

visit using ultrasound. Differences between programmed and actual displacements were determined by paired 2-tailed t-tests. Summary statistics were calculated for two groups based on prior instrumentation history. Regression and correlation were used to determine the relationship between tissue depth and length increases.

Results: Thirty-one patients were included, 18 males, 13 females, age 8.1 (&[plusmn]2.5) years, main Cobb 60&[deg] (&[plusmn]14.6) at time of MCGR insertion. In the 12 patients with prior instrumentation, time from initial growing rod placement to MCGR insertion was 23.1 months (&[plusmn]10.6). The number of surgical procedures prior to MGCR insertion was 2.8 (&[plusmn]2). Total length increase relative to the programmed distraction was 86.1% (&[plusmn]21) ($p < 0.001$). Length increases for patients with and without prior surgery were 86.6% (&[plusmn]23) and 85.8% (&[plusmn]19), respectively. Total lengthening was inversely proportional to tissue depth ($r^2=0.38$, $p < 0.005$); the decrease in lengthening achieved was 2.1%/mm.

Conclusions: Increases in rod length were 14% lower than the programmed displacement. Prior instrumentation did not impact the amount of distraction. Greater distance between the rod and the skin surface negatively affected the magnitude of distraction.

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Paper #18

Five or More Proximal Anchors and Including the Upper End Vertebrae (UEV) Protects Against Reoperation in Growth Friendly Constructs



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Summary: Increased number of anchors and instrumentation at or above the upper end vertebrae (UEV) of kyphosis were associated with decreased rates of revision surgery.

Hypothesis: Number, type and placement of proximal anchors will impact the rate of revision surgery in growth friendly constructs.

Design: Retrospective Multi-center enrollment.

Introduction: Proximal anchor pullout and junctional kyphosis are common causes necessitating revision surgery during growth friendly treatment of early onset scoliosis (EOS). Many options exist for proximal fixation and may impact the rate of these complications.

Methods: Retrospective review of multicenter database of patients with growth friendly constructs for EOS. Inclusion criteria were index instrumentation < 10 years of age and minimum of 2 years follow-up.

Results: 357 patients met inclusion and had the following constructs: growing rods with spine anchors=306; growing rods with rib anchors=16 and VEPTR=35. Mean age at Index Instrumentation was 5.9 years. Mean pre-op Cobb angle was 76° and pre-op kyphosis was 54°. Mean follow-up was 6.1 years. 21.6% (77/357) experienced anchor pullout. Lower anchor pullout rates were associated with a higher numbers of proximal anchors ($p=0.003$, $r=-0.157$), and 5 or more anchors were associated with lower rates of anchor pullout ($p=0.010$). Anchor type did not impact rate of anchor pullout ($p=0.850$). Kyphosis data was available for 200 patients. 23.5% (47/200) of patients required proximal extension of their construct after index surgery. Initial instrumentation below UEV of kyphosis was associated with higher rates of subsequent proximal revision - 30% (21/70) ($p=0.027$), compared to 20.0% (26/130) for those instrumented at or above the UEV. Pre-op kyphosis and change in thoracic kyphosis were not associated with anchor pullout ($p=0.944$, $p=0.943$) or proximal revision ($p=0.076$, $p=0.316$).

Conclusions: 5 or more anchors are associated with lower rates of anchor pullout. Proximal anchor placement at or above the UEV

resulted in a significant decrease in rates of proximal extension of the construct.

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Paper #19

Spinal Growth in Patients with Juvenile Idiopathic Scoliosis Treated with Boston Brace



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Summary: The main goal of treatment in juvenile idiopathic scoliosis (JIS) is to control the spinal deformity while preserving spinal growth. This study shows that bracing with Boston brace has no significant effect on longitudinal spinal growth in JIS patients.

Hypothesis: Bracing does not significantly affect spinal growth in JIS patients.

Design: Retrospective study.

Introduction: In children with JIS, the spinal deformity can have serious consequences for lung development and may reduce life expectancy. The treatment goal in JIS is to maximize growth of the spine and thorax while controlling the spinal deformity. Bracing and growth-friendly spine surgery have been used to control the curve. Whereas surgery can decrease spinal growth, the effect of bracing on spinal growth is unknown. The aim of the study is to evaluate spinal growth in braced JIS patients.

Methods: 38 JIS patients were selected from our database. These patients were diagnosed with JIS and were braced. Three radiographs were selected: before start of bracing, after brace treatment and at final follow-up. Age, total length and duration of brace treatment were recorded. The following variables were measured on the radiographs using Surgimap: Cobb angle, T1-T12 length and T1-S1 length.

Results: The average age of diagnosis was 7.1 years (1.5-9.5). Brace treatment was started at an average age of 11.3 years with a Risser of 0.5 and was stopped at 14.6 years with a Risser of 4.2. The brace was prescribed for a mean of 40 months. The Cobb angle of the main curve before and after bracing were 33&[deg] and 31&[deg] respectively. At skeletal maturity, 8 patients were treated surgically with a mean angle of 55&[deg] before surgery. Patients not requiring surgical treatment had a mean angle of 28&[deg] at final follow-up. Before treatment, mean T1-T12 length was 241 mm, T1-S1 length 385 mm and total length 1528 mm. After treatment, mean T1-T12 length was 279 mm, T1-S1 length 446 mm and total length 1692 mm. And at last follow-up, mean T1-T12 length was 286 mm, T1-S1 length 458 mm and total length 1711 mm. Spinal growth during brace treatment was 14.3 mm/year (T1-T12) and 23.3 cm/year (T1-S1).

Conclusions: Based on Dimeglio's data, normal spinal growth is 1.1 cm/year (T1-T12) and 1.8 cm/year (T1-S1) between 10 years and skeletal maturity. The braced patients grew 1.4 cm/year (T1-T12) and 2.3 cm/year (T1-S1) during the treatment period indicating that bracing had no significant negative effect on spinal growth.