Scoliosis Specific Exercises

BSPTS
SCHROTH BASED

history

- Scoliosis comes from a Greek term for “crooked”
- There are cultural and historical references thousands of yrs old. Hindu writings around 3500BC, Greek physician Hippocrates (460-370 BC) coined the term scoliosis as well as some early attempts at treatment.
- 1575 physician Ambroise Pare developed 1rst metal brace
- In 1878, Lewis A. Sayre, an orthopedic surgeon, wrote a book called “Spinal Disease and Spinal Curvature. Around this time geometrical methods were applied to determine angles of curves.
From the 1940’s thru current, physical Therapy in the US was generally not utilized for the purpose of decreasing the curve..(e.g. 1-3)

Therefore, in the absence of pain and perhaps a very progressive surgeon who recommends “core strengthening”, physical therapy is quite removed from the overall treatment approach for AIS in the US.
Definition

- Definition of scoliosis is at its simplest, a lateral curve of the spine. However, this is more of a description and the etiology is typically not known, thus Idiopathic.

- More indepth description of Adolescent Idiopathic Scoliosis is a complex 3 dimensional deformity of the spine and trunk, which appears in apparently healthy children, and can progress in relation to multiple factors during any rapid period of growth or later in life. (M. Rigo, Th Grivas, J O’Brian, in Scoliosis 2010)

Causes

- As the name idiopathic suggests, there is no currently verified known cause of AIS. There is a tremendous amount of research in various avenues in search of one or more cause.

- Approximately 30% of patients have a family history, so there is an agreement that genetics plays a role. Others are investigating, hormone imbalances, asymmetrical growth and muscle imbalances....Hueter Volkmann Law, Burwell’s Theory.
Progression Risks

- A curve is defined as progressive when it moves beyond 5° or more in consecutive examinations. Since this disease is linked with skeletal growth, assessing bone maturity is a part of risk analysis.
- Risser sign: quantification of ossification of the iliac crest, grades 0-5
  - 0 is lack of any ossification, 1-4 rates 25-100% ossification, 5 fuses with ilium
- A hand xray can also be used to determine skeletal maturity, showing the growth plates of carpals and meta-carpals

Progression Risks

- Progression Risk Factors: skeletal maturity, pre-menarche, size of curve, shape of curve, female vs male, and treatment compliance
- The younger a patient is at the time of diagnosis, the higher the risk, thus use of bone age tests.
- Greatest growth spurt occurs yr before menarche in girls
- Double curves progress more than single curves
- The larger the curve the greater the risk of progression
Progression Risks

- As structural changes increase, especially in the thoracic region, stresses and changes can occur to discs, vertebrae, ribs, and even the spinal cord. Although, loss of spinal cord function is rare.
- It has been shown that with thoracic curve progression, there is a progressive risk of decreased pulmonary and cardiac output, even in the absence of curve progression or patient report of breathing symptoms. (eg 4-12)
- Aesthetic changes can also negatively affect well-being and self-esteem.
- Curves that reach approximately 50° have been shown to continue to progress due to aging and gravity even beyond skeletal growth, thus the US’ treatment protocol of surgical intervention at this stage.

Progression Risk

- New genetic testing is now available to further assist in progression risk assessment.
- The ScoliScore™
- 53 alleles are identified via a saliva sample. The stratified risk analysis then results in a score of 0-200, 0 being lowest risk of progression and 200 being highest. The company performed validity testing that showed 0-50 was low risk, 51-179 is intermediate risk, and 180-200 is high risk.
- Currently there has not been a successful independent validation study (eg 13)
Progression Risk

- Further biological testing is also attempting to stratify patients with AIS to predict response to brace treatment. (eg14)

Current Screenings

Screenings:
- Adams test – a forward trunk flexion observing for any rib asymmetry.
- Scoliometer – tool for measuring rotation. 3-5 degrees gray area, >7 degrees referral for MD evaluation
Clinical postural evaluations that may be encountered during general physical therapy.
- Lateral Trunk imbalances – trunk or pelvis deviated from central plumb line at C7. Arm/waist window significant differences between L and R.
- Transverse plane deviations of scapulae, pelvis, rib humps or lumbar spine prominences.
- Sagittal plane deviations – kyphosis, significant lumbar lordosis, whole body anterior shifts.

May have combinations of these presentations.
School screenings

Only about half of U.S. states have mandatory scoliosis screening in their schools.

Current evidence and expert opinion are not clear on the validity/value/efficacy of school based screenings.

School Screenings

- A Review of the Impact and Outcomes of the 2004 U.S. Preventive Services Task Force Recommendation Against Scoliosis Screening
- O’Brien, Joseph; Chowanska, Joanna
- SMARTT Institute - National Scoliosis Foundation, Stoughton, MA, USA
- The USPSTF recommendation has reduced the number of screening programs in the U.S., consistent with the intent of their policy. However, the HCUP data suggest that contrary to the USPSTF’s stated rationale, the reduction in scoliosis screening appears to have caused more harm, not less, for IS patients and society as a whole, in terms of an increase in the volume and economic burden of scoliosis surgeries.
Screenings

- New Jersey law continues to support the school-based screenings performed by school nurses.
- Screening methods are not standardized
- Most schools will use the Adams test. Some will also use a scoliometer based on perceived results of Adams test.
- Physical therapists have a great opportunity to participate in standardized, comprehensive scoliosis screenings, working with school nurses and community general physician practitioners.

Diagnosis

- Currently in the US, the diagnosis of scoliosis is confirmed radiographically.
- Utilizing Cobb angles.
  - < 10° within normal
  - > 10° Dx of scoliosis
  - 10°–20° monitoring only
  - 20°–50° bracing recommended
  - >50° surgery
Diagnosis

Scoliosis Radiographs
The Cobb Method of angle measurement

Team

- Team approach is critical for maximizing success of treatment across the span of scoliosis
- Includes:
  - Physicians specializing in spinal care/surgeons
  - Orthotists for bracing
  - Physical Therapists
  - Psychosocial : supports groups, counselors
  - Patient and family MOST IMPORTANT
US, Canada, and England have similar parameters for scoliosis treatment. However, many countries in Europe and Asia have more comprehensive parameters.

US: Main organization that leads treatment options is SRS, Scoliosis Research Society.

Following are the US parameters as per SRS for treatment:

- **Observation:** This is for curves that have a small degree measurement when you are growing (adolescent scoliosis), or for moderate size curves (< 40-45 degrees) when you are done growing. For adults, observation and physical therapy are for those patients who have mild symptoms and have curves which are not large.

- **Bracing:** This is for curves between 25 and 45 degrees in growing children to prevent further progression of the curve while growth of the spine remains. The goal of bracing is to prevent further progression since the brace cannot correct curves.

- **Surgical treatment:** This is reserved for curves which are generally greater than 50 degrees for adolescent patients and adults. Surgery can be performed for smaller curves if the appearance of the curvature is bothersome to the patient or if symptoms are associated with the scoliosis in the adult patient. The goals of surgical treatment are to obtain curve correction and to prevent curve progression. This is generally achieved by placing metal implants onto the spine which are then attached to rods which correct the spine curvature and hold it in the corrected position until fusion, or knitting of the spine elements together.

SRS.org
SOSORT - International Scientific Society on Scoliosis Orthopaedic and Rehabilitation Treatment

- Link for SOSORT’s full published text on guidelines for treatment

“Method - All types of professionals (specialty physicians, and allied health professionals) engaged in CTIS have been involved together with a methodologist and a patient representative. A review of all the relevant literature and of the existing Guidelines have been performed. Documents, recommendations, and practical approach flow charts have been developed according to a Delphi procedure. A methodological and practical review has been made, and a final Consensus Session was held during the 2011 Barcelona SOSORT Meeting.”

Table 6 represents Practical Approach Scheme for Evidence Based Clinical Practice to IS.

From Infantile across the life span to Elderly, combined with increasing Cobb angle. A minimum and a maximum strength of treatment is listed for each combined section.
Treatment SOSORT

- These guidelines have expanded parameters for bracing
- Significant integration of highly trained physical therapy for scoliosis specific exercises
- Integration of psychosocial support and individual patient and family input

![Venn diagram with Evidence, Clinical expertise, and Patients' preferences]

Observation

- 10° – 25° recommend observation. Typically via radiographs.
- A comparison approach to explain risks related to X-ray imaging for scoliosis, 2012 SOSORT award winner

Since it is well know that x-rays are carcinogenic, modern technology has stepped up to begin utilization of computer topographical surface imaging. There is a wide area of research unfolding working to establish validity, correlation to current radiographic measurements, and practical application.
Observation

- Diers FORMETRIC - allows a radiation-free and markerless surface topography scanning method including a 3D reconstruction of the spine. Varied clinical parameters of the objective and quantitative analysis of the body statics and posture, scoliosis, and all forms of spinal deformities can be shown. 4D program has also progressed to dynamic evaluation.

- MTS – Milwaukee Topographical System


Bracing

- US braces – Milwaukee (older), Providence (overcorrection nighttime only), Charleston (overcorrection night), Boston, LA
- Utilize several principles of physics to re-direct the spine and hold. Purpose to stabilize and/or reduce the curve and prevent its progression.
- European braces – Sforzesco (Italy), Cheneau (France), Rigo Cheneau (Spain and Germany), DDB Spondylus (Greece)
- Follow similar principles of physics and some expand upon the 3D dimensions working to integrate rotational corrections as well. European models have been recently becoming more readily available in the US.
- WCR by Align Clinic CA and NY. Rigo Cheneau Orthotic Solutions, VA
Bracing

- BRAIST study - Bracing in Adolescence Idiopathic Scoliosis Trial.
- Sept 2013 Presented at SRS annual meeting in Lyon, France.
- Multi-center RCT reported that bracing of adolescents with moderate scoliosis was effective treatment in the reduction of the number of patients who advance to the need for surgery. In addition, a positive dose response effect was found between the number of hours of brace wear with the success rate of bracing. (eg 15)

However, there is much work to be done in the area of research for bracing as well. There are many types of braces and little strong literature to compare them. The level of skill of the orthotist is just as critical.
- A patient’s growth and how that brace responds to it.
- Variations in wearing schedules from only nighttime/sleep to 22hrs per day
- Compliance with use…..did it get dumped in the locker?
Exercise

- Exercises, traction tables and benches have been around for centuries.
- In the last 50 yrs in the US, typical exercise was encouraged for maintaining balance, strength, and cardio pulmonary health. Physical therapy played a role perhaps in creating a HEP for core strength, flexibility and perhaps some pain management if present.
- In the 80’s electrical stimulation was utilized on the convex side of the curve to alter the curve. By the 90’s control group studies disproved the use of e-stim for decreasing curve progression.
- Exercise for the sole purpose of halting the progression of scoliosis was shown not to be effective. (Lonstein 1987 and 1988)

Schroth History

- (1894-1985). Having scoliosis herself, and training in exercise, she began to pursue a specific method of decreasing the structural and postural changes that came with scoliosis....and thus the Schroth Method was born in the 1920’s.
- By the 1930’s her method was empirically recognized as the most effective conservative treatment in Germany
Schroth History

Christa Lehnert-Schroth

- Katharina’s daughter grew up helping her mother with her patients. She became a physiotherapist, furthering the scientific principles that underlie her mother’s method.
- She was director, until 1995 at the Asklepios Katharina Schroth Clinic in Germany and author of Schroth text book.
- Retired from active treatment, she continues to participate in Schroth.

Schroth History

Elena Salvá

(1926 – 2007)

- Worked with Christa in the 1960’s, in Germany and became good friends
- She founded the Elena Salva Institute in Barcelona, Spain in 1968, treating patients with scoliosis via the Schroth Method.
- Her passion and technical excellence was continued by her daughter Gloria Guera-Salva and son-in-law Manuel Rigo
Schroth History

- Dr. Manuel Rigo and Dr. Gloria Quera-Salvá received approval to begin teaching Schroth certification courses for physical therapists in 1989 – first in Barcelona and later in Israel and the USA. In 2009, Dr. Rigo founded BSPTS to further develop scoliosis curriculum for educating physical therapists.
- BSPTS teaches the original principles of Schroth, with advanced concepts learned during years of clinical experience and research. The first International Body of Instructors for the school was formed in 2011 in order to begin offering scoliosis rehabilitation education courses across the world. 
  www.bspts.net

Other European SSE schools

- SEAS, out of Italy. “SEAS is the acronym for Scientific Exercise Approach to Scoliosis, It is not a Method but an Approach and as such it’s in a continuous evolution thanks to the knowledge and to the scientific evidences which ISICO achieves through the research.”....http://en.isico.it

- Treatment is provided by specially trained physiotherapist. Focus is on self auto elongation and individual postural control in all 3 dimensions. Programs are 2-3x per week for 45min 2-3 months. Then home program.
Other European Schools

- Lyon Method out of France
- Greece has conservative centers utilizing 3-dimensional bracing and exercise
- DOBO Method out of Poland
- FITS out of Poland
- FED

All of these schools share a common principle of auto-elongation, reductions/corrections of postural displacements in all 3 dimensions, and a respiratory component.
Currently, there is very little research to compare methods.

BSPTS SSEs

- Utilizes the original principles from Katharina and Christa Schroth
- Integrates the current knowledge and theories of physical therapy, including sensory, corporal schema, motor learning, and neuro-muscular re-education.
- No contact or affiliations with the AKSK/HR Weiss in Germany
- Trained over 300 PT internationally
BSPTS SSEs

General Principles
- Prevent asymmetric compressive forces related to passive posture
- Reduce secondary muscle imbalance
- Prevent lordosing reactive forces
- Prevent asymmetric torsional forces from gait
- Produce dynamic de-rotational forces involving breathing mechanics

-Monica Villagrasa-Escudero, PT MSc, DO, SRS Annual meeting 2013, Half Day course: Non-Operative Spinal Deformity Treatment Techniques

Goals
- Stop progression of curves
- Improvement of cosmesis
- Improvement of general health
- To assist in coping and understanding the psycho-social impact of the deformity and treatment
- Diminish functional limitations
**Goals of Rehabilitation** by Beth Jansen PT Scoliosis

Rehab, WI

Subcortical Center
Corporal Schema

Motorneuron

Reference value

Effective value

Muscular length
Muscular tension

Muscular lengthening

Afferent receptors

Rehabilitation must create a new sense of “normal”

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**Classifications**

- Lenke et al 2001 described a new classification system. It is complex and includes side bending x-rays and is currently rarely used for non-operative cases.
- SRS currently classifies according to the curve level. Ex: Thoracic, Thoracolumbar, Lumbar. In addition they may describe it as a single, double, major or minor.
- There is currently no universal classification that is regularly used to assist in non-operative treatment.
BSPTS Scoliosis classification

- Group 1: Deformity in the sagittal plane only
  Kyphosis, Lordosis
- Group 2: Deformity in 3 planes
  3curve, 4curve, non3-non4, single lumbar, thoracolumbar
- Group 1-2 (combo): Deformity in 3 planes
  Thoracolumbar or lumbar with sagittal plane issue as well

BSPTS classification

- Curves will divide the body into different segments that will rotate opposite of each other, move anterior or posterior to each other, and will laterally deviate from each other….thus producing the 3-dimensional.
- Clinical assessment using various measurements including: Central Sacral Line, Scoliometer, Inclinometer, and specific postural alignment observation
- Radiographic assessment as well will help to confirm the classification: COBB angles, vertebral rotation measurements, Transition point, and Central Sacral Line.
Main prominence is thoracic. (Most commonly to the Right)
- It produces a shift of the ribs laterally and rotates in the direction of the convexity
- Lumbar spine and pelvis move together to compensate, typically shifting to side of the concavity
- Head and Shoulders/Scapulae also move opposite of the main thoracic prominence and typically will shift and rotate to side of concavity
- For the commonly Right 3 curve, the transition point is to the Right of the Central Sacral Line.
Main prominence is thoracic (again more common to Right)

A clear secondary or double lumbar prominence is then noted to the opposite side (thoracic concave side)

Pelvis is separated from the direction of the lumbar curve and shifts back to the side of the main thoracic prominence

Head and shoulders/scapulae shift and rotate to side of thoracic concavity

Presence of countertilt is noted on x-rays to confirm the separation of the lumbar and pelvic segments

Transition point is shifted opposite the main curve from the Central Sacral Line
Group 2
4-Curve Scoliosis by Beth Jansen PT Scoliosis Rehab, WI

Non3-non4

- Main prominence is in the Thoracic
- May or may not have a lumbar prominence opposite of the thoracic
- Pelvis is however, balanced and centered on the Central Sacral Line
- Transition Point is also balanced on the Central Sacral Line
Group 2
Non 3-Non 4 w/ and w/o Lumbar Curve by Beth Jansen PT Scoliosis Rehab, WI

Group 2
Lumbar or Thoracolumbar by Beth Jansen PT Scoliosis Rehab, WI
Exercise Principles

- Corrections are built through the whole chain, feet to head
- Auto-Elongation from a stable pelvis
- Deflection and Derotation correction of each body segment in the frontal and transverse plane.
- Asymmetrical Sagittal Straightening
- Rotational Angular Breathing
- Facilitation - Stabilization

Rotational Angular Breathing (RAB) by Beth Jansen PT
Scoliosis Rehab, WI

RAB – Corrective Breathing results from the other Principles of Correction

Once RAB begins to happen in the patient, ask the patient to perceive it… then the PT can facilitate it more
3C Scoliosis Corrections

4C Scoliosis Corrections
Exercise Principles

- Various positions are used to challenge these corrections in relation to gravity and stabilizing weight bearing segments. Ex Supine, Prone over small stool, sidelying, side standing, and sitting.
- Functional movements are re-trained with these active corrections: gait, squats, lifting, or specific sports
- Bars or a wall rack is used for assisting in auto-elongation, passive traction, UE and LE positioning and stabilizing
- Pads and Wedges are used to passively correct in various directions and then trained to actively move off of the pads or wedges.
- Belts and poles may be used to increase traction forces and level of difficulty

Exercise principles

- This program goes far beyond an orthopedic.
- Principles of motor learning and re-education are critical for the successful change in corporal schema.
- Mass practice, skilled and trained therapists provide verbal and manual cues and facilitations.
- Ultimately patients work to become independent in this program at home.
Exercise principles

- Adolescence who have yet to reach skeletal maturity are recommended to perform program 5-6 days/week
- Adolescence who are skeletally mature or adults are recommended to perform program 2-3x/week or as needed to balance work, hobbies, or sports.
- Modifications in the program are possible for juvenile, adults with painful degenerative spines, and post surgical scoliosis spinal fusions.

Resources

- SRS – Scoliosis Research Society
- Scoliosis – online- open access, peer review journal via BioMed Central scoliosisjournal.com
- Curvy Girls Scoliosis – non-profit group, international, for the support and education of girls with scoliosis. www.curvygirlsscoliosis.com
309 Black Oak Ridge Rd Wayne NJ 07470
C2 and C1 certified therapists. First Center in NJ.
Now treating patients from early onset scoliosis into later adulthood.
Second Office to open Summer of 2014 in Manhattan, NY
Our intensive programs run 2hrs per day for 10 days, then follow-up based on reevaluation of individual performance and level of independence with HEP, typically upward of an additional 20hrs spread out.
Adults with pain/degeneration 1hr, 1-3x per week.

Emma Craig, artist, med student, patient!!!
Curvy Girls is a network of peer-led support groups that reduce the emotional impact of scoliosis by empowering girls through mutual support and acceptance to become leaders, make healthy lifestyle choices, and improve self-esteem.
National, state, and International chapters

www.curvygirlsscoliosis.com