoliosis-specific exercises (PSSE). Central stabilization exercises (CEE) are known for their purported effects on stability and strengthening of the spine.

Objective

The aim of this study was to know the effect of CEE on radiological and clinical issues such as pain or quality of life.

Methods

Following the PRISMA review protocol, a search for articles was carried out in the PubMed, Web Of Science and PEDro databases. Randomized controlled clinical trials (RCTs) with adolescents diagnosed with AIS, Cobb angle between 10º and 45º that used CEE and published in the last decade in English or Spanish were selected.

Results

Five papers are included in which methodological quality and risk of bias are assessed. The total sample consists of 231 subjects with a mean age of 13.8 years (0.9), a Cobb angle of 28.68º (2.3) and a Risser sign of 1.7 (0.7). The interventions include core strengthening exercises with or without a brace in combination with traditional exercises or PSSE

Conclusion

There is enormous heterogeneity in the interventions and in the results obtained. However, it could be interesting to improve aspects such as pain or quality of life.

Conflict of Interest Disclosure

We have no conflict of interest to declare.

Chêneau Type Brace Treatment Possibilities In Patients With Progressive Idiopathic Scoliosis Spine Deformities

by Dmitry K. Tesakov | Darya D.Tesakova | Arkadii I.Kazmin | Republican Scientific and Practical Center of Traumatology and Orthopedics, Belarus, Minsk | Federal State Budgetary Educational Institution of Further Professional Education "Russian Medical Academy of Continuous Professional Education" of the Ministry of Healthcare of the Russian Federation | National Medical Research Center of Traumatology and Orthopedics named after N.N. Priorova, Russia, Moscow

Background

The generally accepted indications for the brace treatment for scoliosis are deformities in growing patients over 200 by Cobb. However, patients with progressive deformities over 400 by Cobb are implicated in brace treatment, because of controversial growing spine surgery data.

Objective

To evaluate Chêneau type brace treatment effectiveness in growing patients with initially IS surgical spine deformities.

Methods

Prospective comparative consistent study was performed in Republic traumatology and orthopedics center from 2010 to 2019 years and enrolled 283 growing patients with IS surgical deformities. Thoracic deformity type was in 122 patients, thoracolumbar - in 79, combined - in 82. The initial value of pathological arcs was 41-135 degrees by Cobb. Brace treatment was started at the age of 5-16 years, all patients had active spine bone growth by Risser and Sadof'eva tests. Duration of brace treatment was from 3 to 7 years, it was stopped at the final stage of spine bone growth. Follow-up term of patients - 2-10 years.

Results

In 157 (56 %) patients with initial arcs of 41-71 degrees under brace mode by the bone growth completion was obtained stable spine deformity correction, which did not require surgical treatment, since the value of the arcs does not exceed 40 degrees, and the spine had sustained frontal and sagittal balance. In the remaining 126 (44 %) cases (initial arc 41-135 degrees) the brace therapy allowed to restrain deformity process in the patient general physiological development and perform scheduled surgical treatment stage in the most favorable period of spine bone growth completion (these patients were successfully operated at the age of 16-20 years).

Conclusion

The analysis showed that the Chêneau type brace treatment is an effective method of treatment for IS in growing patients with initially surgical spinal deformities. It allowed to avoid surgery in 56% cases when deformity regress achieved non-surgery parameters (p<0,05). In the other

group of patients brace treatment improved final surgical correction by restraining deformity progress before it progressed in 44% cases (p<0,05).

Reducing the pelvis constriction changes the sagittal plane in the brace. A retrospective case-control study of 37 free pelvis vs 336 classical consecutive very-rigid Sforzesco braces.

by Stefano Negrini | Fabrizio Tessadri | Francesco Negrini | Marta Tavernaro | Fabio Zaina | Andrea Zonta | Sabrina Donzelli | University of Milan - IRCCS Istituto Ortopedico Galeazzi, Milan | Orthotecnica, Trento | IRCCS Istituto Ortopedico Galeazzi, Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan

Background

The sagittal plane preservation is one of the main aims of modern bracing. The Sforzesco brace, ancestor of very-rigid (VRB) group, has a push-up action to decrease brace's adverse sagittal effects. Recently, we introduced the "Free Pelvis" (FP) (semi-rigid ethylene vinyl acetate) in the Sforzesco VRB to improve comfort, sagittal balance (automatic pelvis positioning) and brace adaptability (independent pelvis and trunk diameters).

Objective

We aimed to check if the FP innovation changes the sagittal plane results of VRB for adolescents with idiopathic scoliosis (AIS)?

Methods

We performed a matched Case-Control Study comparing the Sforzesco brace classical version (VRB) versus the Free Pelvis one (FPB). We extracted from our prospective database all FPB and VRB at first consultation in our Institute following these inclusion criteria: AIS, age 10-16, VRB prescribed 20 hours/day, sagittal x-rays available at the start and either at the second consultation or in-brace (at 1-month). We compared in-brace and out-of-brace results to the pre-brace starting x-ray for the following sagittal parameters: thoracic kyphosis (TK), lumbar lordosis (LL), pelvic incidence (PI) and tilt (PT), sacral slope (SS), and lumbosacral angle (LSA). We also checked TK/LL, PT/SS and LSA/LL ratios and PI-LL difference. We used descriptive statistics according to the type of variables and their distribution. We used unpaired and paired t-test to check the differences between and within the groups, respectively.

Results

Out of 4431 VRB and 96 FPB, 336 (8%) and 37 (39%) respected the inclusion criteria. Baseline data showed no differences.

	FPB		VRB		P
Number	33		333		
Males	14%		19%		**0,422**
Menarche	44%		56%		**0,179**
Previous brace	22%		27%		**0,458**
	Av	SD	Av	SD	
Age (years)	13	2	13	2	**0,070**
Age at menarche (years)	11	1	12	1	**0,265**
Risser	1	2	2	1	**0,098**
Weight (kg)	52	25	50	12	**0,779**
Height (cm)	156	10	159	14	**0,212**
ATR (°Bunnell)	12	4	12	4	**0,868**
Aesthetics (TRACE points)	8	2	8	2	**0,953**
C7 plumbline (mm)	25	20	28	19	**0,470**
L3 plumbline (mm)	19	20	25	18	**0,073**
S2 plumbline (mm)	-2	23	4	20	**0,145**
Brace prescription (hours/day)	23	1	23	1	**0,134**
Declared brace use (hours/day)	22	1	22	2	**0,594**

Compared to the baseline, we found similar statistically and clinically significant TK reductions in both groups, and some statistically, but not clinically significant changes of lumbopelvic parameters. Changes prevailed at in-brace radiograph (particularly in the LSA/LL ratio) and in VRB (see Table 2).

Conclusion

Free Pelvis innovation causes less in-brace lumbopelvic strain than classical VRB and slightly changes the short-term out-of-brace results. It is worthwhile exploring possible medium/long term changes.

Conflict of Interest Disclosure

SN has a stock of ISICO. The other authors have no Conflicts of Interest to disclose.

Table 2

	Pre brace					In-brace					Short-term				
	FPB		VRB		P	FPB		VRB		P	FPB		VRB		P
	Av	SD	Av	SD		Av	SD	Av	SD		Av	SD	Av	SD	
Degrees															
Kyphosis (TK)	36	16	37	39	**0,681**	28	11	27	9	**0,646**	28	12	29	12	**0,520**
P (vs Pre)						**0,001**		**0,000**			**0,005**		**0,000**		
Lordosis (LL)	61	12	62	23	**0,726**	54	10	52	11	**0,294**	57	12	57	10	**0,988**
P (vs Pre)						**0,001**		**0,000**			0,074		**0,000**		
Lumbo-sacral angle (LSA)	11	6	11	6	**0,820**	10	6	13	6	**0,056**	10	7	9	6	**0,357**
P (vs Pre)						0,887		0,610			0,064		**0,000**		
Pelvic incidence (PI)	48	14	50	25	**0,416**	51	11	51	12	**0,859**	48	13	49	12	**0,796**
P (vs Pre)						0,159		0,245			0,084		0,610		
Sacral slope (SS)	40	9	41	9	**0,567**	40	8	38	9	**0,378**	40	8	41	9	**0,705**
P (vs Pre)						0,874		**0,000**			0,483		0,820		
Pelvic Tilt (PT)	8	8	9	22	**0,433**	11	8	12	7	**0,462**	8	7	8	8	**0,909**
P (vs Pre)						**0,034**		0,206			**0,023**		0,512		
PI-LL	-13	12	-11	30	**0,480**	-4	10	-1	10	**0,152**	-9	9	-8	12	**0,845**
P (vs Pre)						**0,000**		**0,000**			**0,002**		0,062		
Ratios															
TK/LL	58%	25%	58%	20%	**0,953**	52%	17%	53%	16%	**0,724**	47%	16%	52%	20%	**0,236**
P (vs Pre)						**0,038**		**0,050**			**0,004**		**0,000**		
PT/SS	17%	20%	21%	68%	**0,470**	28%	21%	34%	20%	**0,214**	19%	15%	21%	24%	**0,715**
P (vs Pre)						**0,026**		**0,023**			**0,033**		0,901		
LSA/LL	18%	10%	18%	9%	**0,846**	20%	12%	25%	11%	**0,030**	18%	11%	15%	10%	**0,258**
P (vs Pre)						0,213		**0,001**			0,281		**0,001**		

The modular MI-brace is as effective as the classical custom- made Sforzesco brace. A matched case-control study of 120 consecutive high-degree female AIS

by Stefano Negrini | Fabrizio Tessadri | Francesco Negrini | Marta Tavernaro | Fabio Zaina | Andrea Zonta | Sabrina Donzelli | University of Milan - IRCCS Istituto Ortopedico Galeazzi, Milan | Orhotecnica, Trento | ISICO (Italian Scientific Spine Institute), Milan - IRCCS Istituto Ortopedico Galeazzi, Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan | ISICO (Italian Scientific Spine Institute), Milan

Background

In very-rigid (high-density polyethylene) brace (VRB), we introduced the "Free Pelvis" (FP) (semi-rigid ethylene vinyl acetate) to improve comfort, sagittal balance (automatic pelvis positioning) and brace adaptability (independent pelvis and trunk diameters). We also introduced the "Adjustable Posterior Closure" to improve correction (adaptable pressures) and adaptability in the short-term (to follow spine push-up), and medium-term (to follow trunk and pelvis diameter changes). These two innovations converged in a new modular (5 connected elements) VRB, the MI-brace (Modular Italian brace) (MIB).

Objective

We aimed to compare the new MIB to the classical custom-made Sforzesco VRB for adolescents with idiopathic scoliosis (AIS)

Methods

We performed a matched Case-Control Study. We extracted from our prospective database all MIB and VRB at first consultation in our Institute following these inclusion criteria: AIS, age 10-16, VRB prescription 23 hours/day, standing full-spine x-rays available at first and second consultation, the primary curve between 36 and 65°, Angle of Trunk Rotation between 7 and 23° Bunnell. We matched for Risser (range 0 to 4), menarche age (10 to 15), weight (33.5 to 83), height (140 to 180), BMI (13.5 to 29), aesthetics (TRACE index 4 to 12), plumbline distances (S1: -60 to 35; C7+L3: -10 to 115), referred brace use (22 to 24). We excluded from VRB all AIS with parameters out of the MIB patients' range. Finally, we randomly chose a subset of VRB to keep a 1:10 ratio between the groups. We checked in- brace radiographic results at one month, and short-term out-of-brace radiographic and clinical results. We used descriptive statistics according to the type of variables and their distribution. We used unpaired and paired t-test to check the differences between and within the groups, respectively.

Results

Out of 4431 VRB and 18 MIB, 27% and 61% respected the inclusion criteria, defining the 11 MIB (13±1 y, 50±11°). After matching, remained 183 from which we randomly chose the 110 final VRB participants (age 13±1, 47±7°). At baseline, we found no differences between groups. All frontal parameters improved statistically and clinically in both groups (p<0.001). MIB group improved more in-brace (-20±7° vs -16±6°), but we found no differences at short-term for scoliosis (-9±7° vs -8±5°), ATR (-4±3° vs -4±3°) and aesthetics (-4±3 vs -4±2). In the sagittal

plane, short-term differences were statistically significant for VRB S1 (-3±15), and almost (p<0.1) for MIB S1 (-8±11) and C7+L3 (-11±15), and between groups for C7+L3 but not S1.

Conclusion

While better in-brace, MIB results in the frontal plane are not different from VRB in the short term. Results could change in the future with a bigger MIB group or in the medium-, long-term.

Conflict of Interest Disclosure

SN has a stock of ISICO. The other authors have no Conflicts of Interest to disclose.

A New Clinical Tool for Scoliosis Risk Analysis: 'Scoliosis Tele-Screening Test'

by Aslıhan Kusvuran Ozkan | Hurriyet Yilmaz | Ahsen Buyukaslan | Filiz Tuna | Hande Tunc | Sibel Ozdogan | Zeynep Turan | 1Department Physical Medicine and Rehabilitation, Ozulku Medical Center, Adana, Turkey | 2Department of Physiotherapy and Rehabilitation, Halic University School of Health Science, Istanbul, Turkey | 3Formed Healthcare Scoliosis Treatment and Brace Center, Istanbul, Turkey | 4Department Physical Medicine and Rehabilitation, Trakya University, Edirne, Turkey | 3Formed Healthcare Scoliosis Treatment and Brace Center, Istanbul, Turkey | 5Department Physical Medicine and Rehabilitation, Yıldız Medstar Hospital, Antalya, Turkey | 6Department Physical Medicine and Rehabilitation, Koc University School of Medicine, Istanbul, Turkey

Background

In pandemic, there is need of a virtual scoliosis screening test.

Objective

To develop a new scoliosis screening tool "Scoliosis Tele-Screening Test" (STST), evaluate its feasibility, and examine parents' satisfaction.

Methods

STST was developed by seven scoliosis specialists considering aesthetic deformities in shoulder, thorax, waist and hips, and risk score categories were determined considering hereditary risk, Adams test, menarche status and gender. Total score ranged 0-18 and risk was categorized as low; 0-5/ 0-4 point, moderate; 6-11/ 5-8 point and high;12-18/9-13 point for girls/boys, respectively. Test was delivered to the participants via "Scoliosis Research and Treatment Association Turkey" social networks. Children in moderate and high-risk groups were evaluated in research centers or virtually using TRACE scale and Adams test. Posterior-anterior radiographs were taken to diagnose children with suspected scoliosis.

Results

835 forms were collected between June, 2020 and February, 2021. The mean age was 11.9 years (3-18). There were 490 females, 29 % without menarche. The mean test score was 4.06 (0-17). Out of 72 (8.6 %) respondent children, 59 (81.9%) were suspected with scoliosis and confirmed as scoliosis. 78% of scoliosis patients were girls. The mean age in scoliosis patients was 12.7 years (7-18), mean STST score was 10.6 (0-17), mean TRACE score was 7.4 (3-12). There was a correlation between STST score and TRACE scores, suspicion of scoliosis and Adams test positiveness (R = 0.570, P =0.000, R = 0.526, P = 0.000, R = 0.405, P = 0.000, respectively). STST was found beneficial by 98 % of parents.

Conclusion

STST can be a useful method to detect children with high-risk for scoliosis. Our virtual test was found quite feasible and beneficial by participants. This tool may be used even after COVID-19 pandemic in terms of cost effectiveness, feasibility and implementation without geographic location limiting.

Conflict of Interest Disclosure

"We have no Conflicts of Interest to disclose."

Optimization and validation of a new low profile adherence sensor for monitoring spinal orthosis wear-time.

by Dominic Wardell | Raveen Jayasuriya | Nikki Totton | Andrew Mills | Lee Breakwell | Ashley Cole | Medical School, University of Sheffield | Spinal Service, Sheffield Children's Hospital | Clinical Research Trials Unit, University of Sheffield | Spine Corporation, Chesterfield | Spinal Service, Sheffield Children's Hospital | Spinal Service, Sheffield Children's Hospital

Background

Self-reported brace wear-time adherence in adolescent idiopathic scoliosis is unreliable and overestimated. Previous bracing studies have utilized an array of thermal sensors with great methodological variability to validate such sensors, many of which use self-reported wear- time diaries as the "gold standard" for comparison. No previous studies have used a fixed don-doff protocol to characterize the thermal profile of the sensor. Little is known about the optimum anatomic position to fit the sensor in the brace, or the thermal micro-climate in each position.

Objective

To identify the optimal sensor position within the brace, quantify warm-up and cool-down effect, and calculate the optimum threshold temperature for agreement between measured and true wear-time.

The outcomes of this study will inform the upcoming Bracing AdoleScent Idiopathic Scoliosis (BASIS) multicenter RCT evaluating full-time versus night-time bracing.

Methods

This study involved three healthy participants donning a rigid custom CAD/CAM brace. Seven Orthotimer and five iButton (DS1925L) sensors were set to record temperature at their highest frequency, one and five minutes respectively. The 12 sensors were placed flush to the foam lining at four brace locations: anterior abdomen, axilla, lateral-gluteal and sacrum. Nine repeats of a 180-minute protocol (30-minutes off, 90-minutes on, 60-minutes off), and three repeats of a 240-minute protocol (60-minutes off, 60-minutes on indoors, 60- minutes on outdoors, 60-minutes off) were performed, with both sensors and timer synchronized to coordinated universal time (UTC).

Statistical analysis was performed for threshold temperatures between 15-36∘. Agreement between actual wear-time and sensor measured wear-time was analyzed by intraclass correlation coefficient (ICC).

Results

An inverse relationship exists between warm-up and cool-down time, thus ideal threshold for each sensor and location was identified when mean warm-up and cool-down times equated.

Orthotimer thresholds: abdomen 26o (ICC 0.901, p<0.001), axilla 27o (ICC 0.966, p<0.001), lateral-gluteal 24o (ICC 0.898, p<0.001), and sacrum 22.5o (ICC 0.184, p=0.284).

iButton thresholds: abdomen 26.5o (ICC 0.888, p<0.001), axilla 28o (ICC 0.947, p<0.001), lateral-gluteal 23.5o (ICC 0.673, p=0.006), and sacrum 24o (ICC 0.404, p=0.079).

Mean warm-up and cool-down time to optimal temperature in each location for Orthotimer: abdomen 10 minutes, axilla 12 minutes, lateral-gluteal 16 minutes, and sacrum 15 minutes.

Mean warm-up and cool-down time to optimal temperature in each location for iButton: abdomen 6 minutes, axilla 6 minutes, lateral-gluteal 8 minutes, and sacrum 11 minutes.

Conclusion

Axilla sensors demonstrated the highest peak temperatures and highest optimised brace-on threshold of 27 and 28◦ with both sensors. This combination provides lowest variance and excellent statistical agreement between measured and true wear-time. Warm-up and cool- down range 6-12 minutes at optimal axilla thresholds, suitably low for clinically relevant wear-time measurement. Abdominal sensors showed a similar, but marginally inferior profile.

Sacral and lateral-gluteal sensors demonstrated poor peak temperatures, greatest variance in detected wear-time, and thus poor reliability.

This study shows that sensor position and brace-on threshold temperature is critical for accurate, reliable measurement of brace wear. UK temperatures rarely reach 28o making this an ideal threshold for a UK multicentre RCT.

Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

The Effects of the Cognitive-Affective Treatment Modules on the Postural Perception Scale, Focused on Music Tuned to 432Hz and Motivationally Directed Communication, as a Supplement to the Cobb Angle.

by Nanyeong Ji | THINKBODY

Background

The Cobb angle has long been recognized as the "primary disease process outcome," despite some research calling for its alternatives. Given the widely perceived necessity for Cognitive-Affective (CA) therapies for scoliosis, a hypothetical "postural perception scale" may be proposed as such an alternative, given the effects of CA treatment modules on that scale.

Objective

To investigate whether a form of CA therapy, incorporating intervention tools such as music and communication, can lead to improvements in the postural perception scale, as a supplementary index to the Cobb angle.

Methods

We carried out experiments with 50 scoliosis patients, by combining conventional intervention methods such as Schroth exercise with CA treatment modules, including offering music tuned to 432Hz and motivationally oriented communication with the patients and their family members, for 12 weeks. The average age was 21(14-28) and their Cobb angles ranged from 35 to 78, with few of them having surgery or braces.

In addition to regular exercise, the patients were exposed to music tuned to 432Hz during the exercise. Further, our communications with the patients and their family members were aimed at encouraging the scoliosis patients to stay motivated to correct their posture for higher quality of life. Remarkably, our CA Treatment Modules were targeted at introducing positive change to the scoliosis patients, by guiding their healthy eating habits, enhancing the quality of their sleep, sharpening their cognitive skills, and encouraging them to feel "connected" with their therapists and their family members through open and empathetic communication without words of judgment, with a clear objective of establishing good posture.

Before and after the 12-week treatment regiment, the participants rated their "postural perception scale," ranging from 1 to 10, reflecting their perception of pain, whether they could maintain good posture, and their own body images.

Results

Prior to the implementation of our CA Treatment Modules, the participants' average rating on their postural perception scale was 1.4, whereas their overall rating increased to 8.7 following the therapy. In particular, the patients reported higher sense of concentration after being exposed to music tuned to 432 Hz, which resulted in their higher sensitivity to and focus on their muscular movements. Furthermore, the majority of the patients (86%) mentioned that they feel "cherished" and respected as equals when communicating with the therapists, with the results that they were able to stay focused on incorporating good posture in their everyday lives.

Conclusion

Today humans' natural desire for connection is felt more palpably and urgently than ever, and treatment of scoliosis may need to go beyond just improving the Cobb angle, taking into account the research findings of related disciplines. With the Cobb angle continuing to serve   as the primarily desirable outcome of scoliosis treatment, our CA Treatment Modules, given   its inclusion of the postural perception scale as an objective index of quality of life of scoliosis patients, may function as a supplement to the conventional intervention methods, warranting further research on the interdependence of body and mind in scoliosis treatment.
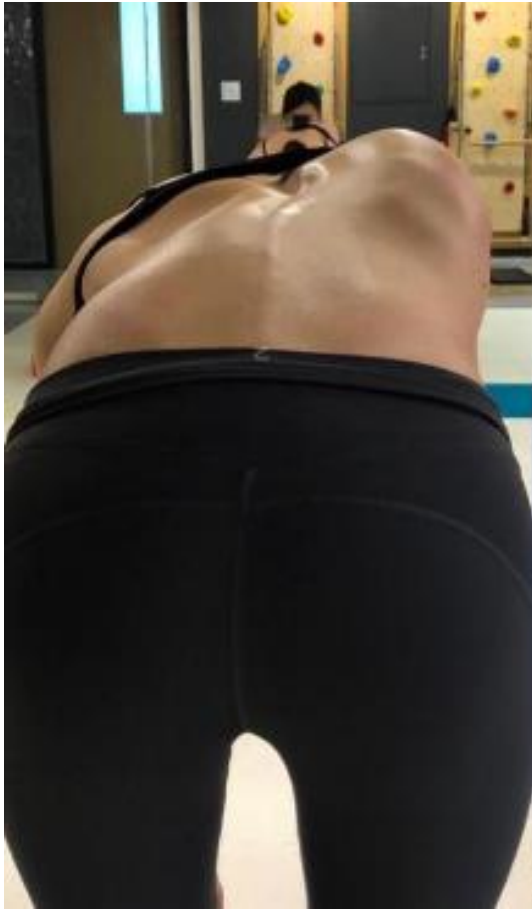
Conflict of Interest Disclosure

We have no Conflicts of Interest to disclose.

Improvements through specific exercises for scoliosis

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