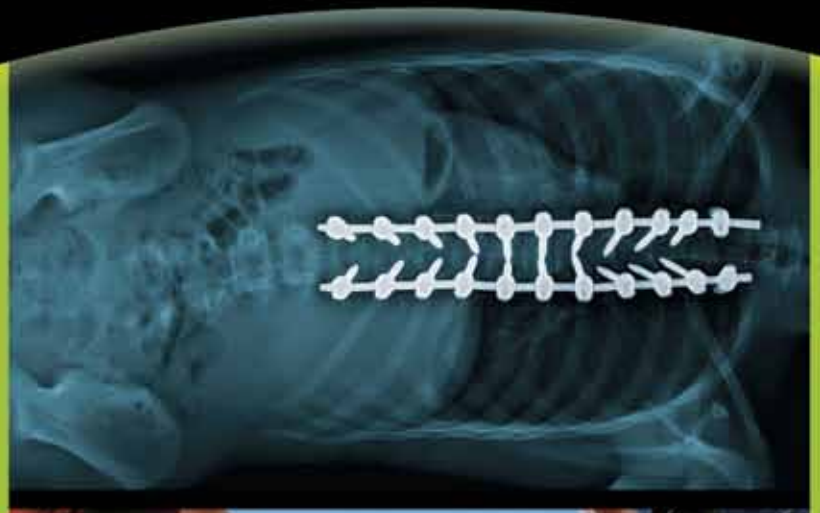
2010 / 2011 ANNUAL REPORT



HARMS STUDY GROUP FOUNDATION

A LETTER FROM THE CHAIRMAN

Childhood and adolescent scoliosis continues to impact the lives of hundreds of thousands of youths. Although scoliosis care has made great strides in the past 50 years, there is certainly room to improve the care and lives of these patients. As any parent knows, a medical condition effecting the health and wellbeing of a child can be devastating. The surgeon members of the Harms Study Group along with their skilled research teams understand this, and continue their dedicated work to improve the treatment of adolescent scoliosis.

It is with great pride that we present the 2010-2011 biannual report of the Harms Study Group Foundation. The vision of the group remains clear and the accomplishments speak for themselves. Each answer to a research question generates several more new questions. This is the way advances in a field are made, and the Harms Study Group remains poised and committed to advancing spinal deformity care through ongoing research. We greatly appreciate the support of our generous donors and top notch research teams that continue to make these advances a reality for our patients.

Peter Newton, MD

President, Harms Study Group Foundation

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THE DIAGNOSIS

SCOLIOSIS, or curvature of the spine, is a devastating diagnosis for a child or adolescent and affects almost 3% of, or an estimated 6 million, people in the United States alone. The diagnosis is usually made between the ages of 8 – 15, at or near the onset of puberty. Each year, hundreds of thousands of children are put into a brace for scoliosis and 38,000 undergo spinal fusion surgery. In spite of extensive research efforts, adolescent scoliosis remains idiopathic, which means cause unknown. Scientists have identified that Idiopathic Scoliosis is a genetic condition and they continue to work to discover the combination of individual genes that cause scoliosis.

Stopping the progression of scoliosis prevents significant health issues associated with severe scoliosis – pulmonary and organ compromise, neurological complications, and muscular pain. Surgical correction of scoliosis changes lives. Normalizing appearance and preventing the progression of the deformity are the goals that motivate orthopaedic surgeons who seek to return children back to an active life – for the long term.

Katie Lyons' ultimate goal was to live the life of an athlete. Surgery to correct Adolescent Idiopathic Scoliosis did not prevent her from competing nationally as a skier while in college.

The experience was so positive that Katie has entered medical school with another goal of specializing in orthopaedics.

A champion swimmer, Kayla Ring had surgery to correct a 59-degree curvature that was causing her rib cage to turn in and contributing to breathing problems. A 2010 graduate of Cal Poly, San Luis Obispo, she looks forward to graduate studies and continuing to compete in triathlons.

Kayla's x-ray before surgery

Kayla's x-ray after surgery

THE RESEARCH

"The HSG allows the most creative minds and skilled surgeons involved in pediatric scoliosis treatment to dream about what the future might hold for their patients…and then go gather the information to validate their innovations and solutions. Scoliosis care is advanced by this collaborative group at a rate that would not be possible without it. "

Peter O. Newton, M.D.

THE PROFESSOR JURGEN HARMS STUDY GROUP

In the late 20th Century, the German school of scoliosis surgery gained international attention. It was at that time that a young German professor, Jürgen Harms, emerged as a leading voice and practitioner for advanced techniques in spine and scoliosis surgery. Since its creation in 1994, the Harms Study Group (HSG) has been dedicated to improving spinal deformity care through excellence in clinical research.

The HSG began with seven participants and is named for world-renowned surgeon, Professor Jürgen Harms, M.D., who continues to participate on its Executive Committee and as one of its fifteen core members. His vision to create a new paradigm to treat scoliosis and his drive to study the outcomes has made the study group's research a significant factor in state-of-the-art treatment for scoliosis and a world-class information source.

At its inception, the Harms Study Group received critical start-up underwriting from German inventor and visionary entrepreneur, Lutz Biedermann, who recognized the impact that collective research could make in the treatment of spinal deformity.

The HSG is a collaborative cohort of distinguished surgeons worldwide who perform comprehensive, multi-center prospective research studies. The group's primary purpose has been the advancement of treatment for children and adolescents with spine deformity. The comprehensive studies answer important clinical questions regarding spinal deformity treatment approach and techniques. The development and maintenance of a strong infrastructure and a robust database - the largest in existence - has been a key to the group's success.

THE RESEARCH

"We are extremely grateful for the continued commitment and support that our sponsors provide to our study group. The long relationship with our sponsors has been successful in allowing our surgeon members to chip away at the knowledge void that faces patients, parents and surgeons dealing with spinal disorders the world over."
HSG Members

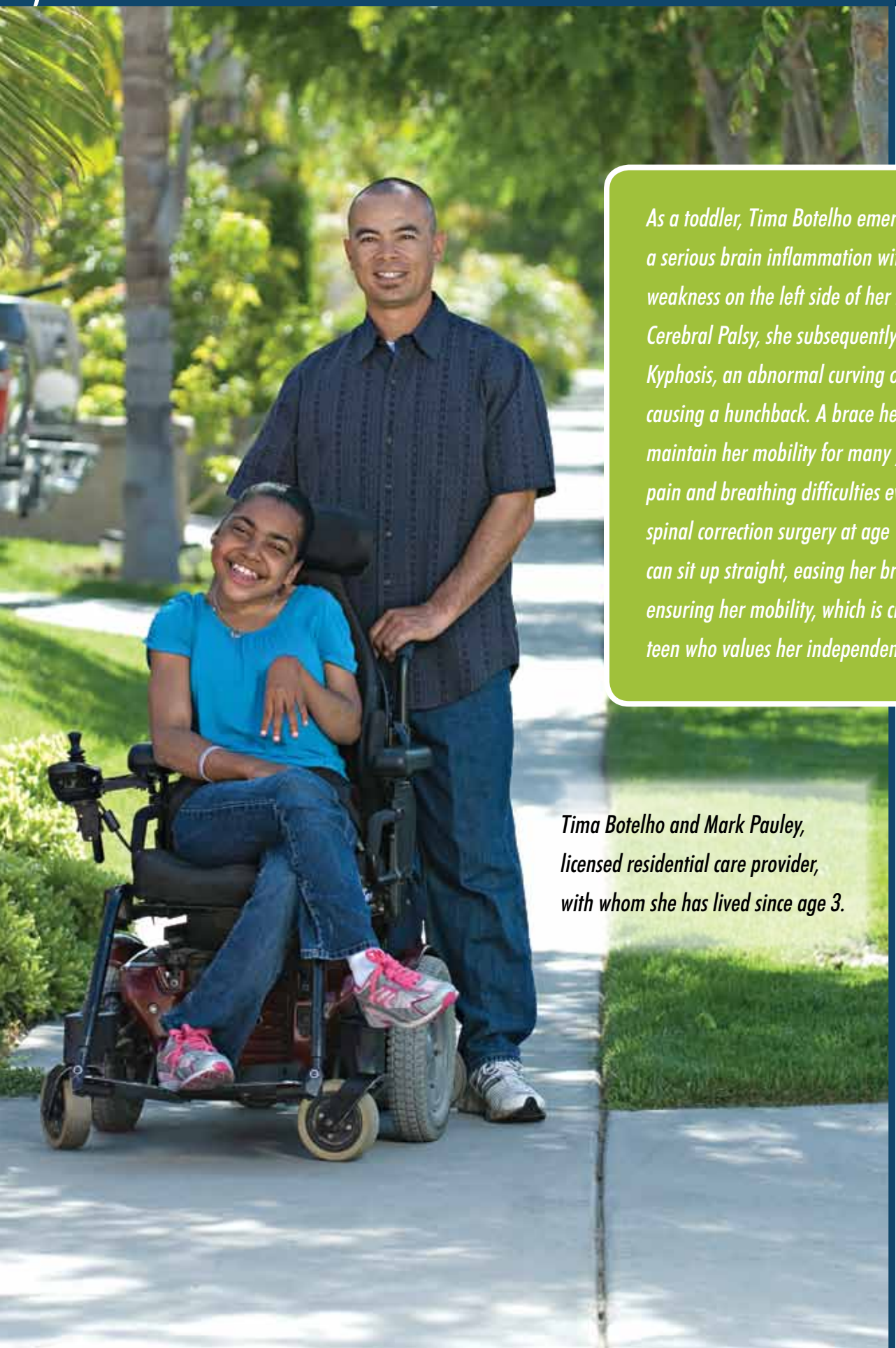
To date, over 3,800 patients with spinal deformity have been enrolled in the prospective research being conducted by the Harms Study Group. Improving patient outcomes remains the primary aim of their research.

During the HSG's seventeen-year existence, 116 publications and 490 scientific presentations have been produced. The positive impact on spinal deformity treatment and advancement of techniques, as a result of this group's research, spreads worldwide through international meetings and through international surgeon membership. HSG research has improved surgical approaches so that a better correction of the deformity is achieved through obtaining a more solid fixation and fusion of the spine.

The medical textbook entitled, *Idiopathic Scoliosis, The Harms Study Group Treatment Guide*, published in 2010, is cited as "essential reading for all involved in the management of spinal deformities."

Currently, the Harms Study Group receives funding from industry research grants, Scoliosis and Orthopedic society research grants, consulting work, database leasing/building and fundraising. This funding supports multi-center research studies and an infrastructure which supports all research and educational endeavors of the group.

Tima Botelho: Correction of her Kyphosis (roundback) allows improved sitting posture for improved activities of daily life.



As a toddler, Tima Botelho emerged from a serious brain inflammation with muscle weakness on the left side of her body. Born with Cerebral Palsy, she subsequently developed Kyphosis, an abnormal curving of the spine causing a hunchback. A brace helped Tima maintain her mobility for many years, but back pain and breathing difficulties eventually led to spinal correction surgery at age 18. Today, Tima can sit up straight, easing her breathing and ensuring her mobility, which is critical for the teen who values her independence.

Tima Botelho and Mark Pauley, licensed residential care provider, with whom she has lived since age 3.

THE GROUP MEMBERS

HSG EXECUTIVE COMMITTEE

Professor Jürgen Harms, M.D.
Chief of Spine Surgery at Klinikum Karlsbad-Langensteinbach, Karlsbad Germany: Professor of Orthopaedic Surgery

Peter O. Newton, M.D.
Chief of Orthopedic Research and the Scoliosis Service at Rady Children's Hospital in San Diego, California; Clinical Professor of Orthopaedic Surgery at the University of California, San Diego; Primary coordinator for the Harms Study Group; HSGF Board member

Randal R. Betz, M.D.
Chief of Staff and Medical Director of Spinal Cord Injury Unit at Shriner's Hospital for Children, Philadelphia, Pennsylvania; Professor of Orthopaedic Surgery at Temple University School of Medicine; Founding member of the Harms Study Group; HSGF Board member

Harry Shufflebarger, M.D.
Director, Division of Spinal Surgery, Department of Orthopedic Surgery, Miami Children's Hospital, Miami, Florida; HSGF Board member

Amer F. Samdani, M.D.
Director of the Spine Service at Shriner's Hospital for Children, Philadelphia, Pennsylvania; HSGF Board member

Michelle C. Marks, PT, M.A.
PT, MA: Research/Executive Director, Harms Study Group Foundation; HSGF Board member

THE GROUP MEMBERS

HSG CORE MEMBERS

There are fifteen core members at any one time. Core members contribute significantly to the main studies of the group. Membership is by invitation of the Executive Committee.

David Clements, M.D.
Director of the Spine and Scoliosis Service at Cooper Bone & Joint Institute, Camden, New Jersey; Associate Professor in the Department of Orthopaedic Surgery, Robert Wood Johnson School of Medicine; Attending Surgeon, Shriners Hospital for Children-Philadelphia Unit; Founding member of the Harms Study Group; Board member

Suken A. Shah, M.D.
Division Chief, Spine and Scoliosis Center at Nemours/Alfred I. DuPont Hospital for Children in Wilmington, Delaware; Fellowship Director, Pediatric Orthopaedic Surgery; Associate Professor of Orthopaedic Surgery at Jefferson Medical College in Philadelphia, Pennsylvania; Board member

Lynn Letko, M.D.
Spinal Surgeon at Klinikum Karlsbad-Langensteinbach, Karlsbad Germany

Jack Flynn, M.D.
Associate Chief in the Division of Orthopaedics at the Children's Hospital of Philadelphia; Associate Professor of Orthopaedic Surgery at the University of Pennsylvania

Baron Lonner, M.D.
Director of Scoliosis Associates and the Spinal Deformity Center at the Hospital for Joint Diseases in New York; Clinical Professor of Orthopaedic Surgery at New York University Medical School; Board member

Firoz Miyanji, M.D.
Spine Surgeon at British Columbia Children's Hospital, Vancouver, British Columbia, Canada

Paul Sponseller, M.D.
Head of the Division of Pediatric Orthopaedics at Johns Hopkins Hospital in Baltimore, Maryland; Professor of Pediatric Orthopaedics, Johns Hopkins Medical Institution

Patrick J. Cahill, M.D.
Spine Surgeon at Shriners Hospital for Children— Philadelphia, Pennsylvania

Hubert Labelle, M.D.
Professor of Surgery at University of Montreal and Chief of the MSK axis of excellence at CHU Saint-Justine Mother and Child University Hospital Center

Burt Yaszay, M.D.
Spine Surgeon at Rady Children's Hospital in San Diego, California; Clinical Assistant Professor of Orthopaedic Surgery at the University of California, San Diego

THE GROUP MEMBERS

HSG ASSOCIATE MEMBERS

Associate members, some of whom have served as Core Members, participate by contributing follow-up data on previously enrolled patients or by contributing patients to prospective studies.

Alvin Crawford, M.D.
Director Emeritus Crawford Spine Center, Cincinnati Children's Hospital Medical Center

Lawrence Lenke, M.D.
Jerome J. Gilden Endowed Professor of Orthopedic Surgery; Co-Chief of Pediatric and Adult Spinal, Scoliosis, and Reconstructive Surgery, Washington University—St. Louis Medical School; Chief of Spinal Surgery, St. Louis Children's Hospital, Missouri

Daniel J. Sucato, M.D.
Staff Orthopedist and Director of the Sarah M. And Charles E. Seay/Martha and Pat Beard Center for Excellence in Spine Research, Texas Scottish Rite Hospital for Children in Dallas, Texas; Professor, Department of Orthopaedic Surgery, University of Texas at Southwestern Medical Center

Mark Abel, M.D.
Lillian Pratt Distinguished Professor & Chair Department of Orthopaedic Surgery, Professor of Pediatrics, University of Virginia, Charlottesville, Virginia

Christopher Reilly, M.D.
Head and Assistant Professor, Division of Pediatric Orthopaedics at the British Columbia Children's Hospital; Director of Postgraduate Education in the University of British Columbia Department of Orthopaedics, Vancouver, British Columbia, Canada

Munish Gupta, M.D.
Professor, Chief of Spine Service, Co-Director of the Spine Center, University of California, Davis Department of Orthopaedic Surgery, Sacramento, California

Michael O'Brien, M.D.
Medical Director of Research, Baylor Scoliosis Center, Plano, Texas

Stefan Parent, M.D., Ph.D.
Orthopaedic Surgeon, Assistant Professor of Surgery, University of Montreal; Ste-Justine Pediatric Spinal Deformity Academic Chair, Montreal, Canada

Peter G. Gabos, M.D.
Co-Director of the Close-Division of Spine and Scoliosis Surgery, Nemours/Alfred I. DuPont Hospital for Children, Wilmington, Delaware; Assistant Clinical Professor of Orthopaedic Surgery, Jefferson Medical College, Philadelphia, Pennsylvania

Jean Ouellet, M.D., FRCSC
Chief of Scoliosis & Spine Center, Montreal Children's Hospital in Montreal, Canada

Stewart K. Tucker, M.D., FRCS
Consultant Spine Surgeon; Lead Clinical Spine Surgery, Great Ormond Street Hospital for Children; Royal National Orthopaedic Hospital, London, UK

Joshua D. Auerbach M.D.
Chief of Spine Surgery, Department of Orhopedics, Bronx-Lebanon Hospital Center, Albert Einstein College of Medicine, Bronx, New York

Peter Sturm, M.D.
Alvin H. Crawford Chair Spine Surgery, Director Crawford Spine Center, Cincinnati Children's Hospital Medical Center, Ohio

Dennis Wenger, M.D.
Rady Children's Hospital in San Diego, Clinical professor of Orthopaedic Surgery at the University of California, San Diego

Jahangir Asghar, M.D.
Spine surgeon, Division of Spinal Surgery, Department of Orthopedic Surgery, Miami Children's Hospital

"Being a part of HSG has allowed me to be mentored and learn from the leaders in the field of scoliosis. From our discussions as a group we hear different perspectives on solving a particular problem, which taken together often results in a solution."

Amer F. Samdani, M.D.

Inset demonstrates the pre-surgical condition compared to the background image illustrating the posterior spinal fusion procedure performed to correct and stabilize scoliosis in this 13 year old girl.

Josh Adams was diagnosed with Adolescent Idiopathic Scoliosis at age 14. Now a high school junior, he is a soccer player and future paramedic.

THE FOUNDATION

FUNDING FOR THE FUTURE: HARMS STUDY GROUP FOUNDATION

The Harms Study Group Foundation is a not-for-profit established in 2008. Its purpose is to enable fundraising efforts by the Harms Study Group membership to further support and advance techniques in the treatment of spinal deformities in children and adolescents.

"HSG participation permits direct access to many thought leaders in spinal surgery. HSG research has been important to me in selecting cutting edge treatment options for my patients."

Harry Shufflebarger, M.D.

GOAL : TO AUGMENT THE CURRENT ANNUAL SUPPORT BY ONE MILLION DOLLARS EACH YEAR IN ORDER TO STRENGTHEN AND EXPAND RESEARCH IN PEDIATRIC AND ADOLESCENT SPINE DEFORMITY.

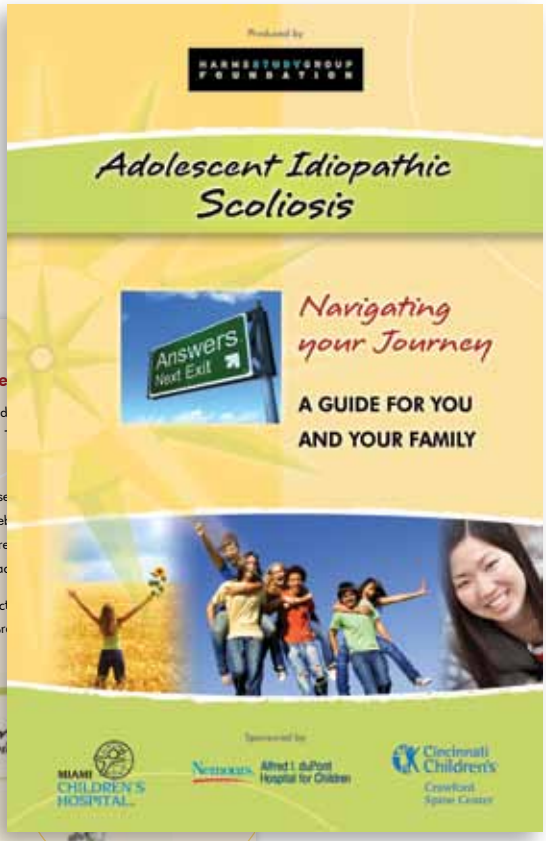
SUPPLEMENTARY FUNDING WILL

- Expand capability with additional sites and researchers
- Incorporate other diagnoses in research studies (Paralytic Scoliosis, Spinal Deformity in Muscle Disease, Congenital Scoliosis, Syndromic Spinal Deformity)
- Increase patient enrollment in all studies
- Continue to upgrade and provide the best and highest quality computerized assessment technology
- Contribute to a better understanding of the natural history of Adolescent Idiopathic Scoliosis that will define and change the indications for surgery, as well as provide significant impact in future treatment of the disease

ADOLESCENT IDIOPATHIC SCOLIOSIS HANDBOOK

The Harms Study Group will provide copies of this booklet to newly diagnosed patients with scoliosis throughout North America and eventually much of the world. We are planning to translate this information into five different languages (Spanish, French, German, Chinese, and Japanese).

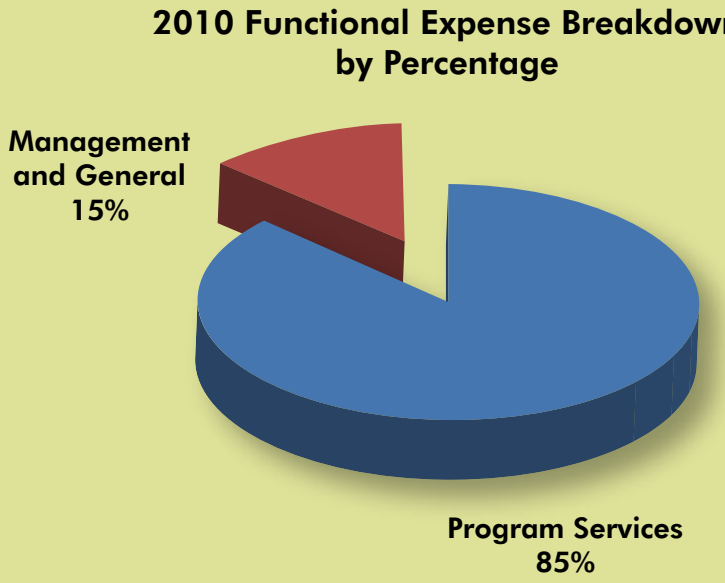
One of the main objectives of our study group is to provide patient and surgeon education in spinal deformity diagnoses, treatment and outcomes. The creation and revision of this handbook has been a significant stride forward in our educational efforts. We are optimistic that the widespread distribution of this handbook will improve the education and support for our patients, their families and the medical community.



HSGF FINANCIAL REPORT

Fiscal Year Ended December 2010

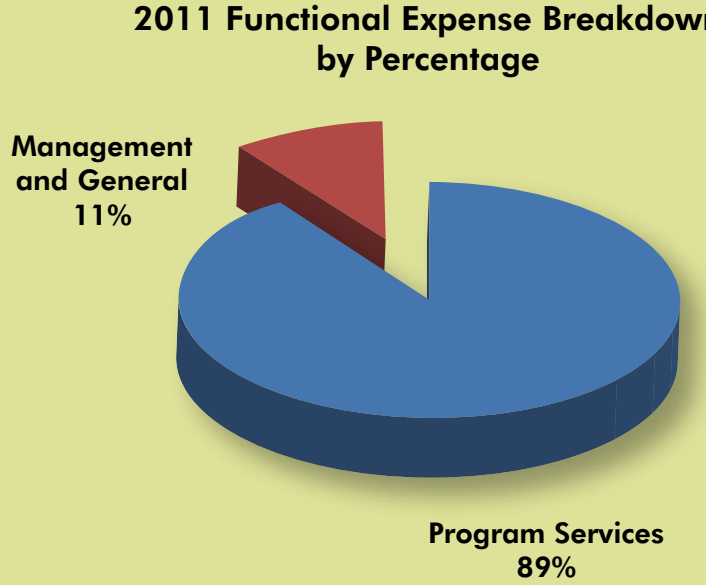
Revenue and support	
Research revenue	$939,080
Contributions	114,600
Database licensing revenue	75,000
Consulting revenue	9,500
Other revenue	2,462
Interest revenue	576
	$1,141,218
Functional expenses	
Program services	$271,751
Management and general	47,156
	$318,907



Fiscal Year Ended December 2011

Revenue and support	
Research revenue	$922,951
Contributions	74,680
Database licensing revenue	10,000
Consulting revenue	5,025
Other revenue	4,769
Interest revenue	6,438
	$1,023,863
Functional expenses	
Program services	$829,773
Management and general	101,856
	$931,629

Not audited



INFRASTRUCTURE

The HSGF Board of Directors is poised for growth and development. Their mission is to enable fundraising efforts to further support and advance techniques in the treatment of spinal deformities in children and adolescents.

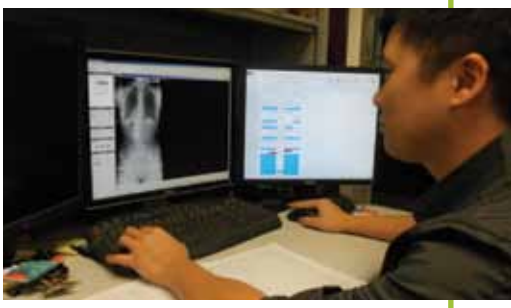
HSGF Board of Directors

Peter Newton, *Chairman* - Board member since 2008
David Clements, *Treasurer* - Board member since 2010
Michelle Marks, *Secretary* - Board member since 2008
Harry Shufflebargers - Board member since 2008
Randy Betz - Board member since 2008
Amer Samdani - Board member since 2008
Suken Shah - Board member since 2010
Baron Lonner - Board member since 2010
Alvin Crawford - Joining in 2012
Tom Errico - Joining in 2012
Sally Lynch - Joining in 2012
Robert Stone - Joining in 2012

The HSGF staff is committed to excellence in research productivity. Our central infrastructure performs central data coordination (x-ray measuring, data QA and verification, image acquisition from sites, Internal Review Board approval and Informed Consent tracking), project management, database management and site management, in addition to, management of the foundation finances, contracting and development.

Staff:

Maty Petcharaporn, BS – HSGF SD Team Manager/ Co-research Director
Harvey Ly, BS – HSGF Webmaster/Central X-ray Measurer
Amy Bartley, BA – HSGF Office Manager/QA Manager
Sierra Abate – HSGF Research Assistant
Caitlin Schulte, BS – HSGF Research Associate
Matt Dolman, BS – HSGF Accountant
Jennifer Kremel, CPA – HSGF External Accountant and Tax Preparer
Jon Marie Basel – HSGF Contracts & Finance Administrator
Tracey Bastrom, MA – HSGF Statistician
Michelle Marks, PT, MA – HSGF Research and Executive Director



HSGF sponsored children's museum event

To learn more about the Harms Study Group Foundation or to make a tax-deductible donation please contact the foundation office at: research@hsgf.org

PRODUCTIVITY

HARMS STUDY GROUP YEARLY PRODUCTIVITY

Year	Podium presentations*	Poster Presentations*	Manuscripts published^
2000	8	10	8
2001	5	5	8
2002	6	8	6
2003	7	5	6
2004	9	3	8
2005	7	17	6
2006	5	12	2
2007	20	49	7
2008	20	31	11
2009	26	24	13
2010	28	26	6
2011	**27**	**34**	**14**

***at AAOS, POSNA, IMAST, SRS, AACPDM, AAP, NASS; ^ in a peer reviewed journal**

HSGF Grateful Patient ...

Kathy is a nineteen year old who underwent spinal surgery in Delaware in 2009. Kathy, who was and is an avid dancer, experienced physical pain and emotional distress after her surgery. At a time when most girls are simply looking forward to their oncoming senior year of high school, Kathy was faced with a long recovery. Kathy never gave up. Since her surgery, Kathy has made an spectacular recovery, and she has also decided to donate an extraordinary amount of her effort and time to improving the lives of others in as many ways as she can.

In October, Kathy organized a pumpkin carving contest to help raise funds for the production of the Harms Study Group Scoliosis Handbook. We still have a ways to go, but Kathy's commitment is making a world of difference. On behalf of all members of the Harms Study Group, thank you, Kathy! We truly appreciate your gifts. If you wish to read more of Kathy's story or find out how you can become involved as a grateful patient, please visit us at www.hsgf.org.

2010 HSG PUBLISHED MANUSCRIPTS

1. Tis JE, O'Brien MF, Newton PO, Lenke LG, Clements DH, Harms J, Betz RR. **Adolescent Idiopathic Scoliosis Treated with Open Instrumented Anterior Spinal Fusion:** Five Year Follow-up. Spine (Philadelphia Pa 1976). 2010 Jan 1; 35 (1): 64-70.

STUDY DESIGN: A multi-center prospective database was queried for patients who underwent open instrumented anterior spinal fusion (OASF) for treatment of primary thoracic (Lenke 1) adolescent idiopathic scoliosis (AIS).

OBJECTIVES: To present the intermediate radiographic and pulmonary function testing (PFT) data from patients who underwent OASF using modern, rigid instrumentation.

SUMMARY OF BACKGROUND DATA: Anterior spinal fusion is an excellent method to correct the three-dimensional deformity produced by AIS. Modern instrumentation consisting of stronger metals, unthreaded rods and dual rod systems should theoretically decrease the incidence of rod breakage, pseudarthrosis and loss of correction seen in earlier OASF studies. The paucity of intermediate and long-term data prevents surgeons and patients from making an informed decision regarding the true incidence of these complications.

METHODS: Of 101 potential patients who underwent OASF with a minimum five year follow-up, 85 (85%) were studied. Standing radiographs were analyzed before surgery and at first standing erect, two year, and five year follow-up. PFT data was collected before surgery and at five years after surgery.

RESULTS: Complete five year follow-up was obtained in 85 patients. Five years after surgery, the mean coronal correction was 26 degrees (51%; $P < 0.05$) and the thoracolumbar/lumbar curve improved 16 degrees (51%). There was a 9 degree ($P < 0.001$) increase in kyphosis, and there were 9 patients (11%) in whom the C7 plumb line translated >2 cm. There was a 6.7% decrease in predicted FEV1 over the five year period, from 75.5% +/- 13% before surgery to 68.8% +/- 2% at five year follow-up ($P = 0.007$); however, there was no significant change in FVC. There were three significant adverse events: one implant breakage requiring re-operation and two cases of progression of the main thoracic curve requiring re-operation.

CONCLUSION: OASF is a reproducible and safe method to treat thoracic AIS. It provides good coronal and sagittal correction of the main thoracic and compensatory thoracolumbar/lumbar curves that is maintained with intermediate term follow-up. In skeletally immature children, this technique can cause an increase in kyphosis beyond normal values, and less correction of kyphosis should be considered during instrumentation. As with any procedure that employs a thoracotomy, pulmonary function is mildly decreased at final follow-up.

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2. Helgeson MD, Shah SA, Newton PO, Clements DH, Betz RR, Marks MC, Bastrom T, Harms Study Group. **Evaluation of Proximal Junctional Kyphosis in Adolescent Idiopathic Scoliosis Following Pedicle Screw, Hook, or Hybrid Instrumentation.** Spine (Philadelphia Pa 1976). 2010 Jan 15; 35 (2): 177-81.

STUDY DESIGN: Retrospective review.

OBJECTIVE: To compare the incidence of, and risk factors, for proximal junctional kyphosis (PJK) in adolescent idiopathic scoliosis (AIS) following posterior spinal fusion using hook, pedicle screw or hybrid constructs.

SUMMARY OF BACKGROUND DATA: Proximal junctional kyphosis is a recently recognized phenomenon in adults and adolescents after AIS surgery. The postoperative effect on PJK with the use of hooks, hybrid constructs or screws has not been compared in a multi-center study to date.

METHODS: From a multi-center database, the preoperative and two year follow-up radiographic measurements from 283 with AIS who were treated with posterior spinal fusion using hooks (group 1, n = 51), hybrid constructs (group 2, n = 177), pedicle screws (group 3, n = 37) and pedicle screws with hooks only at the top level (group 4, n = 18) were compared.

RESULTS: The average proximal level kyphosis at two years after surgery was 8.2 degrees (range -1 to 18) in the all screw constructs, representing a significant increase when compared with hybrid and all hook constructs, 5.7 degrees (P = 0.02) and 5.0 degrees (P = 0.014), respectively. Conversely, average postoperative T5-T12 kyphosis was significantly less (P = 0.016) in the screw group compared with the all hook group. Of potential interest, but currently not statistically significant, was the trend towards a decrease in proximal kyphosis in constructs with all pedicle screws except hooks at the most cephalad segment, 6.4 degrees. The incidence of PJK (assuming PJK is a kyphotic deformity greater than 15 degrees) was 0% in group one, 2.3% in group two, 8.1% in group three, and 5.6% in group four (P = 0.18). Patients with PJK had an increased body mass index compared with those who did not meet criteria for PJK (P = 0.013).

CONCLUSION: Adjacent level proximal kyphosis was significantly increased with pedicle screws, but the clinical significance of this is unclear. A potential solution is the substitution of hooks at the upper-instrumented vertebrae, but further investigation is required.

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3. Lonner BS, Auerbach JD, Sponseller P, Rajadhyaksha AD, Newton PO. **Variations in Pelvic and Other Sagittal Spinal Parameters as a Function of Race in Adolescent Idiopathic Scoliosis.** Spine (Philadelphia Pa 1976). 2010 May 1; 35 (10): E374-7.

STUDY DESIGN: A retrospective review of clinical and radiographic data from a multi-center adolescent idiopathic scoliosis (AIS) database.

OBJECTIVE: The purpose of this study was to perform a comprehensive radiographic evaluation of the differences in pelvic parameters between two groups (white and black) in a scoliotic population.

SUMMARY OF BACKGROUND DATA: Increasingly, the importance of spinopelvic alignment and balance is appreciated as a major factor in the energy-efficient posture of the individual in the normal and diseased states. Pelvic incidence (PI) determines the lordosis of the patient and equations defining the interplay of pelvic parameters, lordosis and kyphosis have been developed to

guide surgical decision-making for spinal deformity. PI and thoracic lordosis have been previously shown to be higher in the AIS population.

METHODS: Data were obtained from a prospective multi-center AIS database from a total of 1658 patients. We evaluated the two largest racial subsets in our database. We identified 421 white and 115 black patients who met inclusion criteria. The parameters evaluated on preoperative full-length coronal and lateral radiographs were PI, sacral slope (SS), pelvic tilt, lumbar lordosis (LL), thoracic kyphosis, sagittal Cobb angle and the shift of the sagittal C7 plumb line.

RESULTS: Age, gender, major and minor Cobb angles were similar in the two groups. PI, pelvic tilt and LL were found to be significantly greater in the black group when compared with the white group (black: 56.0, 13.9, and -63.6 vs. white: 52.5, 10.8, and -59.1).

CONCLUSION: In our study, significant differences were found in three of the six sagittal plane parameters between the two groups. With a larger PI, a larger LL is required in order maintain a neutral sagittal balance. Our results suggest that race may influence an individual's natural spinopelvic alignment, and serves as a reminder when planning surgical reconstruction for spinal deformity.

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4. Newton PO, Yaszay B, Upasani VV, Pawelek JB, Bastrom TP, Lenke LG, Lowe T, Crawford A, Betz R, Lonner B, Harms Study Group. **Preservation of Thoracic Kyphosis is Critical to Maintain Lumbar Lordosis in the Surgical Treatment of Adolescent Idiopathic Scoliosis.** Spine (Philadelphia Pa 1976). 2010 Jun 15; 35 (14): 1365-70.

STUDY DESIGN: Retrospective analysis of prospectively collected multi-center series.

OBJECTIVE: To evaluate the sagittal profile of surgically treated adolescent idiopathic scoliosis (AIS) patients.

SUMMARY OF BACKGROUND DATA: With the increasing popularity of segmental pedicle screw spinal instrumentation, thoracic kyphosis (TK) is often sacrificed to achieve coronal and axial plane correction.

METHODS: Radiographs of AIS patients with a Lenke type 1 deformity and minimum two year follow-up after selective thoracic fusion (lowest instrumented vertebra of T11, T12 or L1) were evaluated. Changes in TK were correlated with changes in lumbar lordosis (LL). Patients were divided according to approach (open/thoracoscopic anterior vs. posterior). Analysis of variance was used to compare pre and postoperative radiographic measures.

RESULTS: Two hundred fifty-one patients (age: 14 +/- 2 years) were included. Sixty-seven percent of the patients had anterior surgery (97 open anterior, 71 thoracoscopic) and 33% (83 patients) had posterior spinal fusion. A decrease in postoperative TK was significantly correlated (P < or = 0.001) with a decrease in LL at first erect (r = 0.3), one year (r = 0.4) and two years (r = 0.4), independent of surgical approach. LL decreased significantly at the first erect regardless of approach (P = 0.003); however, at two year postoperative, TK and LL were significantly decreased after a posterior approach (P < or = 0.001) when compared with an anterior approach that added kyphosis. The decrease in LL (5.6 degrees +/- 9.7 degrees) was nearly twice the decrease in TK (2.8 degrees +/- 11.4 degrees) in the posterior group at two years.

CONCLUSION: Given that thoracic AIS is often associated with a preexisting reduction in TK, ideal surgical correction should address this deformity. Procedures which further reduce TK also reduce LL. It is unclear if the loss of LL from thoracic scoliosis correction will compound the loss of LL that occurs with age and lead to further decline in sagittal balance. With this concern, we recommend a posterior column lengthening and/or an anterior column shortening to achieve restoration of normal TK and maximal LL.

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5. Betz RR, Lavelle WF, Samdani AF. **Bone Grafting Options in Children.** Spine (Philadelphia Pa 1976). 2010 Aug 1; 35 (17): 1648-54.

STUDY DESIGN: Retrospective review of the literature.

OBJECTIVE: To review the current literature as well as recent trends in bone grafting techniques available for children.

SUMMARY OF BACKGROUND DATA: The currently accepted gold standard in bone grafting for adolescent idiopathic scoliosis (AIS) is autogenous iliac crest. Due to questions concerning complications, such as donor site pain, other options have been explored, including various allograft sources, demineralized bone matrix and bone morphogenetic protein.

METHODS: A review of the current medical literature was completed and additional case examples are presented.

RESULTS: A review of the literature reveals that up to 31% of patients have persistent pain at two years post-surgery when autogenous iliac crest bone graft is harvested. Allograft supplementation of local autograft has been demonstrated in the literature to be as effective as autogenous iliac crest bone grafting in contributing to a successful posterior spinal fusion in patients with AIS. Modern demineralized bone matrix formulations have been found in both animal models as well as in a recent retrospective clinical review to contribute to a successful posterior spinal fusion in AIS. Bone morphogenetic protein has been shown to contribute to a successful posterior spinal fusion in complex pediatric spinal deformity patients. At two years follow-up, patients who underwent a posterior instrumented spinal fusion that was not augmented with any bone graft appear to have successful spinal fusions.

CONCLUSION: Although autogenous iliac bone graft remains the benchmark to which bone grafting materials are compared, other options including the placement of no bone graft at all provides similar fusion rates in patients with AIS.

2010 HSG PUBLISHED MANUSCRIPTS

6. Samdani AF, Tantorski M, Cahill PJ, Ranade A, Kock S, Clements DH, Betz RR, Asghar J. **Triggered Electromyography for Placement of Thoracic Pedicle Screws: Is it Reliable?** Eur Spine J. 2011 Jun; 20 (6): 869-74. Epub 2010 Dec 18.

STUDY DESIGN: Retrospective analysis of prospectively collected multi-center series.

SUMMARY OF BACKGROUND DATA: Reliable electromyography (EMG) thresholds for detecting medial breaches in the thoracic spine are lacking, and there is a paucity of reports evaluating this modality in patients with adolescent idiopathic scoliosis (AIS). This retrospective analysis evaluates the ability of triggered EMG to detect medial breaches with thoracic pedicle screws in patients with AIS.

METHODS: We reviewed 50 patients (937 pedicle screws) undergoing posterior spinal fusion (PSF) with intraoperative EMG testing. Postoperative CT scans were used for breach identification, and EMG values were analyzed.

RESULTS: There were 47 medial breaches noted with a mean threshold stimulus of 10.2 mA (milliamperes). Only 8 out of 47 breaches stimulated at 2-6 mA. Thirteen of the forty-seven screws tested at an EMG value ≤6 mA and/or a decrease of ≥65% compared with intraosseously placed screws. The sensitivity and positive predictive value for EMG was 0.28 and 0.21. A sub analysis of T10-T12 screws identified six of seven medial breaches.

CONCLUSIONS: Using guidelines from the current literature, EMG does not appear to be reliable in detecting medial breaches from T2 to T9 but may have some utility from T10 to T12.

2011 HSG PUBLISHED MANUSCRIPTS

1. Dalal A, Upasani VV, Bastrom TP, Yaszay B, Shah SA, Shufflebarger HL, Newton PO. **Apical Vertebral Rotation in Adolescent Idiopathic Scoliosis: Comparison of Uniplanar and Polyaxial Pedicle Screws.** Journal of Spinal Disorders. 2011 Jun; 24 (4): 251-7.

STUDY DESIGN: Retrospective radiographic outcome analysis.

OBJECTIVE: To compare residual postoperative apical vertebral rotation between uniplanar versus polyaxial bilateral pedicle screw constructs in thoracic adolescent idiopathic scoliosis (AIS).

SUMMARY OF BACKGROUND DATA: Vertebral rotation is a component of the three-dimensional deformity of AIS. The correction of vertebral rotation is an important goal of surgery. A comparison of uniplanar versus polyaxial screws has yet to be studied.

METHODS: A review of a multi-center database of Lenke type 1 to 3 AIS patients who underwent surgical correction of thoracic AIS by posterior segmental pedicle screw instrumentation and fusion with either uniplanar or polyaxial pedicle screws and 5.5mm steel rod constructs was performed. Curves greater than 100 degrees were excluded to control for the propensity to use polyaxial screws to correct larger curves. Postoperative apical vertebral rotation of thoracic curves was graded as zero, one or two based on a computed tomography scan-validated radiographic method that uses the relative position of the screw tips to grade apical vertebral rotation at the six week and one year postoperative visits. By this grading method, higher grades correspond to greater residual apical vertebral rotation.

RESULTS: Two hundred and ten patients met the inclusion criteria. The uniplanar screw group included 95 patients whereas the polyaxial screw group had 115 patients. The respective mean preoperative thoracic Cobb angle of 58±12 and 60±13 degrees (P=0.1), first erect postoperative coronal correction of 72% and 74% (P=0.38), and one year correction of 70% and 76% (P=0.07) were not significantly different between the uniplanar and polyaxial groups. At six weeks post-operation, the uniplanar group had 34% of patients with grade zero rotation, 52% with grade one and only 14% with grade two thoracic apical vertebral rotation. In the polyaxial group, only 14% of patients were grade zero, 35% were grade one and 51% were the most rotated grade two. This was a significant difference in the distribution of the axial rotation grades (P<0.001), with less residual apical vertebral rotation with the use of uniplanar screws. The same pattern of results was found at one year postoperative evaluation (P<0.001).

CONCLUSIONS: There was little difference in the coronal plane correction of thoracic curves between the two types of screws. However, the uniplanar pedicle screw group had a larger proportion of patients with greater thoracic apical vertebral derotation (less residual apical vertebral rotation) compared with the polyaxial screw group. This can be attributed to the increase in rotational leverage afforded by uniplanar screws during intraoperative bilateral direct apical vertebral derotation maneuvers.

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2. Newton PO, Farnsworth CL, Upasani VV, Chambers RC, Varley E, Tsutui S. **Effects of Intraoperative Tensioning of an Anterolateral Spinal Tether on Spinal Growth Modulation in a Porcine Model.** Spine (Philadelphia, PA 1976). 2011 Jan 15; 36 (2): 109-17.

STUDY DESIGN: In vivo analysis in an immature porcine model.

OBJECTIVE: To evaluate the effect of intraoperative tensioning of an anterolateral flexible spinal tether on growth modulation manifested as deformity creation, disc response, spinal motion and screw fixation using radiographs, computed tomography, magnetic resonance imaging, biomechanical testing and histology.

SUMMARY OF BACKGROUND DATA: Spinal growth modulation using an anterolateral flexible tether has been proposed as a nonfusion surgical deformity correction strategy for idiopathic scoliosis and has been successfully demonstrated in a porcine model to create spinal deformity while maintaining disc viability.

METHODS: Twelve seven-month old mini-pigs were instrumented with a screw-staple and polyethylene tether construct over four consecutive thoracic vertebrae (T8-T11). Intraoperative tensioning of the tether (250 N) was performed in alternate pigs (Pretensioned and Untensioned groups, n = 6 per group). Screws were coated with hydroxyapatite in half of the animals in each surgical group. Preoperative, postoperative and monthly radiographs were evaluated, comparing deformity creation, vertebral body wedging and disc wedging between the groups. Vertebral body shape was evaluated by computed tomography. Magnetic resonance and histology evaluated disc health. Biomechanical testing was performed to determine the effect of tensioning the tether on spinal motion and screw fixation.

RESULTS: Intraoperative tensioning produced immediate coronal deformity (8° ± 4° vs. 2° ± 1° in untensioned spines; P = 0.01) and apical disc (T9-T10) wedging, vertex on tethered side, (5° ± 2° vs. 2° ± 1°; P = 0.01). After 12 months, the groups were similar in coronal deformity (28° ± 18° pretensioned, 27° ± 11° untensioned, P = 0.88), sagittal deformity (25° ± 3° vs. 22° ± 3°; P = 0.14), vertebral body wedging (10° ± 5° vs. 8° ± 3°; P = 0.45) and disc wedging (-4° ± 1° vs. -4° ± 3°; P = 0.88). There was no radiographic evidence of screw loosening. One of the discs from each group had diminished T2 signal after twelve months of tethering. Tether pretensioning did not affect spinal stiffness or motion. Interestingly, screw fixation increased with pretensioning; however, there was no significant advantage with hydroxyapatite coating. Histology demonstrated normal-appearing discs.

CONCLUSION: Pretensioning of the tether created immediate deformity without effecting ultimate vertebral or disc deformity creation. Spinal motion and stiffness were not altered by pretensioning; however, pretensioning increased the torque required for screw extraction.

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3. Clements DH, Marks MC, Newton PO, Betz RB, Lenke LG, Shufflebarger H, Harms Study Group. **Did the Lenke Classification Change Scoliosis Treatment?** Spine. 2011 Jun 15; 36 (14): 1142-5.

STUDY DESIGN: A retrospective review of data prospectively entered into a multi-center database.

OBJECTIVE: To evaluate the adherence to classification-specific surgical treatment recommendations for adolescent idiopathic scoliosis (AIS) before and after the Lenke classification system introduction in 2001.

SUMMARY OF BACKGROUND DATA: The Lenke classification system of AIS was developed in 2001 to provide a comprehensive and reliable means to categorize and guide treatment. The treatment recommendations of the system state that major and structural minor curves are included in the instrumentation and fusion and the nonstructural minor curves are excluded.

METHODS: Surgical AIS cases for each Lenke classification (curve types 1--6) were queried for "rule breakers," in which the treatment performed did not follow the recommendations of the Lenke classification system. Each "rule breaker" case was individually evaluated to ensure correct Lenke classification and radiographic image verification was performed. "Rule breaker" patients were expressed as a percentage of the total number of patients for each curve type. The presence of "rule breakers" before and after the introduction of the Lenke classification system in 2001 was evaluated for statistical difference using a chi-square analysis.

RESULTS: The data for 1310 AIS patients who underwent surgical correction for their deformity were included in this analysis. Overall, treatment of 191 patients did not follow the classification recommendations; the rules are broken 15% of the time. The proportion of "rule breakers" (18%) was significantly greater prior to the introduction of the Lenke classification system than it was after (12%) (P=0.001).

CONCLUSION: The introduction of this system has led to a reduction in the variation of treatment approaches; however, our data suggest that 6% to 29% of the time, depending on the curve pattern, there are other aspects of the clinical and radiographic deformity that suggest deviation from the recommendations of the classification system. The outcome of adherence to this system remains yet to be evaluated.

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4. Imrie M, Yaszay B, Bastrom TP, Wenger DR, Harms Study Group, Newton PO. **Adolescent Idiopathic Scoliosis: Should 100% Correction Be the Goal?** Journal of Pediatric Orthopedics. 2011 Jan-Feb; 31 (1 Suppl): S9-13.

INTRODUCTION: What constitutes optimal thoracic curve scoliosis correction is controversial. The development and application of powerful pedicle screw-aided instrumentation constructs has, in some cases, led to hypercorrection of the thoracic scoliosis with resulting coronal imbalance, trunk shift and shoulder imbalance. The purpose of this study was to compare the clinical and radiographic outcomes between Lenke 1 patients with the highest and lowest degree of correction to assess this risk. Our hypothesis was that greater scoliosis curve correction can be done without producing secondary decompensation.

METHODS: Using a prospective AIS database, Lenke 1 curves, with two year follow-up (n=385) were ranked by percent coronal correction. The top 15% or high correction group (>80% coronal correction) were compared with the bottom 15% or low correction group (< 40% coronal correction). Clinical and radiographic outcomes, including parameters of coronal and sagittal balance, were compared using ANOVA and χ tests ($P \leq 0.007$).

RESULTS: The high correction group (n=39) and the low correction group (n=40) did not differ preoperatively except in lumbar flexibility. In the coronal plane, the high correction group did not show postoperative clinical imbalance (trunk shift and shoulder height) and had better radiographic balance (C7-CSVL shift). The deformity-flexibility quotient (DFQ), which is the ratio of residual lumbar curve to remaining unfused lumbar segments, was lower (optimal) in the high correction group. The residual rib hump was also better. In the sagittal plane, the high correction group had less kyphosis secondary to a loss of kyphosis compared with a gain (improvement) in the low correction group. Despite these differences, SRS scores were not different.

CONCLUSIONS: Maximizing Lenke 1 curve correction to achieve greater lumbar correction and improved clinical appearance can be done without compromising coronal balance but may occur at the expense of sagittal alignment. However, surgeons who are learning to apply powerful new corrective methods should be cautious in trying to obtain full correction. Proper preoperative evaluation, fusion level selection, and surgical technique are needed to attain this outcome.

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5. Takahashi J, Newton PO, Ugrinow VL, Bastrom TP. **Selective Thoracic Fusion in Adolescent Idiopathic Scoliosis: Factors Influencing the Selection of the Optimal Lowest Instrumented Vertebra.** Spine (Philadelphia, PA 1976). 2011 Jun 15; 36 (14): 1131-41.

STUDY DESIGN: Analysis of multi-center, prospectively collected data.

OBJECTIVE: To determine how selection of the lowest instrumented vertebra (LIV) relative to the stable vertebra (SV) and the end vertebra (EV) effects correction of the main thoracic curve, compensatory lumbar curve and incidence of coronal decompensation after selective thoracic fusion.

SUMMARY OF BACKGROUND DATA: Traditionally, in Lenke type 1B and 1C curves, the LIV is selected as the SV; however, selection of the LIV continues to be controversial.

METHODS: Inclusion criteria were patients with adolescent idiopathic scoliosis (AIS) with Lenke type 1B, 1C or 3C curves that had a selective thoracic fusion with the LIV from T11 to L1 (n=172). The patients were divided into three curve patterns on the basis of the relative position of SV and EV. Group SBE (stable below end; n=93) had SV below EV, group SAE (stable at end; n=66) had SV at the EV, and group EBS (end below stable) (n=13) has EV below SV. In addition, each group was divided into six subgroups based on the selected LIV: LIV above SV, at the SV, below SV, above EV, at the EV and below EV. Each was compared for preoperative and two year postoperative radiographic parameters and clinical data.

RESULTS: In group SBE, the two year postoperative thoracic curve correction rate when the LIV was below the EV (64%+16%) was significantly greater than when the LIV was at the EV (54%+13%; P<0.001). The two year postoperative spontaneous lumbar curve correction (SLCC) rate similarly correlated with the LIV selection subgroups, 52%+20% and 43%+19%, respectively (P=0.03). In group SAE, the two year postoperative thoracic curve correction rate when the LIV was below the EV/SV (64%+14%) was significantly greater than when the LIV was at the EV/SV (52%+14%; P=0.004). The two year postoperative SLCC rate for group SAE similarly correlated with the LIV selection subgroup, 56%+16% and 38%+21%, respectively (P<0.01). In group EBS, the two year postoperative thoracic curve correction and SLCC rates were not significantly different among the LIV selection subgroups; however, the incidence of decompensation was 38%.

CONCLUSION: When performing a selective thoracic fusion of Lenke type 1B, 1C and 3C AIS curves, in which the SV was at or below the EV, the greatest correction of the main thoracic and compensatory lumbar curves occurred when the LIV was at, or at least, one level distal to the SV. This more distal LIV did not result in an increased rate of truncal imbalance.

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6. Tsutsui S, Pawelek JB, Bastrom TP, Shah SA, Newton PO. **Do Discs "Open" Anteriorly with Posterior Only Correction of Scheuermann's Kyphosis?** Spine (Philadelphia, PA 1976). 2011 Jul 15; 36 (16): E1086-92.

STUDY DESIGN: Retrospective radiographic analysis.

OBJECTIVE: To investigate where and to what degree the correction of Scheuermann's kyphosis occurred in two different procedures: posterior instrumentation/fusion with an anterior release and posterior-only instrumentation/fusion with Ponte procedure.

SUMMARY OF BACKGROUND DATA: Controversy remains regarding the outcome for these two procedures. The postoperative segmental disc shape change that account for deformity correction has not been described for either procedure.

METHODS: Eleven patients undergoing a thoracoscopic anterior release followed by posterior instrumentation (A + P) and eleven patients having posterior-only (PO) instrumentation/fusion were retrospectively reviewed. In addition to conventional Cobb measurements, segmental measures of intradiscal angulation as well as anterior and posterior disc heights were made before and after surgery.

RESULTS: The thoracic hyperkyphosis was corrected to similar degrees in both groups (A + P vs. PO, P = 0.87). The PO group averaged 82.7° ± 6.4° before surgery and corrected to 47.9° ± 5.4° after surgery; while the A + P group averaged 84.9° ± 10.2° before surgery and corrected to 48.6° ± 5.7° after surgery. The segmental analysis demonstrated similar degrees of intradiscal angular changes between the two surgical procedures. The majority of the correction occurred at and below the apex and was independent of an anterior release. The changes in both anterior and posterior disc thicknesses were also similar between the two groups. Both groups' anterior disc spaces opened at T8 and below, whereas maximum anterior disc opening occurred at the thoracolumbar junction. To a lesser extent, the posterior disc heights were reduced, but also to similar degrees for both surgical approaches.

CONCLUSION: For both surgical procedures, the majority of the kyphosis correction occurred in the lower thoracic levels and anterior disc heights increased up to twice as much as posterior disc heights shortened. The addition of the anterior release did not significantly alter the degree of correction or the disc shape changes.

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7. Yaszay B, O'Brien M, Shufflebarger HL, Betz RR, Lonner B, Shah SA, Boachie-Adjei O, Crawford A, Letko L, Harms J, Gupta M, Sponseller PD, Abel MF, Flynn J, Macagno A, Newton PO. **Efficacy of Hemivertebrae Resection for Congenital Scoliosis (CS): A Multi-center Retrospective Comparison of Three Surgical Techniques.** Spine (Philadelphia, PA 1976). 2011 Nov 15; 36 (24): 2052-60.

STUDY DESIGN: Multi-center retrospective study.

OBJECTIVE: To compare the outcomes of three surgical treatments for congenital spinal deformity due to a hemi vertebra.

SUMMARY OF BACKGROUND DATA: Congenital anomalies of the spine can cause significant and progressive scoliosis and kyphosis. Their management may be challenging and controversy remains over the "best" surgical treatment.

METHODS: A multi-center retrospective study of patients with congenital spinal deformity due to one or two level hemi vertebra(e) was performed. The surgical treatments included hemiepiphysiodesis or in situ fusion (group 1), instrumented fusion without hemi vertebra excision (group 2), or instrumented hemi vertebra excision (group 3).

RESULTS: Seventy-six patients with minimum two year follow-up were evaluated. The mean age was eight years (range: 1-18). The hemi vertebra were fully segmented, nonincarcerated (67%), incarcerated (1%), and semisegmented (32%). There were 65 patients with single hemi vertebra and 11 patients with double hemi vertebra. There were 14 (18.4%) group 1, 20 (26.3%) group 2, and 42 (55.3%) group 3 patients. Group 1 (37 ± 14°) and group 3 (35 ± 26°) patients had smaller preoperative curves than group 2 patients (55 ± 26°) ($P < 0.01$). Group 3 had better percent correction at two years than groups 1 and 2 ($P < 0.001$). Group 3 had shorter fusion ($P = 0.001$), less estimated blood loss (EBL, $P = 0.03$), and a trend toward shorter operative times than group 2 ($P = 0.10$). The overall complication rate for the entire group was 30% group 1 (23%), group 2 (17%) and group 3 (44%) ($P = 0.09$).

CONCLUSION: While hemi vertebra resection for congenital scoliosis had a higher complication rate than either hemiepiphysiodesis/in situ fusion or instrumentated fusion without resection, posterior hemi vertebra resection in younger patients resulted in better percent correction than the other two techniques.

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8. Hwang SW, Samdani AF, Tantorski M, Cahill PJ, Nydick J, Fine A, Betz RR, Antonacci MD. **Cervical Sagittal Plane Decompensation After Pediatric Idiopathic Scoliosis Surgery: An Effect Imparted by Postoperative Thoaracic Hypokyphosis.** Journal of Neurosurgery, Spine. 2011 Nov; 15 (5): 491-6. Epub 2011 Jul 29.

OBJECTIVE: Several studies have characterized the relationship among postoperative thoracic, lumbar and pelvic alignment in the sagittal plane. However, little is known of the relationship between postoperative thoracic kyphosis and sagittal cervical alignment in patients with adolescent idiopathic scoliosis (AIS) treated with all pedicle screw constructs. The authors examined this relationship and associated factors.

METHODS: A prospective database of pediatric patients with AIS undergoing spinal fusion between 2003 and 2005 was reviewed for those who received predominantly pedicle screw constructs for Lenke Type 1 or Type 2 curves. Parameters analyzed on pre and postoperative radiographs were the fusion levels; cervical, thoracic and lumbar sagittal balance; and C-2 and C-7 plumb lines.

RESULTS: Preoperatively, 6 (Group A) of the 22 patients included in the study had frank cervical kyphosis (mean angle 13.0°) with mean associated thoracic kyphosis of 27.2° (range 16°-37°). Postoperatively, cervical kyphosis (13.0°) remained in the patients in Group A along with mean thoracic kyphosis of 17.7° (range 4°-26°, $p < 0.05$). Preoperatively, the remaining 16 of 22 patients had neutral to lordotic cervical alignment (mean -13.8°) with thoracic kyphosis (mean 45°, range 30°-76°). Postoperatively, 8 (Group B) of these 16 patients demonstrated cervical sagittal decompensation (> 5° kyphosis), with 6 showing frank cervical kyphosis (10.5°, $p < 0.05$). In Group B, the mean postoperative thoracic kyphosis was 25.6° (range 7°-49°, $p < 0.05$). The other 8 patients (Group C) had mean postoperative thoracic kyphosis of 44.1° (range 32°-65°), and there was no cervical decompensation ($p < 0.05$).

CONCLUSIONS: The sagittal profile of the thoracic spine is related to that of the cervical spine. Surgical treatment of Lenke Type 1 and 2 curves that uses all pedicle screw constructs has a significant hypokyphotic effect on thoracic sagittal plane alignment (19 [86%] of 22 patients). If postoperative thoracic kyphosis is excessively decreased (mean 25.6°, $p < 0.05$), the cervical spine may decompensate into significant kyphosis.

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9. Trobisch P, Samdani A, Pahys J, Cahill P. **Post-operative Trunk Shift in Lenke 1 & 2 Curves: How Common Is It? An Analysis of Risk Factors.** Eur Spine J. 2011 Jul; 20 (7): 1137-40. Epub 2011 May 1.

STUDY DESIGN: A retrospective, multi-centered analysis of data.

OBJECTIVE: The purpose of this retrospective, multi-center data analysis was to analyze the incidence of postoperative trunk shift in patients with surgical treatment for AIS.

SUMMARY OF BACKGROUND DATA: The goal of surgical treatment for adolescent idiopathic scoliosis (AIS) is to achieve a solid fusion in a balanced spine. While many previous studies analyzed coronal balance, there is a paucity of studies that comment on postoperative trunk shift, which has shown to have impact on clinical outcome.

METHOD: We conducted a retrospective, multi-center data analysis of 1,555 patients with AIS. Patients with a Lenke type 1 or 2 curve pattern and a minimum follow-up of 24 months after surgery were included. A >2 cm deviation of the trunk in relation to the pelvis was considered positive trunk shift. A sub analysis was performed to identify potential risk factors for trunk shift. 273 patients meeting the inclusion criteria were analyzed.

RESULTS: While the preoperative prevalence of trunk shift was surgically reduced from 29.3 to 13.6%, 24 patients (8.8%) with postoperative trunk shift had not had preoperative trunk shift, and the trunk shift was considered iatrogenic.

CONCLUSION: Under correction of the lumbar curve was identified as potential risk factor, whereas thoracic correction, coronal balance, angulation and translation of the lowest instrumented vertebra did not seem to influence postoperative trunk shift. Iatrogenic postoperative trunk shift has an incidence of 8.8% in the surgical treatment of AIS.

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10. Hwang SW, Samdani AF, Hubler K, Marks MC, Bastrom TP, Betz RR, Cahill PJ. **Effect of Direct Vertebral Body Derotation on the Sagittal Profile in Adolescent Idiopathic Scoliosis.** Eur Spine J. 2011 Aug 30. [Epub ahead of print]

PURPOSE: We sought to clarify the effect of applying derotation maneuvers in the correction of adolescent idiopathic scoliosis (AIS) on the sagittal plane.

METHODS: We retrospectively queried a large, multi-center, prospectively collected database for patients who underwent surgical correction of AIS. All patients had at least two years of follow-up and documentation as to whether or not a derotation maneuver was performed during surgery. All patients underwent posterior spinal fusion with pedicle screw constructs. Patients who underwent concurrent anterior procedures were excluded.

RESULTS: A total of 323 patients were identified, of whom 66 did not have direct vertebral body derotation (DVBD) maneuvers applied during the deformity correction. The remaining 257 had a vertebral body derotation maneuver performed during their surgical correction. Although no significant differences were identified between the two groups when comparing pre-op and post-op thoracic kyphosis using T2-12 and T5-12 endplates, the absolute change in angulation measured from T2-12 was significantly different between the two groups. Postoperatively, the derotation group had a mean decrease in thoracic kyphosis of 5.1 ± 15.3° as compared to 10.8 ± 18.9° in the control group, P = 0.03.

CONCLUSION: Although patients in both groups had decreased mean thoracic kyphosis postoperatively, application of DVBD in the correction of scoliosis did not additionally worsen the sagittal profile.

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11. Marks M, Newton PO, Petcharaporn M, Bastrom TP, Shah S, Betz RR, Lonner B, Miyanji F, Harms Study Group. **Postoperative Segmental Motion of the Unfused Spine Distal to the Fusion in 100 Adolescent Idiopathic Scoliosis Patients.** Spine (Philadelphia, PA 1976). 2011 Oct 21. [Epub ahead of print].

STUDY DESIGN: A cross sectional study.

OBJECTIVE: The purpose of this study was to assess inter-vertebral segmental and cumulative motion in the distal un-fused segments of the spine in patients with Adolescent Idiopathic Scoliosis (AIS) following instrumentation as a function of the lowest instrumented level.

SUMMARY OF BACKGROUND DATA: The implications of hyper or hypo-mobility in the un-fused segments of the spine following instrumentation are poorly understood. There is a paucity of research on changes in functional movement capabilities of the spine following thoracolumbar spinal fusion.

METHODS: Patients were prospectively offered inclusion into this IRB approved cross-sectional study at their routine two, three, four or five year post-operative visit at one of five participating centers. Motion was assessed by standardized radiographs acquired in maximum right, left and forwarding bending positions. The intervertebral angles were measured via digital radiographic measuring software at each level from T12 to S1. The relationship of the vertebral segmental motion for each interspace to the lowest instrumented vertebrae was evaluated with an ANOVA. The relationship between the cumulative preserved motion and each domain of the Scoliosis Research Society (SRS) questionnaire were evaluated using a Pearson's correlation coefficient.

RESULTS: The data for 100 patients are included. The lowest instrumented vertebrae ranged from T10 to L4. In lateral bending, an association was detected between the lowest fused vertebral level and the degree of motion at the distal unfused segments. With a more distal instrumented vertebrae, there was significantly greater L2/L3, L3/L4, and L4/L5 segment motion

(p = 0.002, 0.009 and 0.001 respectively). A similar trend was appreciated at L5-S1 level. In addition, the summed motion from L3 to S1 also increased with a more distal fusion (p = 0.001). Similar results were not found in forward bending. None of the domains of the SRS questionnaire correlated with the preserved L3-S1 motion.

CONCLUSION: In a group of post-operative adolescent idiopathic scoliosis patients, evaluation of the distal unfused intervertebral motion showed that preservation of vertebral motion segments allowed greater distribution of functional motion across more levels. With each distal fusion level, motion was significantly increased at the L2/L3, L3/L4, and L4/L5 segmental levels in lateral bending. The relationship between the increased motion and subsequent disc degeneration with a more distal fusion is unknown, but suspected.

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12. Dhawale AA, Shah SA, Sponseller PD, Bastrom T, Neiss G, Yorgova P, Newton PO, Yaszay B, Abel MF, Shufflebarger H, Gabos PG, Dabney KW, Miller F. **Are Antifibrinolytics Helpful in Decreasing Blood Loss and Transfusions During Spinal Fusion Surgery in Children With Cerebral Palsy Scoliosis?** Spine (Philadelphia, PA 1976). 2011 Oct 27. [Epub ahead of print]

STUDY DESIGN: Therapeutic comparative study.

OBJECTIVE: To evaluate the safety and efficacy of antifibrinolytic agents in reducing blood loss and transfusions during posterior spinal fusion (PSF) in children with cerebral palsy (CP) scoliosis.

SUMMARY OF BACKGROUND DATA: Scoliosis surgery in children with CP is associated with substantial blood loss. Few reports on the role of antifibrinolytics exist.

METHODS: A multi-center, retrospective review of a prospectively collected database of 84 consecutively enrolled CP patients (age < 18 yrs) with spinal deformity who underwent PSF and instrumentation. The use of antifibrinolytics, tranexamic acid (TXA), epsilon-aminocaproic acid (EACA) or none was based on surgeon preference. Estimated blood loss (EBL), transfusion requirements, and length of stay were recorded. Analysis was performed with the independent samples t test and one way ANOVA with post hoc Bonferroni analysis.

RESULTS: The average age at surgery was 14.4 ± 2.6 years. The groups were well matched in preoperative major deformity, age, levels fused and operating time. Forty-four patients received antifibrinolytics (30 TXA and 14 EACA), and forty received no antifibrinolytics (NAF). The EBL averaged 1684 ml for the antifibrinolytics group and 2685 ml for the NAF group, P = 0.002. There was more cell salvage transfusion in the NAF group. No significant differences were found in total transfusion requirements. There was a trend for decreased hospital stay in the antifibrinolytics group. No adverse effects were seen. On comparison of the three groups (NAF, TXA, and EACA), a significant difference was observed between the TXA and the other groups with respect to EBL and cell salvage transfusion.

CONCLUSION: Antifibrinolytics significantly reduced intra-operative EBL associated with PSF, with no adverse effects; however, we could not demonstrate significant differences in total transfusion, except in cell salvage. Tranexamic acid was more effective than EACA in decreasing the EBL and cell salvage transfusion.

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13. Sponseller PD, Flynn JM, Newton PO, Marks MC, Bastrom TP, Petcharaporn M, McElroy MJ, Lonner BS, Betz RR, the Harms Study Group. **The Association of Patient Characteristics and Spinal Curve Parameters with Lenke Classification Types.** Spine (Philadelphia, PA 1976). 2011 Nov 14. [Epub ahead of print]

STUDY DESIGN: Retrospective review.

OBJECTIVE: To determine the association of patient characteristics and spinal curve parameters with Lenke curve types.

SUMMARY OF BACKGROUND DATA: The Lenke curve classification may be used for surgical planning and clinical research.

METHODS: We retrospectively reviewed the records of 1912 patients with adolescent idiopathic scoliosis who underwent initial surgery at ≤21 years; collected data on patient age, patient gender, primary curve magnitude (<50°, 50° to 75°, and >75°) and SRS-22 outcome score; and compared that data by Lenke curve type. ANOVA and chi-square tests were used as appropriate (significance level, $P \leq 0.005$).

RESULTS: Lenke types vary by gender: males had more major thoracic (types 1 - 4) than major thoracolumbar/lumbar (types 5 and 6) curves, fewer lumbar C-modifiers (32% vs. 44%), and less apical lumbar translation (1.1 vs. 1.7 cm). Lenke types vary by frequency: the most common type was 1 (50%); the least common, 4 (4%). Lenke types vary by magnitude: type 4 had the greatest percentage of large curves (52% of curves >75), most of the smaller curves were types 1 and 5, and type 4 had the largest mean magnitude (78° ± 17°). Lenke types vary by patient age: type-5 curves occurred in the oldest patients (average age at surgery: 15.4 ± 2.2 vs. 14.3 ± 14.6 years for all others), despite having the lowest mean magnitude ($P = 0.001$); curve size was negatively correlated with age at surgery ($r = -0.16$, $P = 0.001$). Lenke types vary by patient self-image: patients with type-4 curves had lower preoperative SRS outcome scores for self-image than did patients with type-1 curves ($P = 0.005$).

CONCLUSIONS: Lenke types vary by gender, frequency magnitude, patient age and patient self-image, all of which should be considered in designing studies.

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14. Mulcahey MJ, Chafetz RS, Santangelo Am, Costello K, Merenda LA, Calhoun C, Samdani AF, Betz RR. **Cognitive Testing of the Spinal Appearance Questionnaire With Typically Developing Youth and Youth With Idiopathic Scoliosis.** Journal of Pediatric Orthopedic Surgery. 2011; 31: 661–667. Volume 31, Number 6, September 2011.

BACKGROUND: The Spinal Appearance Questionnaire (SAQ) underwent initial psychometric studies, which suggested good reliability and discriminative ability. Although the SAQ is used as a self report of appearance, our center was concerned about its use with youth owing to complex words and vague questions. We conducted this cross-sectional study to evaluate the readability, comprehension and interpretation of items on the SAQ.

METHODS: Cognitive interview methodology of 76 youths (8 to 16 years; average age 13) included 31 with scoliosis and 45 typically developing. Subjects were required to read each SAQ item and think aloud to capture cognitive processes about the items and responses. Interviews were audio taped and transcribed verbatim. Problems were categorized and frequencies for each category were calculated.

RESULTS: There were reading and comprehension problems and problems understanding the illustration with every written and pictorial SAQ item, respectively. The percent of subjects who encountered at least one problem ranged from 16% to 96%. Subjects had difficulty with understanding the intent of every SAQ item and with understanding the meaning of specific words such as "prominence" and "flank." The pictorial illustrations for items 2 and 3 were problematic for 58% and 49% of subjects, respectively. The illustrations of the lungs (item 4) and hips (items 4 and 5) were problematic for 42% and 27% of subjects, respectively. These results were consistent regardless of age or diagnoses.

CONCLUSION: This study does not support the use of the SAQ as currently used with youth owing to use of complex medical words, vague questions, difficult illustrations and various interpretations of the intent of many of the items.

2010 SCIENTIFIC PRESENTATIONS

American Academy of Orthopedic Surgeons (AAOS) Annual Meeting New Orleans, LA - March 9-15, 2010

1. Lonner et al. **Scheuermann's Kyphosis: Prospective Evaluation of Clinical Presentation.** American Academy of Orthopaedic Surgeons Annual Meeting. New Orleans, LA March 9-15, 2010 (poster).

2. Lonner et al. V**alidation: Body Image Disturbance Questionnaire-Scoliosis version.** American Academy of Orthopaedic Surgeons Annual Meeting. New Orleans, LA March 9-15, 2010 (poster).
3. Newton et al. **Left Thoracic Curves Are Not a Mirror Image of Right Thoracic Curves.** American Academy of Orthopaedic Surgeons Annual Meeting. New Orleans, LA March 9-15, 2010 (podium).
4. Marks et al. **Surgical Site Infection (SSI) in Spinal Surgery: The Newest "Never" Event.** American Academy of Orthopaedic Surgeons Annual Meeting. New Orleans, LA March 9-15, 2010 (podium).
5. Yaszay et al. **Does Maximizing Curve Correction of Lenke 1 Curves in AIS Risk Secondary Decompensation?** American Academy of Orthopaedic Surgeons Annual Meeting. New Orleans, LA March 9-15, 2010 (podium).
6. Yaszay et al. **A New Indication for Ponte releases in AIS.** American Academy of Orthopaedic Surgeons Annual Meeting. New Orleans, LA March 9-15, 2010 (podium).

Pediatric Orthopedic Society of North America (POSNA) Annual Meeting - Waikola, HI - May 4-7, 2010

7. Marks et al. **A More Distal Fusion is Associated with Increased Motion at L4/L5: A Set Up for Degeneration?** Pediatric Orthopedic Society of North America Annual Meeting, Waikola, Hawaii May 4-7, 2010 (podium).
8. Shah et al. **Longer Surgical Times May Increase Your Complication Rate.** Pediatric Orthopedic Society of North America Annual Meeting, Waikola, Hawaii May 4-7, 2010 (poster).
9. Yaszay et al. **Does Maximizing Curve Correction of Lenke 1 Curves in AIS Risk Secondary Decompensation?** Pediatric Orthopedic Society of North America Annual Meeting, Waikola, Hawaii May 4-7, 2010 (podium).

International Meeting on Advanced Spine Techniques (IMAST) Annual Meeting - Toronto, CA - July 21-24, 2010

10. Cahill et al. How Tall Will I Be After My Scoliosis Surgery?: **A Uni- and Multi-variate Analysis of Factors Associated with Change in Height in 461 AIS Patients.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
11. Cahill et al. **Impact of Derotation Maneuvers on the Thoracic Sagittal Plane in Adolescent Deformity Correction.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
12. Cahill et al. **Obesity Does Not Affect Fusion Levels in Adolescent Idiopathic Scoliosis: A Matched Cohort Analysis.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
13. Cahill et al. **Does Pedicle Screw Instrumentation Improve Trunk Shape Compared to Hybrid Techniques?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
14. Clements et al. **The Effect on Pedicle Screw Pullout Strength of Optimizing Pedicle Fill using a Tool to Size and Dilate the Pedicle.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (podium).

2010 SCIENTIFIC PRESENTATIONS

15. Letko et al. **Posterior Hemivertebra/Bar Resection and Segmental Instrumentation in the Treatment of Congenital Scoliosis at the Cervicothroracic Junction.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (podium).
16. Letko et al. **Hypokyphosis/Lordosis in Lenke 1 AIS Curves: Should the Sagittal Profile Determine the Scoliosis Classification?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
17. Lonner et al. **Body Image Disturbance Questionnaire-Scoliosis Version: Responsiveness to Change Associated with Surgical Treatment.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (podium).
18. Lonner et al. **Adolescent Idiopathic Scoliosis: Does Disease Severity Vary By Country?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
19. Lonner et al. **Race and Adolescent Idiopathic Scoliosis: Are There Racial Differences in Deformity Characteristics and Clinical Severity Preoperatively?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
20. Lonner et al. **Early and 1 Year Complication and Re-operation Rates in Scheuermann's Kyphosis: A Comparative Analysis to Operative Adolescent Idiopathic Scoliosis.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
21. Miyanji et al. **Does Statistical Significance of SRS-22 Correlate with Clinical Significance? A multi-center Longitudinal Study Evaluating the Minimal Clinically Important Difference of the SRS-22.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
22. Miyanji et al. **Impact of Surgical Waitlists On Scoliosis Surgery: Surgeon's Perspective.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
23. Newton et al. **3-Dimensional Correction of Severe Scoliosis: Should We Bring the Anterior Release Back?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
24. Newton et al. **The 15-Year Evolution of the Thoracoscopic Anterior Release: Does it Still Have a Role?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (podium).

25. Newton et al. **Defining Two Components of Shoulder Balance: Clavicle Tilt and Trapezial Prominence.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
26. Newton et al. **Does More Complete Thoracic Apical Vertebral Derotation Really Help with the Rib Prominence?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (podium).
27. Newton et al. **A Novel Method for Assessing Axial Plane Rotation based on Differential Rod Curvature on the Lateral Radiograph.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
28. Newton et al. **Ideal Rod Contouring for Maintaining Sagittal Alignment in AIS: How much to Over Bend.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
29. Samdani et al. **Direct Vertebral Body Derotation, Thoracoplasty or Both: Which is Better with Respect to Inclinometer and SRS-22 Scores?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (podium).
30. Samdani et al. **Direct Vertebral Body Derotation: How much Correction of the Rib Hump can be Expected?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (podium).
31. Shah et al. **Does Obesity Affect Sagittal Alignment in Adolescent Idiopathic Scoliosis?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).

2010 SCIENTIFIC PRESENTATIONS

32. Shah et al. **Rod Strength: Is it an Important Factor in Coronal and Sagittal Realignment after Surgery for Adolescent Idiopathic Scoliosis?** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (podium).
33. Yaszay et al. **Adding Fusion to the Thoracic Curve in Lenke 5 Curves – Risks and Benefits.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (podium).
34. Yaszay et al. **Factors Influencing Fusion of the Thoracic Spine in Thoracolumbar/ Lumbar Curves.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).
35. Yaszay et al. **When every Dose of Radiation Matters in the Young Patient: How do Bending Films Influence Surgical Decision Making in Moderate AIS Curves.** International Meeting on Advanced Spine Techniques, Toronto Canada July 21-24, 2010 (poster).

Scoliosis Research Society (SRS) Annual Meeting Kyoto, Japan – Sept. 22-25, 2010

36. Mulcahey et al. **Cognitive Testing of the Spinal Appearance Questionnaire (SAQ) with Typically Developing Youth and Youth with Idiopathic Scoliosis.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).
37. Cahill et al. **Factors Associated with Loss of Coronal Deformity Correction in Patients with AIS.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).
38. Cahill et al. **Impact of Derotation Maneuvers on the Thoracic Sagittal Plane in Adolescent Deformity Correction.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (poster).
39. Flynn et al. **Selective Thoracic Fusion in Adolescent Idiopathic Scoliosis: Implications of Leveling of the Lowest Instrumented Vertebra on Lumbar Curvature and Coronal Balance.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).
40. Lonner et al. **Body Image Disturbance Questionnaire-Scoliosis Version: Discriminant Validity in AIS.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).
41. Miyanji et al. **Larger Curve Magnitude is Associated with Increased Perioperative Healthcare Resource Utilization: A Multi-center Analysis of 422 Adolescent Idiopathic Scoliosis Curves.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).
42. Newton et al. **Which Lenke 1A Curves Are The Greatest Risk for Adding-On… and Why?** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).
43. Newton et al. **The 15-Year Evolution of the Thoracoscopic Anterior Release: Does it Still Have a Role?** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (poster).
44. Newton et al. **Defining Two Components of Shoulder Balance: Clavicle Tilt and Trapezial Prominence.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (poster).
45. Samdani et al. **Direct Vertebral Body Derotation, Thoracoplasty or Both: Which is Better with Respect to Inclinometer and SRS-22 Scores?** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (poster).
46. Sponseller et al. **Significant Differences among Patients in Lenke Curve Types.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).
47. Sponseller et al. **Do Pedicle Screws Alone Control Curves in Patients with Open Triradiate Cartilages?** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).
48. Yaszay et al. **A Comparison of Perioperative and Delayed Major Complications Following 1630 AIS Procedures.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).
49. Yaszay et al. **Adding Fusion to the Thoracic Curve in Lenke 5 Curves – Risks and Benefits.** Scoliosis Research Society Annual Meeting. Kyoto Japan Sept. 22-25, 2010 (podium).

2010 SCIENTIFIC PRESENTATIONS

American Academy of Cerebral Palsy and Developmental Medicine (AACPDM) Annual Meeting – Washington, DC – Sept. 22-25, 2010

50. Narayanan et al. **Sensitivity of the CPCHILD Questionnaire to change following surgery for scoliosis in children with severe cerebral palsy.** American Academy of Cerebral Palsy and Developmental medicine Annual Meeting. Washington, DC Sept. 22-25, 2010 (podium).

North American Spine Society (NASS) Annual Meeting Orlando, FL – Oct. 5-10, 2010

51. Lonner et al. **Race and Adolescent Idiopathic Scoliosis: Are There Racial Differences in Deformity Characteristics and Clinical Severity Preoperatively?** North American Spine Society Annual Meeting. Orlando, FL. October 5-10, 2010 (poster).

American Academy of Pediatrics (AAP) Annual Meeting San Francisco, CA – Oct. 2-5, 2010

52. Flynn et al. **What is different after surgery for AIS patients who enjoy a "minimal clinically important difference" (MCID)?** American Academy of Pediatrics Annual Meeting. San Francisco, CA October 2-5, 2010 (podium).
53. Newton et al. **Ideal rod contouring for maintaining sagittal alignment in AIS: How much to Over Bend.** American Academy of Pediatrics Annual Meeting. San Francisco, CA October 2-5, 2010 (podium).
54. Shah et al. **Does Obesity Affect Sagittal Alignment in Adolescent Idiopathic Scoliosis?** American Academy of Pediatrics Annual Meeting. San Francisco, CA October 2-5, 2010 (podium).

2011 SCIENTIFIC PRESENTATIONS

American Academy of Orthopedic Surgeons (AAOS) Annual Meeting San Diego, CA – February 16-19, 2011

1. Ono, Bastrom, Newton, HSG. **Defining Two Components of Shoulder Balance: Clavicle Tilt and Trapezial Prominence.** American Academy of Orthopaedic Surgeons Annual Meeting. San Diego CA Feb 16-19, 2011 (poster).
2. Sponseller, Flynn, Newton, Marks, Bastrom, Petcharaporn, Betz. **Significant Differences Among Patients in Lenke Curve Types.** American Academy of Orthopaedic Surgeons annual meeting. San Diego CA Feb 16-19, 2011 (podium).
3. Sponseller, Newton, Lonner, Shah, Shufflebarger, Betz, Marks, Bastrom. **Do Pedicle Screws Alone Control Curves in Patients with Open Triradiate Cartilages?** American Academy of Orthopaedic Surgeons annual meeting. San Diego CA Feb 16-19, 2011 (podium).
4. Yaszay, Schulte, Marks, Newton, Betz, Shah, Lonner, Shufflebarger, Flynn, HSG. **A Comparison of Perioperative and Delayed Major Complications Following 1630 AIS Procedures.** American Academy of Orthopaedic Surgeons annual meeting. San Diego CA Feb 16-19, 2011 (poster).
5. Yaszay, Bartley, Bastrom, Newton, HSG. **When Every Dose of Radiation Matters in the Young Patient: How Do Bending Films Influence Surgical Decision Making in Moderate AIS Curves?** American Academy of Orthopaedic Surgeons annual meeting. San Diego CA Feb 16-19, 2011 (poster).

American Academy of Neuro Surgeons (AANS) Annual Meeting, Phoenix, AZ - March 9-11, 2011

6. Hwang, Samdani, Lonner, Newton, Marks, Bastrom, Betz, Cahill. **Direct Vertebral Body Derotation, Thoracoplasty or Both: Which is Better with Respect to Inclinometer and SRS-22 Scores?** American Academy of Neurosurgeons Annual Meeting. Phoenix, AZ Mar 9-11, 2011 (poster).
7. Hwang, Samdani, Lonner, Newton, Marks, Bastrom, Betz, Cahill. **Direct Vertebral Body Derotation: How Much Correction of the Rib Hump Can Be Expected?** American Academy of Neurosurgeons Annual Meeting. Phoenix, AZ Mar 9-11, 2011 (poster).
8. Hwang, Marks, Bastrom, Betz, Cahill, Samdani. **Direct Vertebral Body Derotation: A Comparison of Different Techniques.** American Academy of Neurosurgeons Annual Meeting. Phoenix, AZ Mar 9-11, 2011 (poster).

Pediatric Orthopedic Society of North America (POSNA) Annual Meeting, Montreal, Canada - May 11-14, 2011

9. Miyanji, Slobogean, Verghese, Reilly, Betz, Newton. **Does Statistical Significant of SRS-22 Correlate with Clinical Significance? A Multi-center Longitudinal Study Evaluating the Minimal Clinically Important Difference of the SRS-22.** Pediatric Orthopedic Society of North America Annual Meeting Montreal CA May 11-14, 2011. (poster).
10. Yaszay, Schulte, Marks, Newton, Betz, Shah, Lonner, Shufflebarger, Flynn, HSG. **A Comparison of Perioperative and Delayed Major Complication Following 1630 AIS Procedures.** Pediatric Orthopedic Society of North America Annual Meeting Montreal CA May 11-14, 2011 (podium).
11. Lark, Yaszay, Bastrom, Newton, HSG. **Adding Fusion to the Thoracic Curve in Lenke 5 Curves – Risks and Benefits.** Pediatric Orthopedic Society of North America Annual Meeting Montreal CA May 11-14, 2011 (podium).
12. Faloon, Shah, Betz, Newton, Lonner, Shufflebarger, HSG. **Better Clinical Outcomes with All Pedicle Screw Constructs in Patients Surgically Treated for Adolescent Idiopathic Scoliosis (AIS).** Pediatric Orthopedic Society of North America Annual Meeting Montreal CA May 11-14, 2011 (poster).

2011 SCIENTIFIC PRESENTATIONS

European Pediatric Orthopedic Society (EPOS) Annual Meeting Switzerland – April 6-9, 2011

13. Narayanan, Sponseller, Weir, Marks, Newton, HSG. **Sensitivity of the CPCHILD Questionnaire to Change Following Surgery for Scoliosis in Children with Severe Cerebral Palsy.** European Pediatric Orthopedic Society Annual Meeting Switzerland Apr 6-9, 2011 (podium).

International Meeting on Advanced Spine Techniques (IMAST) Annual Meeting Toronto, CA - July 13-16, 2011

14. Asghar, Shufflebarger, Bastrom, Morales. **Establishing Parameters for T12 as the Lowest Instrumented Vertebra (LIV) in Selective Thoracic Fusions.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).
15. Asghar, Bastrom, Marks, Morales, Samdani, Shufflebarger. **Evolution of Treatment Trends in AIS Surgery Across Implant Eras: How Has Our Practice Changed?** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).
16. Asghar, Sponseller, Morales, Shufflebarger. **Delayed Quadraparesis After Posterior Spinal Fusion for Scoliosis: A Case Series.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).
17. Bess, Yaszay, Line, Gupta, Schwab, Lonner, Lafage, Burton, Akbarnia, Boachie-Adjei, Hart, Hostin, Shaffrey, Study Group International Spine. **Surgical Treatment for Moderate Sized Main Thoracic Scoliosis Demonstrates Similar Acute Perioperative Outcomes for Adolescent and Adult Idiopathic Scoliosis: A Prospective, Matched Cohort Evaluation.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).
18. Letko Ruf, Harms. **Growth Sparing Spinal Deformity Surgery in Children <10 Years Of Age.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).
19. Letko, Ruf, Harms. **The Role of Closed Reduction under General Anesthesia in the Treatment of C1/C2 Rotatory Subluxation in Children.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (podium).
20. Lonner, Cahill, Newton, Terran, Shah, Sponseller, Shufflebarger. **Sagittal Spino-Pelvic Parameters in Scheuermann's Kyphosis–A Preliminary Study.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).
21. Lonner, Terran, Newton, Shah, Shufflebarger, Betz, Samdani, Sponseller, Bastrom. **Is Pre-op PFT Assessment Worthwhile in Scheuermann's Kyphosis?** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).
22. Lonner, Yaszay, Terran, Newton, Shah, Sponseller, Samdani, Betz, Shufflebarger. **Early and One Year Complication Rates in Scheuermann's Kyphosis: Are the Surgical Challenges Different from Adolescent Idiopathic Scoliosis?** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).
23. Lonner, Terran, Shufflebarger, Mo, Pellise, Fazal, Kim, Boachie. **Adolescent Idiopathic Scoliosis: Does Disease Severity Vary by Country?** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

2011 SCIENTIFIC PRESENTATIONS

24. Marks, Bastrom, Petcharaporn, Betz, Shufflebarger, Lonner, Shah, Newton. **Trunk Motion Improves over Time after Spinal Fusion for AIS.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

25. Marks, Bastrom, Petcharaporn, Betz, Shufflebarger, Lonner, Shah, Newton. **Post-Operative Trunk Mobility is Better with the Anterior Approach Versus Posterior in Thoracolumbar Scoliosis.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

26. Miyanji, Marks, Samdani, Shufflebarger, Suken, Betz, Newton. **Baseline Data Variability in Prospective Multi-center Databases: How Comparable is the Data Between Different Centers?** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

27. Alam, Newton, Yaszay, Bastrom, HSG. **Are Thoracic Curves with a Low Apex (T11 or T11/12) Really Thoracic Curves?** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

28. Demura, Newton, Yaszay, Bastrom, Schlechter, HSG. **Does Fusion into the Upper Thoracic Spine Cause a Reduction of Pulmonary Function in AIS?** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

29. Carreau, Bastrom, Petcharaporn, Schulte, Marks, Newton. **Reliability of SterEOS Imaging Software in AIS Curves Greater than 50 Degrees.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

30. Samdani, Marks, Bastrom, Cahill, Garg, Lonner, Shah, Miyanji, Shufflebarger, Newton, Betz. **Treatment of AIS with All Pedicle Screw Constructs with Minimum 5 year Follow up.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

31. Yorgova, Neiss, Curry, Winters, Gabos, Bowen, Shah. **Preliminary Experience with Clinical Use of a DNA Prognostic Test for Adolescent Idiopathic Scoliosis.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (podium).

32. Sponseller, Newton, Shah, Bastrom, Marks, HSG. **Radiographic Classification of Cerebral Palsy.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

33. Sponseller, Newton, Shah, Bastrom, Marks, HSG. **Differences Between Patients who Choose Operative versus Nonoperative Management of AIS.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (poster).

34. Sponseller, Shah, Newton, Samdani, Bastrom, Marks, HSG. **Differences Between Patients with Cerebral Palsy whose Curves are treated Operatively versus Nonoperatively.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (podium).

35. Shufflebarger. **Spondyloptosis, Posterior Approach.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (podium).

36. Shufflebarger. **Solution for Late Arising Infection in Stainless Steel Spinal Implants Placed for Deformity: Exchange for Titanium Implants.** International Meeting on Advanced Spine Techniques, July 13-16, 2011 Copenhagen, Denmark (podium).

2011 SCIENTIFIC PRESENTATIONS

Scoliosis Research Society (SRS) Annual Meeting
Louisville, Kentucky - Sept. 14-17, 2011

37. Asghar, Shufflebarger, Bastrom, Morales. **Establishing Parameters for T12 as the Lowest Instrumented Vertebra (LIV) in Selective Thoracic Fusions.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (poster).

38. Asghar, Sponseller, Morales, Shufflebarger. **Delayed Quadraparesis After Posterior Spinal Fusion for Scoliosis: A Case Series.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (case presentation).

39. Asghar, Samdani, Newton, Cahill, Pahys, Morales, Shufflebarger. **Proximal Junctional Kyphosis at 5 Years after Fusion for AIS: Does it Matter?** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

40. Cahill, Samdani, Pahys, Gresh, Yaszay, Marks, Bastrom, Lonner, Shah, Shufflebarger, Newton, Betz. **Youth and Experience: The Effect of Surgeon Experience on Outcomes in AIS Surgery.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

41. Abhishek, Jain, Crawford. **Pulmonary Function after Costoplasty in Adolescent Idiopathic Scoliosis - A Multi-center Study.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (poster).

42. Lonner, Terran, Newton, Shah, Shufflebarger, Betz, Samdani, Sponseller, Bastrom. **Is Pre-op PFT Assessment Worthwhile in Scheuermann's Kyphosis?** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (poster).

43. Lonner, Newton, Terran, Betz, Shah, Sponseller, Samdani, Shufflebarger. **Scheuermann's Kyphosis: Impact on Quality of Life in 86 Patients.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

44. Lonner, Terran, Newton, Shah, Samdani, Sponseller, Shufflebarger, Betz. **MRI Screening in Operative Scheuermann's Kyphosis: Does it Alter Treatment?** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

45. Marks, Bastrom, Petcharaporn, Betz, Shufflebarger, Lonner, Shah, Newton. **Trunk Motion Improves over Time after Spinal Fusion for AIS.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (poster).

46. Marks, Bastrom, Petcharaporn, Betz, Shufflebarger, Lonner, Shah, Newton. **Post-Operative Trunk Mobility is Better With the Anterior Approach Versus Posterior in Thoracolumbar Scoliosis.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (poster).

47. Miyanji, Marks, Samdani, Newton, HSG. **Minimally Invasive Surgery for AIS: A Prospective Comparison with Standard Open Posterior Surgery.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

48. Narayanan, Sponseller, Newton, Marks, HSG. **The CPChild Questionnaire is Sensitive to Change Following Scoliosis Surgery in Children with Cerebral Palsy.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

49. Monazzam, Newton, Bastrom, Yaszay, HSG. **Multi Center Comparison of the Factors Important in Restoring Thoracic Kyphosis During Posterior Instrumentation for Adolescent Idiopathic Scoliosis.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

2011 SCIENTIFIC PRESENTATIONS

50. Samdani, Garg, Cahill, Marks, Bastrom, Clements, Shah, Shufflebarger, Betz, Newton. **Five Year Results for Lenke 1/2 Curves: Comparison of Anterior, Posterior Hybrid, Posterior All Pedicle Screws.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

51. Shah, Sponseller, Bastrom, Neiss, Yorgova, Newton, Yaszay, Gabos, Dabney, Miller, HSG. **The Use of Antifibrinolytics Substantially Reduces Blood Loss During Surgery for Cerebral Palsy Scoliosis.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

52. Shah, Winters, Curry, Yorgova, Neiss, Hilibrand, HSG. **Cervical Sagittal Contour Decompensation Before and After Posterior Surgery for Adolescent Idiopathic Scoliosis.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

53. Yorgova, Neiss, Curry, Winters, Gabos, Bowen, Shah. **Preliminary Experience with Clinical Use of a DNA Prognostic Test for Adolescent Idiopathic Scoliosis.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (poster).

54. Sponseller, Gjolaj, Shah, Newton, Flynn, Marks, Bastrom, HSG. **Spinal Deformity in Marfan versus AIS: Learning from the Differences.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

55. Demura, Yaszay, Bastrom, Carreau, Newton, HSG. **Is Decompensation Preoperatively a Risk in Lenke 1C Curves? Scoliosis Research Society Annual Meeting.** Louisville, Kentucky Sept. 14-17, 2011 (podium).

56. Ilgenfritz, Yaszay, Bastrom, Newton, HSG. **Lenke 1C and 5C Spinal Deformities Fused Selectively - A Natural History of Uninstrumented Compensatory Curves.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

57. Buckwalter, Bastrom, Ilgenfritz, Yaszay, Newton, HSG. **Prospective Analysis of Intraoperative Neuromonitoring Events During Spinal Corrective Surgery for Adolescent Idiopathic Scoliosis.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

58. Yaszay, Bastrom, Newton, HSG. **Should Shoulder Balance Determine Proximal Fusion Levels in Patients with Lenke 5 Curves?** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

59. Shufflebarger. **Solution for Late Arising Infection in Stainless Steel Spinal Implants Placed for Deformity: Exchange for Titanium Implants.** Scoliosis Research Society Annual Meeting. Louisville, Kentucky Sept. 14-17, 2011 (podium).

North American Spine Society (NASS) Annual Meeting – Chicago, IL – Nov. 2-5, 2011

60. Lonner, Terran, Newton, Shah, Shufflebarger, Betz, Samdani, Sponseller, Bastrom. **Is Pre-Op PFT Assessment Worthwhile in Scheuermann's Kyphosis?** North American Spine Society Annual Meeting. Chicago, IL Nov 1-5, 2011 (poster).

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