

## **Gait and Trunk Range of Motion in Adolescents with Idiopathic Thoracic Scoliosis Undergoing Anterior or Posterior Spinal Fusion**

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**Introduction:** Currently, the majority of surgeries for adolescent idiopathic thoracic scoliosis are performed with posterior instrumentation for a posterior spinal fusion to the thoracic spine. In attempts to address potential problems associated with posterior spinal fusion and to minimize the number of spinal segments fused, anterior spinal instrumentation and fusion has been promoted. No investigations have compared functional measures for patients undergoing either an anterior or posterior spinal fusion. This investigation compared pre- and post-operative gait and trunk range of motion (ROM) in a group of adolescents with idiopathic thoracic scoliosis undergoing anterior spinal fusion surgery (Anterior group) vs. a group undergoing posterior spinal fusion surgery (Posterior group). Our experimental hypotheses were: 1) post-operative gait would be unchanged following the surgery regardless of the group, 2) post-operative trunk ROM would be reduced regardless of the surgical group, and 3) post-operative trunk ROM would be larger in the Anterior group compared to the Posterior group.

**Statement of Clinical Significance:** It has been reported that spinal fusions extending to the lumbar spine should be kept to a minimum, and that 2.5 fusion levels can be saved with the anterior fusion compared to the posterior fusion.<sup>1,3</sup> Functional comparison of the 2 surgical approaches has not been made.

**Methods:** Preop and 24 month postop gait and trunk ROM data were collected from 44 subjects with adolescent idiopathic scoliosis.<sup>2,4</sup> Twenty-three of the subjects underwent surgery using a posterior approach (15 years  $\pm$  2) and 21 underwent surgery using an anterior approach (15 years  $\pm$  2). Reflective markers were placed at right and left acromions, C7, T10, L4, S2 and right and left ASIS's. For gait, each subject walked barefoot along a 9 m walkway and had video data collected from a 6 camera system. Each subject participated in 5 ROM tests: maximum forward flexion, right and left lateral flexion, and right and left trunk rotation. For gait, speed, sagittal vertical alignment (SVA-G) at initial contact, coronal vertical alignment (CVA-G) at initial contact, and the transverse plane ROM of the acromion-pelvis angle (APA-G ROM) were determined. For the standing ROM tests, spinal measures of the entire spine in the coronal, sagittal and transverse planes were determined. An ANOVA with repeated measures and tukey post hoc tests were used to determine differences between the preoperative and post-operative test sessions, and between anterior and posterior groups ( $p < 0.05$ ).

**Results:** The Posterior group had significantly more levels fused than the Anterior group (Anterior, 6.2 $\pm$ 1.3; Posterior, 11.2 $\pm$ 1.3), and the lowest instrumented vertebrae was more distal in the Posterior group compared to the Anterior group (Anterior, T12 $\pm$ 1.2; Posterior, L2 $\pm$ 1.3). Gait speed was not changed as a consequence of the surgery for both the Anterior

(preop 118±13; postop 119±16) and Posterior (preop 119±17; postop 117±18) groups,. The gait kinematics of the spine-pelvic alignment variables in both the coronal and sagittal planes (i.e., CVA-G and SVA-G) indicated no differences between sessions and between groups (Table 1). The ROM in the transverse plane of the Acromion-Pelvis angle (APA-G ROM) resulted in a decrease in ROM between pre- and postoperative sessions for both the Anterior and Posterior groups, with no between group differences. Preoperative trunk ROM results indicated no differences in lateral flexion, forward flexion and right transverse rotation ROM between the groups. There was a significant decrease in ROM (\*) following the surgery for both groups. Postoperative ROM for the Posterior group was significantly less (^) than the Anterior group for all motions.

Table 1. Means and standard deviations for the gait variables of the 2 groups.

Gait	SVA-G @ R Initial Contact		CVA-G @ R Initial Contact		APA-G ROM	
	Pre (cm)	Post 24 (cm)	Pre (cm)	Post 24 (cm)	Pre (°)	Post 24 (°)
Posterior Group	6.5 (2.3)	5.9 (2.0)	2.0 (2.1)	1.0 (1.5)	12 (4)	9 (3)*
Anterior Group	5.9 (2.4)	6.1 (2.1)	1.6 (1.7)	1.1 (1.2)	12 (5)	10 (4)*

Table 2. Means and standard deviations for the ROM variables of the 2 groups..

Trunk ROM	Right/Left Lateral Flexion		Forward Flexion		Right /Left Rotation	
	Pre (°)	Post 24 (°)	Pre (°)	Post 24 (°)	Pre (°)	Post 24 (°)
Posterior Group	25 (7)/31 (10)	16 (7)*^/16 (8)*^	38 (9)	23 (11)*^	38 (14)/38 (15)	24 (12)*^/25 (10)*^
Anterior Group	25 (8)/32 (10)	21 (5)*/23 (4)*	43 (10)	32 (10)*	45 (14)/50 (7)	32 (10)*/34 (8)*

**Discussion:** Gait results showed no change in speed and no change in coronal and sagittal plane kinematics, regardless of the group. Results add to our previous work indicating no changes in lower extremity kinematics.<sup>4</sup> Trunk ROM results indicated motion loss in all three planes, irrespective of group. Nevertheless, the Anterior group had greater postoperative ROM than the Posterior group. It appears the typical walking gait of these patients is not altered 2 years after the surgery. Changes at times greater than 2 years are unknown. It also appears other movements besides gait, such as trunk ROM, are sensitive to changes after the surgery. These and other movements that force the body near its limits may better describe functional changes due to the surgery. Finally, these patients were not randomized, but it was generally surgeon preference that dictated the surgical approach. Thus, with the anterior group having; 1) fewer segments fused, 2) fusions not extending as far distally, and 3) greater postoperative trunk ROM compared to the posterior group, it is possible that the anterior surgical approach may be a beneficial alternative to the posterior surgical approach. Further investigation is warranted.

**References :**

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4. Lenke et al. Spine, 26:e330-e337, 2001.