ORIGINAL RESEARCH

Comparison of pedicle screw construct and other constructs in adolescent idiopathic scoliosis

[1]Dr. Nishant Shrivastava, [2]Dr. Shriram Gautam, [3]Dr. Shikha Shrivastava

[1]Consultant Neurosurgeon and Head, Department of Neurosurgery, M.P Birla Hospital, Satna, M.P, India
[2]Consultant and Head, Department of Anaesthesia and Critical Care, M.P Birla Hospital, Satna, M.P, India
[3]Senior Resident, Department of Forensic Medicine & Toxicology, SSMC, Rewa, M.P, India

Corresponding Author
Dr. Nishant Shrivastava
Consultant Neurosurgeon and Head, Department of Neurosurgery, M.P Birla Hospital, Satna, M.P, India

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ABSTRACT
Background: The gold standard for treating adolescent idiopathic scoliosis (AIS) is widely acknowledged to be thoracic hook instrumentation. The present study was conducted to compare pedicle screw construct and other constructs in adolescent idiopathic scoliosis. **Materials & Methods:**90 cases of right thoracicLenke 1 AISof both genderswere divided into 3 groups. Group I consisted of 30 patients in whom the universal system with segmental intraspinous collar button wires was used. Group II consisted of 30 patients in whom a hybrid construct was used. Group III consisted of 30 patients with a segmental pedicle screw construct. Parameters such as preoperative flexibility (PF), cincinnaticorrection index (CCI), and Kyphosis correction (KC) etc. were recorded. **Results:** Group I had 18 males and 12 females, group II had 20 males and 10 females and group III had 13 males and 17 females. The mean preoperative flexibility (PF) was 45% in group I, in group II was 56% and in group III was 53%. The mean Cincinnati correction index (CCI) was 1.92 in group I, 1.30 in group II and 1.47 in group III. The mean Kyphosis correction (KC) was -41 in group I, in group II was +!2 and in group III was -38. The difference was significant (P< 0.05). **Conclusion:** When the preoperative flexibility of the curve was taken into account, the pedicle screw alonedesign did not result in an improved correction of Lenke 1 AIS.
Keywords:idiopathic scoliosis,pedicle screw, thoracic spine

INTRODUCTION
The gold standard for treating adolescent idiopathic scoliosis (AIS) is widely acknowledged to be thoracic hook instrumentation.[1] The use of lumbar pedicle screws has become more common in the treatment of AIS due to the growing use of pedicle screw fixation in fractures and degenerative disorders, despite conflicting evidence about whether pedicle screws enhance and sustain correction better than hooks.[2]

Many surgeons have started using pedicle screws in the lumbar and thoracolumbar spine. Thoracic pedicle screws are specialized implants used in spinal surgery to stabilize the thoracic vertebrae. The thoracic spine refers to the region of the spine corresponding to the chest area, which consists of twelve vertebrae (T1-T12).[3] Pedicle screws are one component of spinal fixation systems, which are used to treat various spinal conditions such as spinal deformities, fractures, tumors, and degenerative diseases.Due to the concave pedicles' limited anatomical dimensions, the cord's near closeness to the pedicle, and the potential danger of spinal cord damage, the use of pedicle screws in the thoracic spine is not as commonly recognized in AIS.[4,5] Few studies have examined whether the laboratory-based biomechanical superiority of pedicle screw fixation is clinically advantageous in the treatment of thoracic curves, despite the fact that in vitro biomechanical studies have demonstrated that pedicle screws are significantly more resistant to axial pullout and tensile forces than both pedicle and laminar hooks in both the lumbar and thoracic spine. Screws can withstand loads and are intrinsically stable.[6]The present study was conducted to compare pedicle screw construct and other constructs in adolescent idiopathic scoliosis.

MATERIALS & METHODS
The present study consisted of 90 cases of right thoracicLenke 1 AISof both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. The patients were divided into 3 groups. Group I consisted

of 30 patients in whom the universal system with segmental intraspinous collar button wires was used. Group II consisted of 30 patients in whom a hybrid construct was used. Group III consisted of 30 patients with a segmental pedicle screw construct. Parameters such as preoperative flexibility (PF), cincinnati correction index (CCI), and Kyphosis correction (KC) etc. were recorded. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table: I Distribution of patients

Groups	Group I	Group II	Group III
Method	Intraspinous collar button wires	Hybrid construct	Segmental pedicle screw construct
M:F	18:12	20:10	13:17

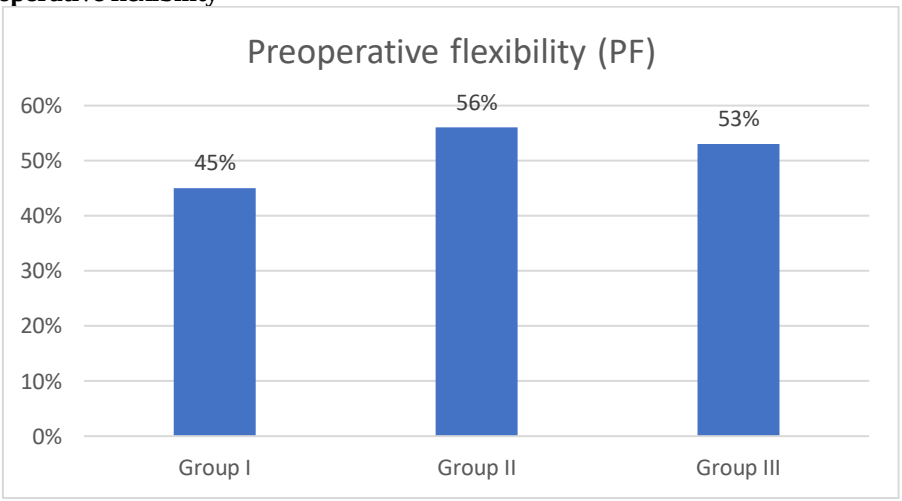
Table I shows that group I had 18 males and 12 females, group II had 20 males and 10 females and group III had 13 males and 17 females.

Table: II Assessment of parameters

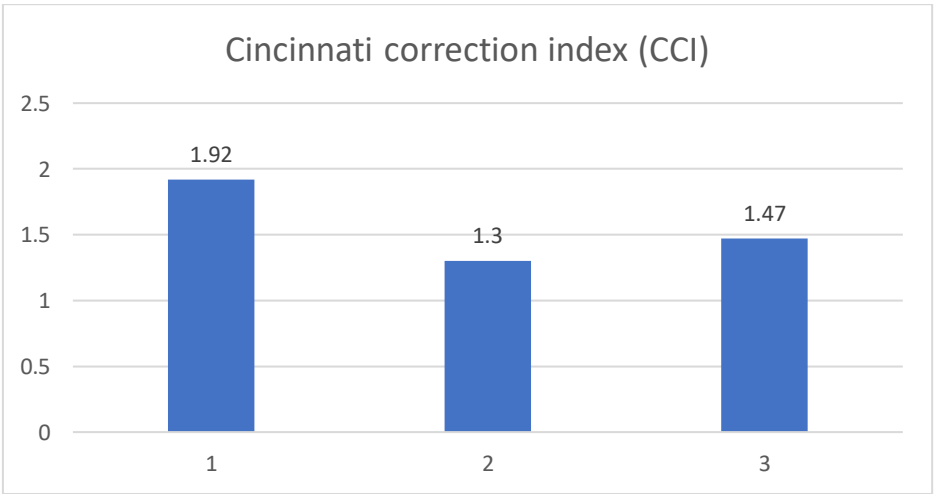
Parameters	Group I	Group II	Group III	P value
Preoperative flexibility (PF)	45%	56%	53%	0.81
Cincinnati correction index (CCI)	1.92	1.30	1.47	0.94
Kyphosis correction (KC)	-41	+12	-38	0.75

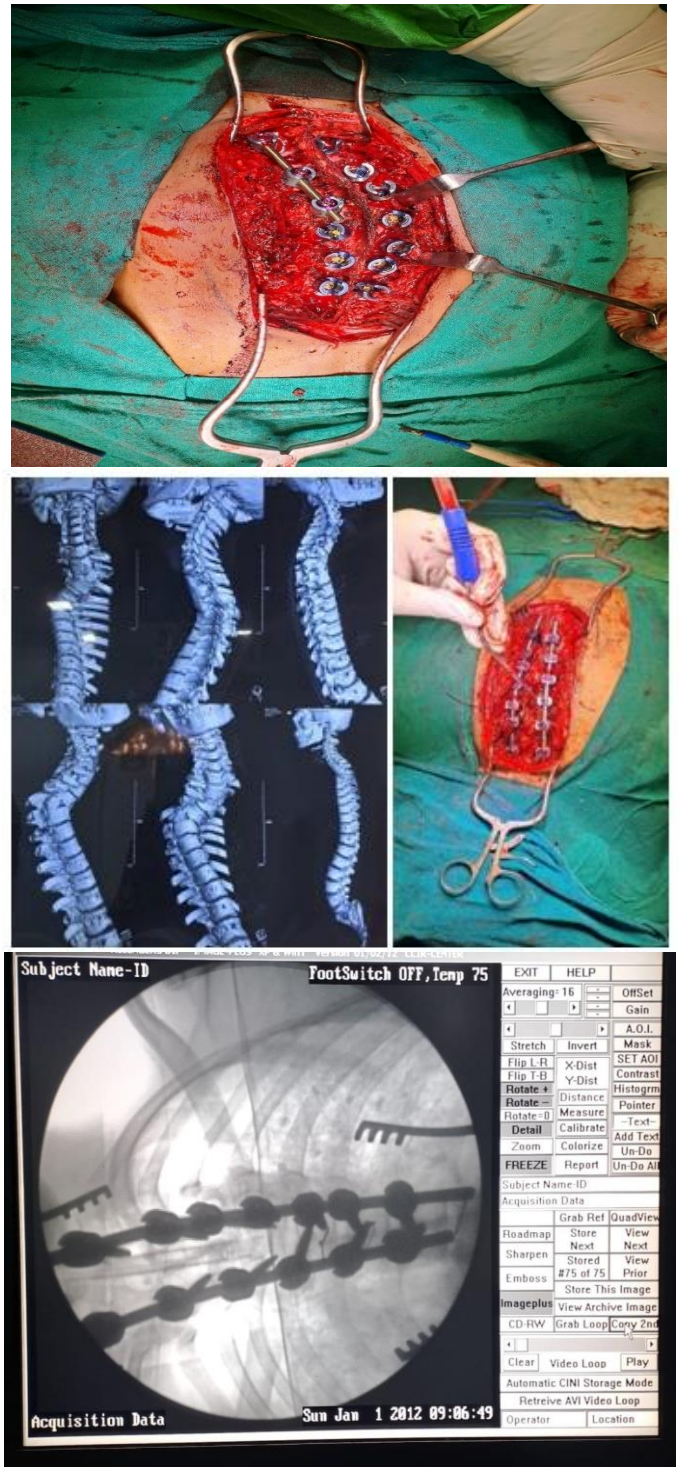
Table II, graph I and group II shows that mean preoperative flexibility (PF) was 45% in group I, in group II was 56% and in group III was 53%. The mean Cincinnati correction index (CCI) was 1.92 in group I, 1.30 in group II and 1.47 in group III. The mean Kyphosis correction (KC) was -41 in group I, in group II was +!2 and in group III was -38. The difference was significant (P< 0.05).

Graph: I Preoperative flexibility



Graph: II Cincinnati correction index





DISCUSSION

Idiopathic scoliosis is a spinal condition characterized by an abnormal sideways curvature of the spine.[7,8] "Idiopathic" means that the cause of the scoliosis is unknown. This condition typically develops during adolescence, but it can also occur in younger children or adults.[9,10]The present study was conducted to compare pedicle screw construct and other constructs in adolescent idiopathic scoliosis. We found that Group I had 18 males and 12 females, group II had 20 males and 10 females and group III had 13 males and 17 females. The mean preoperative flexibility (PF) was 45% in group I, in group II was 56% and in group III was 53%. Vora et al[11] compared the initial postoperative and 2-year follow-up correction of Lenke 1 AIS curves.Groups were as follows: Group 1 (proximal and distal hooks and segmental intraspinous collar button wires), 24 patients; Group 2 (proximal hooks, distal screws, and apical sublaminar wires), 23 patients; and Group 3 (pedicle screws only), 25 patients. The postoperative correction percentage was expressed as a ratio of the preoperative flexibility and was termed Cincinnati correction index (CCI). Mathematically speaking the CCI equals

(postoperative correction/preoperative erect Cobb angle) divided by (supine bending preoperative correction/preoperative erect Cobb angle). The postoperative sagittal correction was also measured. We observed that the mean Cincinnati correction index (CCI) was 1.92 in group I, 1.30 in group II and 1.47 in group III. The mean Kyphosis correction (KC) was -41 in group I, in group II was +!2 and in group III was -38.Storer et al[12]determined the effectiveness and cost of thoracic pedicle screws versus laminar and pedicle hooks in patients undergoing surgical correction of adolescent idiopathic scoliosis (AIS). Immediate preoperative and 6-week postoperative radiographs were examined in 25 consecutive cases of children with AIS who were divided into two groups, those with thoracic pedicle screw constructs and those with thoracic hook constructs. Endpoints collected included radiographic measures, complications, surgical time, implant cost, and quality-of-life measures. Ten children underwent spinal fusion using thoracic pedicle screw fixation and 15 underwent thoracic constructs composed of hooks. Similar sex and age distribution were noted in both groups, and among the 20 girls and 5 boys the average age was 14.5. The mean preoperative Cobb angle was 53.5 degrees for the screw group and 52.5 degrees for the hook group. Correction averaged 70.2% for the screw group and 68.1% for the hook group. There were no significant differences between the two patient groups in terms of percentage of or absolute curve change after surgery. The apical vertebral translation, end vertebral tilt angle, and coronal balance did not differ significantly between the two patient groups. Comparison of operative time and quality of life revealed no significant differences. Screw constructs were significantly more expensive than hook constructs. The correction obtained from thoracic pedicle screw fixation is comparable to traditional hook constructs in AIS. Surgery using either construct effectively corrects AIS. Hamill et al[13] found out whether pedicle screw constructs are safe to employ in the lumbar spine and if they can improve axial, sagittal, and coronal correction without causing more problems. Group A (hooks) consisted of twenty-two individuals, of which 17 had double major curves and five had King type IV curves. These patients had an average of one hook per lumbar fusion segment and a minimum follow-up time of two years. Group B consisted of twenty-two patients (screws), of which two were King type IV curves and the remaining twenty were double majors. The screw configuration for these patients included pedicle fixation on the convex side for correction and occasionally on the concave side for fixing, with a minimum follow-up length of two years. Improved lumbar Cobb correction was observed in pedicle screw fixation designs ($P < 0.05$). The limitation of the study is the small sample size.

CONCLUSION

Authors found that when the preoperative flexibility of the curve was taken into account, the pedicle screw alonedesign did not result in an improved correction of Lenke 1 AIS.

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