Pediatric Orthopaedic Update

Orthopaedics for the Primary Care Practitioner and Rehabilitation Therapist

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New Research

- Spine
  - Non-operative treatments for adolescent idiopathic scoliosis
- Foot and ankle
  - Metatarsus adductus
  - Clubfeet
- Trauma
  - Casting and splinting forearm fractures
- Neuromuscular
  - Duchenne muscular dystrophy

Composed from research reviewed in *Specialty Update, What's New in Pediatric Orthopedics.* JBJS, 2015. Sanders JO, Otsuda N, Martus JE.

Efficacy of Bracing for Adolescent Idiopathic Scoliosis

- BrAIST Clinical Trial
  - Goal was to produce credible evidence about bracing
    - Randomized
    - Multicenter
    - Objective dose monitoring (how long the patient was in the brace per day)
    - Quality of life outcome measure
    - Independent evaluation of bracing progress

Effects of Bracing in Adolescents with Idiopathic Scoliosis. Weinstein SL, Dolan LA, Wright JG, Dobbs MB. New England Journal of Medicine, October, 2013

BrAIST

- Aims:
  - Primary
    - Do braces (TLSO's, Thoracolumbosacral Orthoses) lower the risk of curve progression in high risk patients with AIS, relative to observation alone?
  - Secondary
    - To compare health and functioning, quality of life, and self-image over time in the two treatment groups.
    - To determine the relationship between bracing dose (wear time) and curve response.
    - To develop a predictive model for curve progression based on patient characteristics at initial presentation, and after bracing.

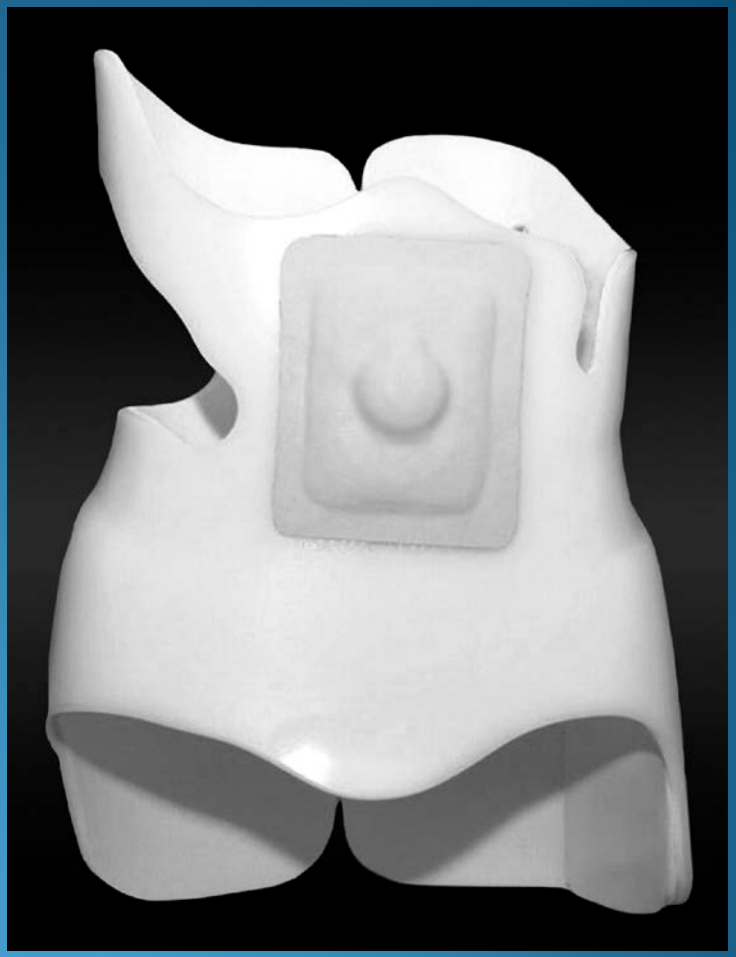
Study Population

- Age range of 10-15
- Risser 0, 1, 2
- Pre-menarchal, or 1 year post-menarchal
- Cobb angle of 20-40 degrees
- Apex at or caudal to T7
- No previous orthopaedic treatment for AIS
- Documented insurance coverage for treatment and/or ability to pay

Study Methods

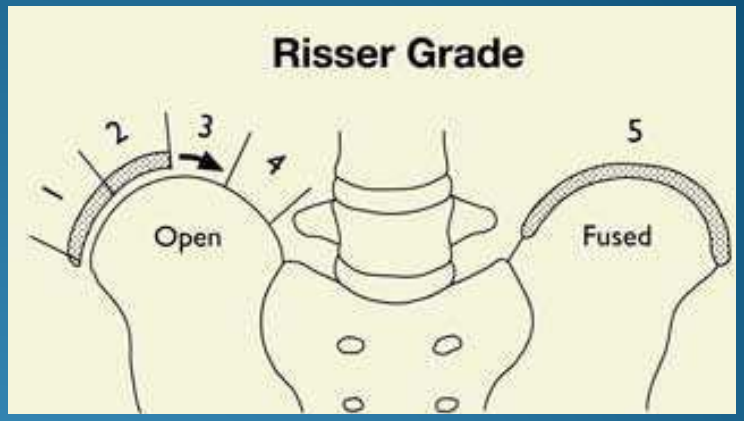
- Families either agreed to randomization or selected their treatment. Cohorts were analyzed separately and together.
- Treatment
  - Brace
    - Shape capture techniques and TLSO type selected by the team
    - In brace –x-ray 4-6 weeks after delivery
    - Orthotist evaluation at least every 6 months
    - Onset temperature monitors in each brace, data downloaded at each visit
  - Evaluation
    - Initial PA, lateral, side bending and hand films, physical exam

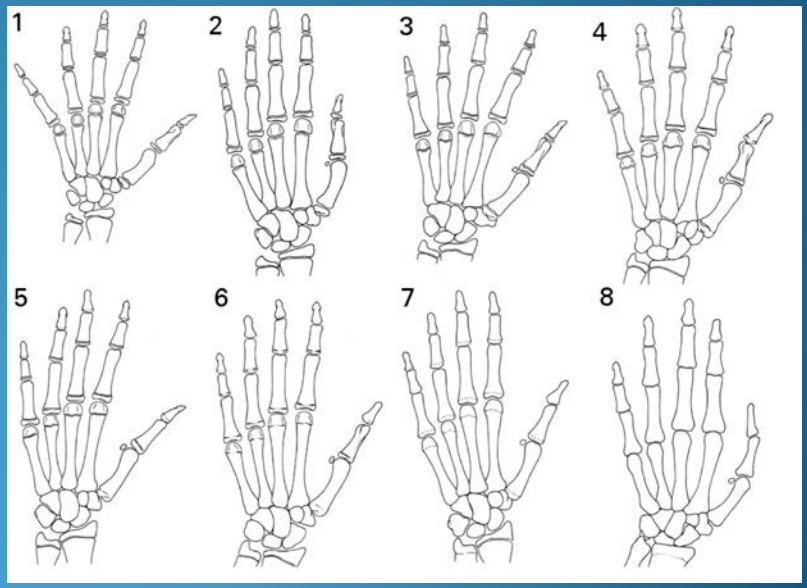
- Follow-up protocol and data
  - PA, lateral and side bending films and hand films (bone age) at baseline, then PA and hand every 6 months, laterals yearly
  - Self-report generic health, function, QOL, and Spinal Appearance Questionnaire
  - Clinical Exam



Endpoints

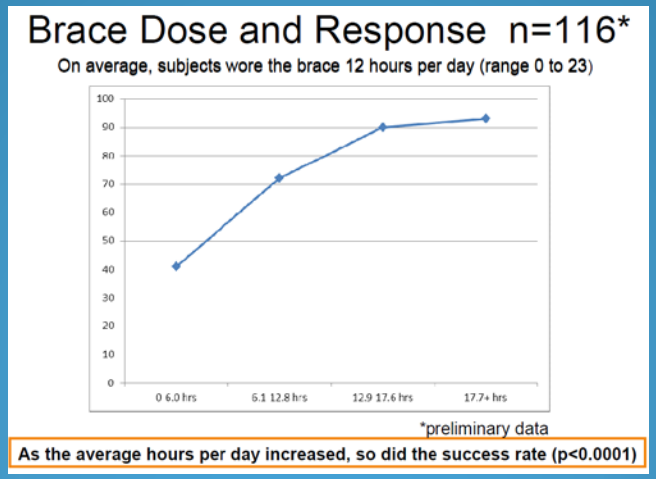
- Success
  - Cobb angle less than 50 degrees and skeletal maturity
    - Risser 4 (5 for boys)
    - Sander's digital maturity stage of 7
- Failure
  - Cobb angle greater than 50 prior to skeletal maturity





Results

- The trial was stopped early owing to the efficacy of bracing
  - The rate of treatment success was 72% after bracing, as compared with 48% after observation.
  - There was a significant positive association between hours of brace wear and rate of treatment success



Non-operative Treatment for AIS
Schroth Method

- Developed in Germany in the 1920s by the late Katerina Schroth and her daughter Christa Lehnert-Schroth
  - The proactive curve-specific conservative treatment approach to treat scoliosis patients of ALL AGES with minimal to moderate curves
  - Three-dimensional scoliosis treatment is based on sensorimotor and kinesthetic principles.
  - Goals are to facilitate correction of the altered posture, and teach the patient to maintain the corrected posture in daily living activities.
  - The patients are individually trained, even though therapy in groups or an open gym setting can be used in intensive and semi-intensive programs.

Example Therapy Program

- Treatment Sessions
  - Typically 45-55 min long and can range from 5 sessions up to 20 sessions.
  - Home exercise program is a lifetime commitment in order to maintain postural correction.
  - Re-evaluations every 2-3 months recommended after discharge from the program.
  - *Bracing* will be prescribed as needed and is a part of current management for patients who participate in a Schroth program.

Scoliosis Specific Exercises (SSE's)

- Exercise Goals
  - Stabilization of the curve(s)
  - Mobilization of stiff body parts
  - Improve postural alignment
  - Teach activities of daily living
  - Promotes corrections
  - Enhance neuromuscular control
  - Increase muscle strength and endurance
  - Pain reduction
  - Improve Cardio-pulmonary function

Spread of the Approach

- Approach also practiced over the last 45 years by the Institute of Elena Salva in Barcelona, Spain
- Currently certifying instructors internationally and in the US since 2003; including therapists from 10 SHC hospitals
- Course
  - Two part- 9 day certification course
  - Lectures, labs, and observation of patient treatment
  - Successful completion/passing of certification test
- Schroth exercises are called "Scoliosis Specific Exercise (SSE) Program"
  - Developing standardized Clinical Guidelines for all hospitals
  - Multi site research planned in the future

Evidence to date

- Randomized controlled trial by Monticone et. Al
  - SSE's compared with non scoliosis specific exercises for treatment of curves measuring less than 25 degrees.
  - Found significantly better results in the SSE group in terms of the SRS-22 scores and Cobb angles at twelve months follow-up.

Active self-correction and task oriented exercises reduce spinal deformity and improve quality of life in subjects with mild adolescent idiopathic scoliosis. Results of a randomized controlled trial. Monticone et al. European Spine Journal, 2014.

Metatarsus Adductus

- Internal angulation of forefoot on a flexible, neutral hind foot and a normal ankle with full ROM → C-shaped lateral border
- If severe → medial cleft
- Etiology
  - Genetic
  - ± Intrauterine Packing

Metatarsus Adductus

Classification	Severity	Flexibility
MILD	heel toe angle <10º	correction past midline
MODERATE	heel toe angle up to 25º	correction to midline
SEVERE	heel toe angle >25º	correction minimal

Serial Casting Versus Bracing

- 27 children younger than 9 months of age with resistant metatarus adductus who failed a home stretching program.
- Randomized to serial casting or orthotic treatment
  - Serial casting protocol
    - Short legged casts applied every 2 weeks
  - Orthotics protocol
    - Bebax orthosis for 23 hours per day, with physician adjustment every two weeks
  - If the treatment lasted longer than 10 weeks then adjunct treatment was instituted.
    - Casting group: daytime use of orthotic shoes
    - Bracing group: nighttime use of the Bebax shoes

Herzenberg and Burghardt, Journal of Orhopedic Science, 2014

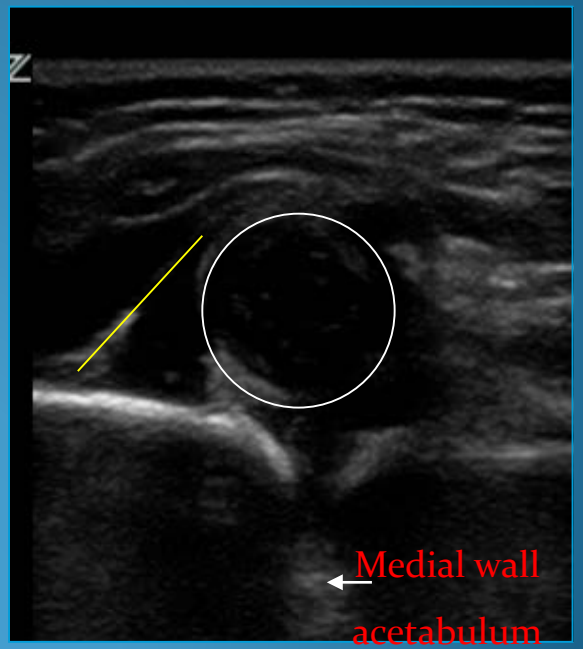
Outcomes

- No statistical difference in outcome between the two groups with regard to length of treatment, number of follow-up visits, or follow-up maintenance treatment.
- Orthotic group had *greater* improvement of footprint heel bisector measurement, though both groups showed improvement.
- Conclusion: the orthotic group requires more parent participation, but is less expensive, at about half the cost of casting.

Developmental Hip Dysplasia

- 2014 Clinical Practice Guidelines, AAOS
  - Moderate evidence does not support universal screening of newborn infants.
  - Moderate evidence does support performing an imaging study before 6 months of age in infants with one or more of the following risk factors:
    - Breech presentation
    - Family history
    - History of clinical instability

- Clinical examination remains the most important tool in diagnosing developmental hip dysplasia
  - Obvious instability
  - Asymmetric thigh/buttock/labial folds
  - Leg length discrepancy
  - **Unilateral limited abduction of the hip after 8 weeks of age.**



Is the limitation of hip abduction a useful clinical sign in the diagnosis and treatment of developmental dysplasia of the hips? Choundry Q, Goyal R, Paton RW. Arch Dis Child 2013;98:862-866.

Both Bone Forearm Fracture Immobilization

Long Arm-Double-Sugar Tong Splint

VS

Bivalved Long Arm Cast, Overwrapped

Levy J et al. Journal of Pediatric Orthopaedics, 2014, April 29, Epub ahead of print.

Prospective, randomized trial of patients 4-12 years old who had a distal radial or distal both-bone forearm fracture.

- At the initial follow-up visit, the long arm cast or the double sugar-tong-splint was overwrapped with fiberglass.
- Radiographic analysis showed that the double-sugar-tong-splint maintained better correction in the sagittal plane over the first two weeks.
- Over the entire treatment period the long arm cast patients had a higher incidence of loss of reduction meeting criteria for re-manipulation then the sugar tong splint group.

Long arm casting

- In a small randomized controlled trial of displaced diaphyseal forearm fractures, long arm casting for 6 weeks was compared to long arm casting with conversion to short arm at 3 weeks.
- Both treatments were equally effective

Colaris et al. Arch Orhtop Trauma Surg 2013 Oct;133(10):1407-14.

Clubfeet

- Ponseti casting has become the standard of care for the treatment of clubfeet.
- A RCT of patients under the age of 3 months, compared treatment outcomes of above knee casting with below knee casting.
- The rate of failure and treatment time were significantly higher in the short leg casting group.

- The study was stopped early because the efficacy of the long leg cast group was proven.
- Failures of the short leg casting:
  - Cast slippage
  - Prolonged treatment time

Marupuri et al. Bone and Joint J. 2013 Nov;95-B(11):1570-4

Duchenne Muscular Dystrophy

- *Clinical Course:*

- *Progressive weakness of the proximal muscle groups that descend symmetrically in both lower extremities, particularly the gluteus maximus, medius, quadriceps and tibialis anterior. The abdominal muscles are involved. Later the lower facial muscles are affected.*

Steroid treatment

- Steroid therapy is associated with improved longevity and walking ability.
- It has prevented or delayed the onset of scoliosis and reduced the need for high risk corrective surgery.
- Virtually all patients with DMD who were not receiving steroid therapy once they became wheelchair dependent developed scoliosis.
- The time in the wheelchair positively correlated with the magnitude of the curve.

Shapiro F, Zurakwoski D, Gui T. Darras BT. Bone Joint J. 2014 Jan;96-B(1):100-5.

- What is next for DMD patients?
  - Exon skipping
    - Exon skipping uses molecules called *antisense oligonucleotides* (AONs) to coax muscle fibers to ignore certain parts of the genetic instructions for dystrophin, thereby restoring the genetic "reading frame.“
    - Allows for production of more of the normal dystrophin protein, increasing strength.
    - Injection site skin reactions can be severe.
  - Mysotatin inhibition
    - Myostatin controls/inhibits muscle growth normally.
    - Inhibiting this function could allow for more muscle to grow, resulting in increased strength.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