



Selective Thoracic Fusion Provides Similar Health-Related Quality of Life but Can Cause More Lumbar Disc and Facet Joint Degeneration: A Comparison of Adolescent Idiopathic Scoliosis Patients With Normal Population 10 Years After Surgery

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Abstract

Objectives: To evaluate the long-term behavior of the lumbar curve in patients with adolescent idiopathic scoliosis treated with selective thoracic fusion and to assess the clinical and radiologic outcomes in this fusion group compared with an age- and gender-matched group.

Summary of Background Data: Selective thoracic fusion for the treatment of adolescent idiopathic scoliosis (AIS) preserves lumbar motion segments but leaves a residual deformity. By avoiding fusion of the lumbar spine, a greater mobility may be preserved, which may be an advantage in long-term follow-up in terms of degenerative changes in unfused segments.

Methods: Group A included 25 AIS patients with mean a age of 23.8 years and a mean 11.4 years of follow-up. Group B included 30 age- and gender-matched subjects without any deformity. Preoperative, postoperative, and follow-up radiographs were reviewed. All patients had MRIs taken at the final follow-up in order to evaluate disc degeneration (DD) and facet joint degeneration (FJD) at the unfused lumbar spine. Clinical evaluation was done by using Scoliosis Research Society–22R, Oswestry Disability Index, and numerical rating scale.

Results: Sagittal and coronal balance and lowest instrumented vertebra disc angulation were stable over time. Mean grading of lumbar DD was 2.16 (2–4) in Group A and 1.86 (1–3) in Group B. Lumbar FJDs were 2.05 (1–4) in Group A and 1.60 (1–3) in Group B. There was significant difference between the two groups for DD except for the L4–L5 level ($p = .26$). FJD was significantly higher in the L1–L2 and L2–L3 levels (L1–L2, $p = .002$, L2–L3, $p = .002$) but not for the other levels. Outcome scores were similar without significant differences between the two groups ($p > .05$).

Conclusion: Selective thoracic fusion provides satisfactory outcomes at more than 10 years of follow-up. Our study demonstrated a moderate increase in the rate of disc degeneration in the unfused segments. Facet joint degeneration was significant at the upper two levels adjacent to the lowest instrumented vertebra.

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Keywords: Selective thoracic fusion; Disc degeneration; Facet degeneration; Long-term follow-up; Adolescent idiopathic scoliosis

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Introduction

The goals of surgical treatment in adolescent idiopathic scoliosis (AIS) are to provide a balanced spine over the pelvis while preserving motion in the segments as distal as possible, improve cosmesis, and prevent back pain and cardiorespiratory failure [1–4].

Selective thoracic fusion (STF) for the treatment of adolescent idiopathic scoliosis preserves lumbar motion segments but leaves a residual deformity that can show different behaviors in the early and late postoperative periods. By avoiding fusion of the lumbar spine, a greater mobility may be preserved, and the surgical exposure is reduced [5,6].

Selective thoracic fusion was first described by Von Lackum in 1949 [7]. He performed fusion of the primary curve alone without instrumentation for flexible single primary thoracic curves and reported successful correction of compensatory curves. He specifically emphasized that overcorrection of the primary curve resulted in subsequent loss of balance in his series. In 1983, King et al. [8] introduced King–Moe classification and described the selective thoracic fusion criteria, especially for Type II curves (major thoracic curve with compensatory lumbar curve).

Although the King–Moe system has been the gold standard for classification of AIS in late 1980s, in subsequent years occasional cases of postoperative coronal decompensation were reported in patients with Type II curves who were managed with segmental spinal instrumentation and selective thoracic fusion. Inappropriate curve selection and/or excessive thoracic correction were identified as the most common etiologies [9–12].

In 2001, Lenke et al. [13] described a new surgical classification system for AIS and recommended selective thoracic fusion for Type 1C, Type 2C, and some Type 3C curves [14].

The number of long-term follow-up studies in the literature about selective thoracic fusion is limited. These studies mainly focused on radiologic progression of non-fused lumbar curve and clinical results, including pain and disability scores [15–17].

To our knowledge, there is no study in the current literature that evaluated the unfused lumbar curve after selective thoracic fusion with MRI study in terms of facet and disc changes together in long-term follow-up.

The purpose of this study is to evaluate the long-term behavior of the lumbar curve in patients with adolescent idiopathic scoliosis (Lenke Type 1B and 1C) treated with selective thoracic fusion and to assess the clinical and radiologic outcomes in this fusion group compared with an age- and gender-matched population group. This study will help to define the natural history of the lumbar spine after STF and demonstrate any relationship between radiographic evidence of degenerative changes and clinical factors with validated outcome measures.

Materials and Methods

We retrospectively reviewed all the AIS cases surgically treated in our institution from 1996 to 2004. Collection and analysis of radiographic and clinical data were performed. A total of 157 AIS patients with Lenke Type 1 curve were operated at our institution. There were 53 patients with Lenke Type 1B curve and 39 patients with Lenke Type 1C curve who had STF surgery for AIS. Among these patients, 37 Lenke Type 1B and 28 Lenke Type 1C patients had full follow-up radiographs. Although these patients had full follow-up radiographs, only some of the patients were able to have a lumbar MRI scan after a minimum 10 years' follow-up.

Inclusion criteria were as follows: Lenke Type 1B and 1C scoliosis patients treated with posterior surgery; the lowest instrumented vertebra (LIV) ended at the L1 level; and a minimum 10-year radiographic follow-up.

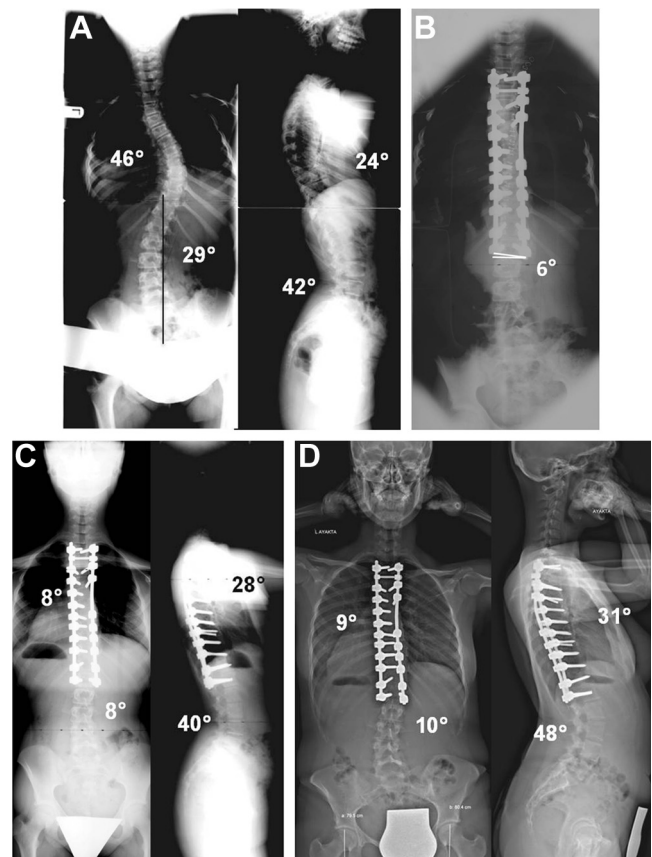


Fig. 1. (A) Preoperative standing anteroposterior (AP) and lateral radiographs of a 13-year-old female. Lenke Type 1C deformity with a main thoracic curve of 46° and 29° compensatory lumbar curve. (B) Intraoperative radiograph in prone position after correction; 6° of L1 tilt was measured after correction. (C) Early postoperative standing AP and lateral radiographs; the main thoracic curve was corrected to 8° and the compensatory lumbar curve was corrected to 8°. (D) The main thoracic curve was measured 9° and the thoracolumbar curve was measured as 10° at the 13-year follow-up. Thoracic kyphosis between T2 and T12 was 31°.

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