



# Results of Posterior Fixation and Instrumentation in Adolescent Idiopathic Scoliosis

Ahmet Serhat Genc<sup>1</sup>, Engin Eren Desteli<sup>2\*</sup> and Serdar Azat Ataman<sup>3</sup>

<sup>1</sup>Department of Orthopedics and Traumatology, Gazi State Hospital, Turkey

<sup>2</sup>Department of Orthopedics and Traumatology, Uskudar State Hospital, Turkey

<sup>3</sup>Department of Orthopedics and Traumatology, Private Medical Park Samsun Hospital, Samsun, Turkey

## Abstract

**Objectives:** The aim was to evaluate the patients treated with posterior fusion and instrumentation for adolescent idiopathic scoliosis both clinically and radiologically.

**Materials and Methods:** 49 patients with the diagnosis of adolescent idiopathic scoliosis who were operated at Ondokuz Mayıs University, Department of Orthopedics and Traumatology were retrospectively evaluated. Preoperative and postoperative radiography and clinical examination was performed to each of the patient. Mean age at the time of operation was 14.6 Mean postoperative follow-up was 35.1 months (4-84 months).

**Results:** Frontal plane correction rate was 48%, considering sagittal plane in 91% of the patients the resultant thoracic kyphosis was in normal range and in 93.9% of them normal lordosis was reached. Apical vertebra derotation was 33.6%. In 87.7% of the patient's frontal balance was obtained and in 96% of the patient's sagittal balance was obtained. Complication rate was 6.1% however we did not observe any major neurological or vascular complication.

**Conclusion:** Accurate preoperative planning is essential in surgical treatment of adolescent idiopathic scoliosis to be able to reach multi planar correction of the deformity and to lower the postoperative lumbar pain complication fusion site must not involve lower segments of the spinal column.

## OPEN ACCESS

### \*Correspondence:

Engin Eren Desteli, Department of Orthopedics and Traumatology, Uskudar State Hospital, Istanbul, Turkey, Tel: +90 212 4747900-152; E-mail: erendesteli@yahoo.co.uk

Received Date: 15 Jul 2019

Accepted Date: 01 Oct 2019

Published Date: 11 Oct 2019

### Citation:

Genc AS, Desteli EE, Ataman SA. Results of Posterior Fixation and Instrumentation in Adolescent Idiopathic Scoliosis. Clin Surg. 2019; 4: 2609.

Copyright © 2019 Engin Eren Desteli. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**Keywords:** Adolescent Idiopathic Scoliosis; Posterior Segmental Instrumentation; Lumbar Pain

## Introduction

Among all spinal deformities idiopathic scoliosis is the most common pathology that orthopedic surgeons deal. Idiopathic scoliosis is a slow progressing disease so the diagnosis of the pathology is extremely important in treatment [1]. Spinal fusion is the basis of surgical treatment. Nowadays surgical techniques maintaining solid fusion of the spine are standard treatment modality. Harrington's system is admitted as the new age for internal fixation of the spine. Three-Dimensional correction ability of the Cotrel-Dubousset (CD) system is regarded as the gold standard method of surgical treatment [2].

Numerous modifications of the CD system have been evolved. Recently pedicle screws are being frequently used in thoracic fixation and this technique decreases the negative biomechanical effects of the multi segmental hooks used in CD system. Argue still continues regarding the 'junctional kyphosis' and balance problems caused by the derotation maneuver [3]. The aim of this study is to evaluate the advantages and the disadvantages of anterior and posterior spinal fusion used in treatment of Adolescent Idiopathic Scoliosis in the light of the operations made in our clinic.

## Materials and Methods

Among 72 patients operated at Ondokuz Mayıs University Department of Orthopedics and Traumatology with the diagnosis of Adolescent Idiopathic Scoliosis, 49 of them had useful documentation and were able to come to controls and these 49 patients were included to the study. All of the patients enrolled were clinically and radiologically evaluated both preoperatively and postoperatively. The information in clinical evaluation included the beginning age of the curvature, family history, and if they had any treatment or not Maturity findings, balance, pelvic tilt were investigated, Anteroposterior, lateral supine, right and left bending and traction graphics

were received in long scoliosis cassettes. MR images of the full vertebral column were received. Curvatures were measured using the Cobb method in AP films; apical rotations of the curves were measured using the Pedriolle Method. Flexibility of the curves was evaluated using the traction-films. Frontal balance was measured by the measuring the deviation between midsacral line and C7 spinous process and >10 mm was accepted as an imbalance. Trunkal asymmetry parameter was found by measuring the deviation between mid-point of the apical vertebral body and the midsacral line. Sagittal balance was measured by the deviation between the C7 mid-point and promontorium. Values greater than 20 mm were accepted as imbalance. Curves between 20 to 40 degrees were followed up with conservative treatment. If >5 degrees progression was found in six months follow-up, conservative treatment was treatment of choice however in curves >50 degrees deformity surgical treatment was planned. In curves of 40 to 50 degrees deformity treatment modality was chosen according to following criteria; age of the patient, type of the curvature skeletal maturity according to Risser's evaluation and appearance of secondary sex characteristics. Prophylactic IV Cefazolin Na was used for all patients. Posterior segmental fusion and instrumentation was performed to all of the patients. Wake-up test was performed to all of the patients to evaluate any neurological deficit. Fluoroscopy was used to evaluate the screw positions after instrumentation. TLS orthoses were used postoperatively for 4-6 months for all of the patients to protect the fusion and to be able to compensate secondary lumbar curves. Patients were mobilized postoperative second day. Patients were evaluated at outpatient clinic at postoperative 6<sup>th</sup> week and 3<sup>rd</sup>, 6<sup>th</sup> and 12<sup>th</sup> months. In each visit AP and lateral graphs were obtained.

## Results

18 of the patients were male and 31 of them were female. Mean age at the time of surgery was 14.6 (12-20) Mean follow-up time was 35.1 months (14-84 months). All of the patients had the findings of secondary sexual characteristics. 25 of the 31 girls had menarche. 18 patients were conservatively treated with braces but were operated due to progression of the disease. Preoperatively 5 of the patients were Risser stage 2, 15 of them were Risser stage 3, 23 patients were stage 4 and 6 patients were stage 5. 44 of the patients received posterior fixation and stabilization and 4 patients were additionally operated anteriorly for anterior discectomy and release. One patient received posterior fusion 15 days after anterior discectomy. 5 patients received thoracoplasty on the convex side involving 3 to 5 ribs. In Types I and V curves both of the curvatures were included to fusion however in Type II curves only thoracic fusion was made. In 33 of the patients stable vertebrae were the distal end vertebra of the fusion, in 16 of the cases fusion ended proximal to the stable vertebra. Mean distal instrumented vertebra was L2-3, in all of the cases lumbar vertebrae were instrumented with pedicle screws however in 9 thoracic sites hooks, in 40 cases thoracic pedicle screws and transverse process hooks were used proximally. Preoperatively in frontal plane mean of major curvatures was 57.2 degrees (38 to 120 degrees) postoperatively mean value was 22.9 degrees. Correction rate was 60.9%. Rigidity of the curve was inversely related with the correction rate. Type I curves were corrected most. Preoperative and postoperative values of the compensatory curves were 37.1 vs. 19.6 degrees respectively. Mean correction rate was 48%. Mean lordosis values in the sagittal plane was 35 degrees preoperatively ad 38.4 postoperatively. Preoperatively hyperkyphotic 8 patients were found to be in normal ranges postoperatively. 3 patients who

had lordotic values of thoracic kyphosis had mean preoperative 63 degrees were postoperatively found to be 16 degrees. Types I and V curves lumbar lordosis and thoracic kyphosis values were found to be lower. According to the vertebra rotation analysis made by using the Pedriolle Method mean rotation value was found to be 33.6 degrees postoperatively it was found to be 22.1. Preoperatively mean rotation of lumbar curve vertebrae was 29 degrees, postoperatively it was 21.2. Sagittal balance evaluations were as follows; preoperatively C7-promontorium distance was - 22.04 mm, postoperatively it was found to be 13.29. Frontal balance evaluation was as follows; translation of the apical vertebra from midsacral line was preoperatively 55.8 mm postoperatively it was 16.1 mm. 4.1% (n:23) of the pedicular screws were found to be within the intervertebral disk space. 0.5% (n:3) of them had penetrated the anteriorvertebral cortex and 8 of them had perforated the lateral cortex (1.4%) We did not observe any neurological or vascular complication. At postoperative 14<sup>th</sup> month proximal hook dislocation was observed in one patient and was revised, due to the fusion of the vertebrae proximal hook was removed and rod was 2 cm shortened.

## Discussion

Primary aim of the surgery for adolescent idiopathic scoliosis are to prevent the formation of the deformity, prevention of pulmonary complications, prevention of pain, correction of the deformity in 3 planes and to reach a balanced body at the end of the procedure solid spinal fusion must be achieved [4-7]. Segmental fixation systems that enable sagittal, transverse and frontal correction of the deformity are recently accepted as surgical treatment of choice. Luque has introduced segmental fixation in 1972 and added sub laminar wiring to Harrington rods [8]. Luque's system successfully corrected the sagittal and coronal planes but the operation was long and blood loss was too much and neurological injury was also found to be increased due to sub laminar wiring. Wisconsin instrumentation system was introduced by Drummond et al. included fixation of rods which were bent in accordance to the sagittal contours by wires passed through the holes put on spinous processes [3,9]. By the use of this system 46% to 70% correction were reached in frontal plane and 10-15 degrees of increase was reached in thoracic kyphosis in the sagittal plane. Cotrel-Dubousset system (CD System) which was started to be used in 1980's made three plane corrections possible [10].

12 patients (24.4%) had lumbar pain at postoperative 24 months. In our series we clearly observed that patients whose fusion site was ended more distally had more back pain. In previous studies reason of pain following scoliosis surgery was investigated, Connolly et al. [11] and Ginsburg et al hypothesized that pain could be due to the increase in compensatory curve Cobb value and to be able to tolerate this decrease formation of hyperlordosis which results in degeneration of the disk, facet joint degeneration [11].

In their 10 year follow-up of patients operated using CD instrumentation Peres et al. [12] proposed that lumbar pain reasons of the operated patients did not differ from normal population [12]. In their 10 year follow-up of patients operated using CD instrumentation Takahashi et al found that preoperative 3% rates of pain increased to 23% after instrumentation [13]. In their 10 year follow-up of patients operated using TSRH instrumentation Benli et al. [14] found lumbar pain in 38 patients (34.8%) and they found degenerative changes in 14 patients. In the light of literature and according to the results of our study we believe that to be able to minimize disk-facet joint degeneration and back pain its essential not

to fuse the distal segments of the vertebrae.

## References

1. Domanic U, Dikici F. Adolescent Idiopathic Scoliosis. *T Klin J Surg Med Sci.* 2006;2(30):27-37.
2. Smorgick Y, Millgram MA, Anekstein Y, Floman Y, Mirovsky Y. Accuracy and Safety of Thoracic Pedicle Screw Placement in Spinal Deformities. *J Spinal Disord Tech.* 2005;18(6):522-6.
3. Atalar H, Yildiz Y, Us K. Brace Usage in Scoliosis Treatment. *T Klin Tip Bilimleri.* 2001;21:141-8.
4. Benli IT, Tüzüner M, Akalin S, Kiş M, Aydın E, Tandoğan R. Spinal Imbalance and Decompensation Problems in Patients Treated with Cotrel-Dubousset Instrumentation. *Eur Spine J.* 1996;5(6):380-6.
5. Bunnell WP. The Natural History of Idiopathic Scoliosis. *Clin Orthop Relat Res.* 1988;(229):20-5.
6. Cowell HR, Hall JN, MacEwen GD. Genetic Aspects of Idiopathic Scoliosis. *A Nicholas Andry Award Essay, 1970. Clin Orthop Relat Res.* 1972;86:121-31.
7. Cochran T, Irstam L, Nachemson A. Long Term Anatomic and Functional Changes in Patients with Adolescent Idiopathic Scoliosis Treated by Harrington Rod Fusion. *Spine.* 1983;8(6):576-84.
8. Bridwell KH, De Wald R. *The Textbook of Spinal Surgery* Second Edition. Lipincott Raven. 1997;425-641.
9. Drummond DS. Harrington Instrumentation with Spinous Processes Wiring for Idiopathic Scoliosis. *Orthop Clin North Am.* 1988;19(2):281-9.
10. Richards BS, Birch JG, Herring JA, Johnston CE, Roach JW. Frontal Plane and Sagittal Plane Balance Following Cotrel-Dubousset Instrumentation for Idiopathic Scoliosis. *Spine.* 1989;14(7):733-7.
11. Connolly PJ, Von Schroeder HP, Johnson GE, Kostuik JP. Adolescent Idiopathic Scoliosis. Long Term Effect of Instrumentation Extending to the Lumbar Spine. *J Bone Joint Surg Am.* 1995;77(8):1210-6.
12. Pérez-Gruoso FS, Fernández-Baíllo N, Arauz de Robles S, García Fernández A. The Low Lumbar Spine Below Cotrel-Dubousset Instrumentation: Long Term Findings. *Spine.* 2000;25(18):2333-41.
13. Takahashi S, Delécrin J, Passuti N. Changes in the Unfused Lumbar Spine in Patients with Adolescent Idiopathic Scoliosis. A 5 to 9 Year Assesment After Cotrel-Dubousset Instrumentation. *Spine.* 1997;22(5):517-23.
14. Benli IT, Ates B, Akalin S, Citak M, Kaya A, Alanay A. Minimum 10 years follow-up Surgical Results of Adolescent Idiopathic Scoliosis Treated with TSRH Instrumentation. *Eur Spine J.* 2007;16(3):381-91.