Comparison of Uniplanar Versus Fixed Pedicle Screws in the Restoration of Thoracic Kyphosis in the Treatment of Adolescent Idiopathic Scoliosis (AIS)

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Introduction: The aim of surgical treatment for adolescent idiopathic scoliosis (AIS) is to obtain a fusion with a balanced spinal column in both coronal and sagittal planes, while preserving the mobility of the lumbar spine. Presently, the posterior use of segmental vertebral anchors linked by rods remains the standard method. Great success has been attained with coronal correction; however, the sagittal profile has received less attention, often resulting in little restoration of normal sagittal plane alignment and an overall hypokyphotic spinal fusion. The purpose of this study was to compare uniplanar and fixed pedicle screws in the restoration of the thoracic spine in the sagittal plane in the treatment of adolescent idiopathic scoliosis.

Methods: Thirty-six consecutive patients with AIS treated by posterior spinal fusion from 2004-06 with fixed screws and those treated in 2008 with uniplanar screws from a single tertiary care academic institution were included in the study. The sagittal profile of two groups of patients that underwent posterior fusion for AIS was compared. One group had spinal fusions that utilized uniplanar screws (n=16) as bone anchors, and the second group had spinal fusions using the fixed screws (n=20). Uniplanar screws have the ability to be adjusted in the sagittal plane before they are secured to the rod; whereas, fixed screws have a tulip that is a fixed component of the screw. Data included: patient demographics (age, gender, height, and weight), medical conditions, curve type, Risser stage, curve magnitude in the coronal and sagittal plane, curve flexibility, fusion levels, type and location of instrumentation, initial postoperative curve magnitude in the coronal and sagittal plane, and curve size at final follow-up. A p-value < 0.05 was considered significant.

Results: Both groups were comparable demographically, medically, in relation to the curve characteristics and the surgical treatment (p>0.05). Higher curvatures preoperatively were related to higher curvatures postoperatively and at follow-up. The average T2-T12 sagittal Cobb measurement at follow-up was approximately 4 degrees higher than the immediate postoperative values. A significant difference was noted in the sagittal alignment (T5-T-12) in the two groups. (p=0.02) The post-correction T2-T12 sagittal Cobb measurements were on average higher by 10 degrees using the uniplanar than the fixed screws providing for a more normal sagittal profile. This difference was seen by the model as steady, both across levels of preoperative T2-T12 measurement and the time of measurement. The uniplanar screw group had better restoration of the thoracic kyphosis in comparison to the fixed screw group (Uniplanar 23.56 (+ 7.96) degrees versus Fixed 16.82 (+ 4.75) degrees).

Discussion: In patients undergoing posterior spinal fusion for AIS, uniplanar screws achieved superior restoration of the sagittal alignment of the thoracic spine than fixed screws. This advantage was maintained in the postoperative follow-up period. The ability of the uniplanar screws to adapt to
variable sagittal orientation appears to contribute to a better outcome. The mild increase in the kyphosis measurements at the follow-up, in both the groups, could be attributed to the ‘settling of the curve’ with time.

**Significance:** The use of uniplanar screws for posterior spinal fusion in patients with AIS demonstrated a superior restoration of thoracic spine in the sagittal plane.

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