



Is There an Optimal Time to Distract Dual Growing Rods?

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Abstract

Study Design: Retrospective multicenter observational cohort study.

Objectives: To determine whether there is a significant difference in final spinal height achieved, instrumented height, or Cobb angle related to the mean time interval between distractions of dual growing rods.

Summary of Background Data: Patients were prospectively enrolled in “The Treatment of Progressive Early Onset Spinal Deformities: A Multi-Center Study.” Additional data were collected via a retrospective review of medical records.

Methods: Using data from a multicenter database, the authors identified 46 patients (23 boys and 23 girls) with early-onset scoliosis who were treated with dual growing rods and who had surgical treatment spanning more than 4 years. The patients were divided into 2 groups: those who had less than 9 months (16 patients) and those who had 9 months or more (30 patients) between distractions. Standard univariate statistics were calculated. The researchers performed 2-tailed *t* tests. Significance was set at $p = .05$.

Results: The differences in primary Cobb angle, T1–S1 height, and instrumented segment length at the last distraction or final arthrodesis, compared with the post-index procedure values, were not significantly different ($p = .52, .58, \text{ and } .60$, respectively) between groups with the available data. The normalized instrumented height gains, in millimeters per year, were not significantly different ($p = .22$).

Conclusions: Patients with longer times between growing-rod distractions (9 or more months) had no significant differences in primary Cobb angle, T1–S1 length, or instrumented length gain compared with patients with shorter times (less than 9 months) between distractions.

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Keywords: Growing rods; Early-onset scoliosis; Scoliosis; Distractions; Lengthenings

Introduction

The concept of dual growing rods, as originally described by Moe et al. [1] and modified by Thompson et al. [2] and Akbarnia et al. [3], involves a limited arthrodesis of a vertebral

segment cephalad and caudal as a foundation, spanned by 2 rods that are each cut and connected via a tandem connector. These rods need to be serially distracted through the tandem connector, as separate surgical procedures, to accommodate the

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patient's spinal growth and curve progression. According to Akbarnia et al. [3] distractions are scheduled based on patient age, sitting height, diagnosis, and curve progression, and surgery is usually performed every 6 months. Thompson et al. [2] stated that rods should be distracted every 6 months regardless of the curve progression. However, a survey of 17 spine surgeons by Yang et al. [4] showed that although most (12 of 17) surgeons in the Growing Spine Study Group recommended distractions every 6 months, in actuality, average time between lengthening of their patients in the database was 8.6 ± 5.1 months, and only 24% of the distractions occurred at intervals of 6 months or less.

If it could be confirmed that prolonging the time between distractions would result in the same overall outcome as performing distractions every 6 months, patients would be able to undergo fewer surgeries and have similar outcomes. The purpose of the current study was to determine whether there is a significant difference in final spinal height, instrumented height, or Cobb angle related to the average time interval between distractions of dual growing rods. The authors' hypothesis was that increased time between distractions of dual growing rods in early-onset scoliosis (EOS) would result in a reduced overall spine height or instrumented segment height and would not result in a decreased ratio of final to initial Cobb angle.

Methods

The researchers obtained institutional review board approval from all participating facilities for this cohort study of prospectively and retrospectively collected data. The inclusion criteria for this study were: 1) treatment begun at 18 months of age or older; 2) treatment for EOS with dual growing rods via the technique described by Akbarnia et al. [3]; 3) 4 or more distraction surgeries or progression to final arthrodesis treatment, whichever came later; and 4) patients who had surgical treatment spanning more than 4 years. Exclusion criteria were single-rod or Vertical Expandable Prosthetic Titanium Rib (DePuy Synthes, West Chester, PA) instrumentation.

Of the 910 patients in the database, 46 (23 boys and 23 girls) met the inclusion criteria and formed the study group. The causes of scoliosis were idiopathic (12), neuromuscular (8), congenital (7), syndromic (17), and unknown (2) (Table 1). The number of surgical distractions ranged from 1 to 13 over a period of 4 to 8 years. The mean initial major Cobb angle for the study cohort was 78° (range, 25° to 128°).

Initial spine height was measured from the superior end plate of T1 to the superior end plate of S1 on the first postoperative (post-index) radiographs after the insertion of implants. The major curve Cobb angle was similarly measured on the post-index radiographs and final procedure radiographs. The instrumented segment height was measured from the superior end plate of the most cephalad instrumented vertebra to the inferior end plate of the most caudally instrumented vertebra.

Table 1
Comparison of diagnoses.

Diagnosis	Group 1 (<9 months) (n [%])	Group 2 (\geq 9 months) (n [%])	Total (n [%])
Congenital	2 (7.69)	5 (25.00)	7 (15.22)
Idiopathic	8 (30.77)	4 (20.00)	12 (26.09)
Neuromuscular	6 (23.08)	2 (10.00)	8 (17.39)
Syndromic	9 (34.62)	8 (40.00)	17 (36.96)
Unknown	1 (3.58)	1 (5.00)	2 (4.35)
Total	26 (57.00)	20 (43.00)	46 (100.00)

Table 2
Comparison of groups.

Parameter	Group 1 (<9 months)	Group 2 (\geq 9 months)
Primary Cobb angle at pre-index (degrees)	73 \pm 17	84 \pm 27
Distractions (lengthening), n	7 \pm 1.82	6 \pm 1.47
Distraction interval from pre-index to last postoperative, years	5.20 \pm 1.42	5.64 \pm 5.64
Age at index procedure, years	5.11 \pm 1.75	5.23 \pm 2.57
Primary Cobb angle after index procedure (degrees)	40 \pm 22	43 \pm 22
Initial T1–S1 length, mm	264 \pm 68	284 \pm 68
Initial instrumented length, mm	195 \pm 81	236 \pm 82
Difference in overall treatment times, years	5.05 \pm 1.19	5.79 \pm 1.42

Note: Values are given as mean \pm standard deviation.

Patients were divided into 2 groups: those with a time between distractions of less than 9 months (Group 1: 16 patients; 35%) and those with a time between distractions of 9 months or more (Group 2: 30 patients; 65%). The mean overall treatment time was 5.05 and 5.79 years for Groups 1 and 2, respectively ($p = .03$) (Table 2). To normalize instrumented height gain between groups, the authors divided the total amount of height gain by the total number of treatment years. With the available numbers, there were no statistically significant differences between groups in any of the demographic characteristics. There were also no statistically significant differences in any of the radiographic measurements between groups. For the current differences to be statistically different between groups with a minimum power of 80%, the study would have needed total sample sizes of 625, 808, and 1068 to compare the Cobb angle, T1–S1 length, and instrumented length, respectively.

Standard univariate statistics were calculated. The authors performed 1-tailed t tests using the SAS System (SAS Institute, Cary, NC). Significance was set at $p = .05$.

Results

Patients in Group 1 achieved a slightly greater T1–S1 segmental height from post-index procedure to the final procedure than those in Group 2 (mean, 63 vs. 53 mm, respectively; $p = .58$) (Tables 3 and 4). However, Group 2

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