Paper #13

Sacral-Alar-Iliac Fixation in Early Onset Scoliosis

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Summary: Sacral-alar-iliac (SAI) fixation is increasingly used for the treatment of scoliosis. This retrospective review of 24 patients with early onset scoliosis (EOS) compares the use of SAI screws to traditional methods of pelvic fixation. While SAI screws and traditional fixation methods effectively correct major curvature, only SAI screws were shown to correct pelvic obliquity with statistical significance in patients with EOS at a 2-year minimum follow-up. Additionally, SAI screws were shown to trend to more stable pelvic fixation.

Hypothesis: SAI screws offer better clinical outcomes compared to traditional pelvic fixation methods in patients with EOS at a 2-year minimum follow-up.

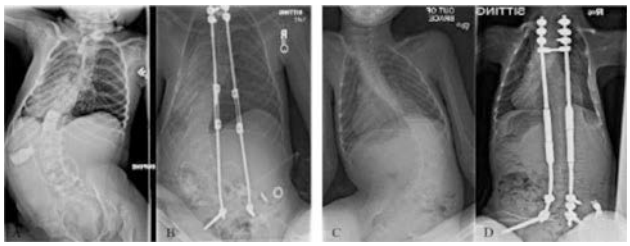
Design: Retrospective.

Introduction: SAI screws have steadily grown in popularity for the treatment of scoliosis. The objective of this study was to compare clinical outcomes in patients with EOS treated with SAI screws vs. other pelvic fixation methods at a 2-year minimum follow-up.

Methods: We retrospectively reviewed patients with EOS from 2000-2014. Inclusion criteria were posterior spinal instrumentation with pelvic fixation before ten years of age and an associated 2-year minimum follow-up. Clinical and radiographic parameters were collected. Data were analyzed using student t-tests at a significance $p<0.05$.

Results: 7 subjects were included in the traditional fixation group (Galveston technique=2, iliac screws=5) and 17 in the SAI group. For the traditional group (mean follow-up=6.1 years), pelvic obliquity improved from a mean of 17&[deg] at initial presentation to 9&[deg] at first instrumentation ($p=0.103$) to 8&[deg] at 2-year minimum follow-up ($p=0.066$), while major curvature improved correspondingly from a mean of 84&[deg] to 50&[deg] ($p=0.002$) to 49&[deg] ($p=0.008$). For the SAI group (mean follow-up=3.8 years) at the same time points, pelvic obliquity improved from a mean of 18&[deg] to 5&[deg] ($p=0.003$) to 4&[deg] ($p=0.003$), while major curvature improved correspondingly from a mean of 84&[deg] to 37&[deg] ($p<0.001$) to 38&[deg] ($p<0.001$). There were no statistically significant changes in pelvic obliquity between initial instrumentation and 2-year minimum follow-up periods for either group. Complications for the traditional group were rod breakage (n=1), fractured pelvic fixation screw (n=2), loosening of pelvic fixation (n=3), and deep infection (n=3). The corresponding values for the SAI group were 7, 1, 1, and 2. Neither group had neurological deficits.

Conclusions: While SAI screws and traditional fixation methods effectively correct major curvature, only SAI screws were shown to correct pelvic obliquity with statistical significance in patients with EOS at a 2-year minimum follow-up. In addition, SAI screws trend to fewer failures of pelvic fixation.



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Paper #14

Three Dimensional True Spine Length: A Novel Technique for Assessing the Outcomes of Scoliosis Surgery

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Summary: This study validates the use of a novel bi-planar, 3D true spine length measurement (3DTSL) for assessing growth-friendly scoliosis surgery outcomes. Accuracy was assessed using physical models while inter- and intra-rater reliabilities (IRRs) were calculated using the bi-planar radiographs of 23 EOS patients. 3DTSL accuracy was 1.2mm(0.4%) while mean clinical IRRs were 0.948. Between the traditional and 3DTSL measurements there was a discrepancy of 37.8mm ($p<0.001$). The novel measurement is accurate, repeatable and complements current growth assessments for EOS treatments.

Hypothesis: The novel 3DTSL measurement is accurate and repeatable.

Design: Physical model and clinical radiographic analysis to evaluate measurement validity.

Introduction: Serial standard-of-care coronal vertical spine height measurements (SoCVH) are used to assess the spine growth of patients undergoing growth-friendly surgical treatment for early onset scoliosis (EOS). Spine-based distraction implants control the deformity in the coronal plane, but have been thought to exhibit a ''law of diminishing returns''. Growth out of the coronal plane is missed by the SoCVH, which underestimates actual spine growth. This study set to validate a novel 3D true spine length (3DTSL) bi-planar radiographic measurement technique.

Methods: 3DTSL accuracy was calculated using ten 270mm long wire models measured by five reviewers. To assess clinical inter- and intra-rater reliability the coronal and sagittal radiographs of 23 EOS patients were measured twice by six reviewers. Inter- and intra-rater reliabilities were assessed using Inter Class Coefficient (ICC) analyses. The discrepancy between the SoCVH and 3DTSL was also investigated.

Results: The model assessment showed excellent measurement accuracy with a mean error of 1.2mm (0.0-3.0, SD:0.9) or 0.4% (0.0%-1.1%, SD:0.5%) and mean ICC of 0.999. The clinical cohort consisted of 7 syndromic, 7 congenital, 6 idiopathic, and 3 neuromuscular patients, a mean age of 5.6yrs (1.3-9.5), and mean Cobb and kyphosis angles of 68&[deg] (22&[deg]-102&[deg]) and 37&[deg] (5&[deg]-85&[deg]), respectively. Inter-rater reliability ICCs averaged 0.952 for the 3DTSL and 0.975 for the SoCVH, while mean intra-rater reliabilities were 0.944 and 0.965 respectively (all $p<0.001$). Mean 3DTSL curve lengths were 193.9mm (142.8-276.8, SD:30.0), while the SoCVH averaged 156.1mm (74.7-207.3, SD:29.7). This is a difference