

# PEDICLE SCREW FIXATION IN THE LUMBAR SPINE OF PATIENTS WITH IDIOPATHIC SCOLIOSIS KING TYPE I, II \*

Daniel ZARZYCKI

Maja ZARZYCKA

Lechoslaw CIUPIK

## ABSTRACT :

Eighty three patients with idiopathic scoliosis King type I, II underwent spinal fusion with pedicle screw inserted on the convex part of lumbar curve. Forty - one patients with King type II underwent spinal fusion with C-D instrumentation with hook configuration.

Average frontal correction in pedicle screw patients was 66% - King I and 71% King II versus 53% hook patients. Sagittal correction was 72% and 75% versus 25% in hook patients. The most significant axial alignment improvement for pedicle screw patients was 24% and 22% correction versus hook patients 12.5% correction.

**Key words :** Idiopathic scoliosis, pedicle screw fixation, King type I, II

The three dimensional instrumentation shows a major improvement especially is it allows a correction of the scoliosis not only in the frontal and sagittal plane but also includes a derotation effect. The derotation effect can be proved on the apex vertebra by CT-scan described by Aaro and Dahlborn (1) or Perdriolle methods (6). In the present study we would like to compare coronal, sagittal and axial correction between hook constructs and pedicle screw constructs used on the convex portion of the lumbar curve in idiopathic patients, King Type I, II (4).

## MATERIALS AND METHODS

Eighty three patients with idiopathic scoliosis King type I, II, underwent spinal fusion between 1993-1994 with pedicle screw inserted on the convex part of lumbar curve with DERO three dimensional instrumentation. Group A consisted 22 patients with King I curves. The L IV was lowest instrumented vertebra. Group B consisted 61 patients with King II curves. The lowest instrumented vertebra was L III. There were seventy females and thirteen males, aged 12-18 years (mean age 14 years). Average follow up was 18 months. Group C constituted 41 patients with double major curve King II operated between 1990-1991 by C-D instrumentation without screw. The lowest instrumented vertebra was

always L IV. Mean age was 15.6 years with average follow up was 4 years 8 months. Axial rotation (AVR) measured by Perdriolle method.

## RESULTS

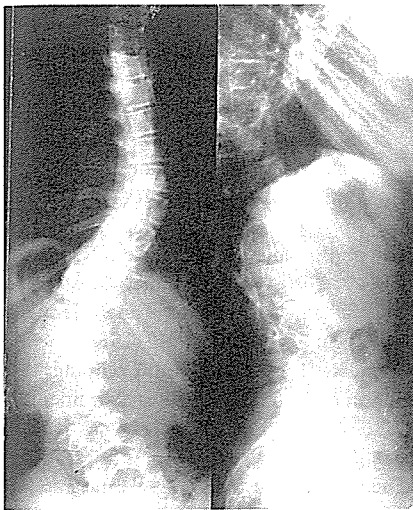
**Group A:** The average standing preoperative lumbar Cobb angle was 68°, and final postoperative Cobb angle was 25° (66% correction). Fig. 1. The average lordosis before surgery was 18°, which improved to 31° (72% correction). Preoperative rotation apical vertebra (AVR) was 37°, which improved to 28°. Average changed rotation was 9° (24% correction) (Table 1).

Table 1. Group A - King Type I  
22 patients - pedicle screw

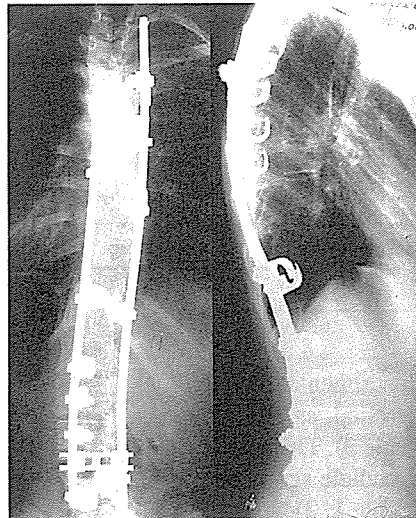
	Lumbar curve			
	preop	postop	follow up	follow up correction
Frontal plane	68°	21°	23°	45° (66 %)
Sagittal plane	18°	34°	31°	31° (72 %)
Rotation (AVR)	37°	28°	28°	9° (24 %)

**Group B:** The average preoperative lumbar Cobb angle was 63°, in follow up 18° (71% correction). Fig. 2. Average preoperative lordosis was 20°, which improved to 37° (75 % correction). Rotation apical vertebra before surgery was 31°, improved to 25°. Derotation effect was 7° (22% correction) (Table 2).

\* Regional Rehabilitation and Orthopaedic Centre for Sick Children and Adolescents. 34-500 Zakopane - POLAND



**Figure 1 A**  
King type I. Preop Cobb angle 48° and 70°



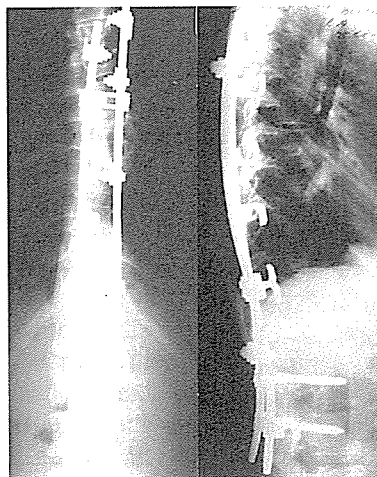
**Figure 1 B**  
Post op. Cobb angle 16° and 11°

**Table 2.** Group B - King Type II  
61 patients - pedicle screw

Lumbar curve				
	preop	postop	follow up	follow up correction
Frontal plane	63°	17°	18°	45° (71 %)
Sagittal plane	20°	36°	37°	17° (75 %)
Rotation (AVR)	31°	24°	25°	7° (22 %)



**Figure 2 A** King type II.  
Preop Cobb angle 55° and 53°



**Figure 2 B**  
Post op. Cobb angle 15° and 7°

**Group C:** The preoperative lumbar Cobb angle was 64°, and final postoperative Cobb angle was 30.3° (53% correction). The average lordosis angle before surgery was 20.4°, which improved to 25.5° (25% correction). Rotation apical vertebra before surgery was 32°, improved to 28° (12.5% correction).

**COMPLICATION:**

Group A and B there was 1 neurologic complication from insertion of screw with full recovery, 2 leak os spinal fluid. Group C: 1 deep infection, 3 leak of spinal fluid. There were no instrumentation failure and no evidence of pseudoarthrosis in either group.

**DISCUSSION**

Idiopathic scoliosis is a complex deformity represented in frontal, sagittal and axial dimension. Deacon (3) and others have emphasized the axial plane rotational deformity that accompanies the coronal and sagittal abnormalities, and the importance of its correction. Various radiographic techniques have been developed to study axial rotational component of scoliosis curve. Employing different radiographic techniques, various autors have reportet ability of three dimentional instrumentations to derotate the axial deformity at between 14% and 40% (2, 4, 6, 7, 8). Derotation instrumentations is reported to achieve derotation of scoliosis by changing the curve from relative lordosis to kyphosis, or kyphosis to lordosis producing a rotational force opposite that of the initial deformity which is then augmented by the insersion of the convex rod.

In our hospital we noticed that in patients with King type I and II scoliosis

**Table 3.** Group C - King Type II  
41 patients hook constructs

Lumbar curve				
	preop	postop	follow up	follow up correction
Frontal plane	64°	27,7°	30,3°	33,8° (53 %)
Sagittal plane	20,4°	25,5°	25,5°	5,1° (25 %)
Rotation (AVR)	32°	28°	28°	4° (12,5 %)

instrumented with CD or DERO instrumentation with hook configuration correction in frontal, sagittal and axial plane was not so effective (Table 3). The patients who had who had lumbar convex pedicle screw fixation showed superior correction (Table 1, 2). Average frontal correction in the pedicle screw patients was 66% - King I and 71% King II versus 53% hook patients. Sagittal correction was 72% and 75% versus 25% in hook patients. The most significant axial alignment improvement for pedicle screw patients was 24% and 22% correction versus hook patients 12.5% correction. Type I and II curves with screw could often effectively be derotated relatively to hook constructs because screw instrumentation may be better suited to absorb the transmitted rotational force and preserve the a balanced spine. Using this technique King II curves should be fused always to L III vertebra.

### CONCLUSIONS

The use of pedicle screw fixation on convex portion of the lumbar spine in patients with King Type I and II scoliosis we improved frontal, sagittal correction and effect of derotation.

### REFERENCES

1. Aaro S, Dahlborn M.: Estmation of vertebral rotation and the spinal and rib cage deformity in scoliosis by computer tomography. *Spine* 6: 460-467, 1981.
2. Dubousset J., Graf h., Miladi L., Cotrel Y.: Spinal and thoracic derotation with CD instrumentation. *Orthop Trans* 10(1): 36, 1986.
3. Deacon P., Flood B. M., Dickon R. A.: Idiopathic scoliosis in three dimensions: A radiographic and morphometric analysis. *J. Bone Joint Surg.* 66 B: 509-512, 1984.
4. Ecker M. L., Betz R. R., Trent P. S., et al: Computer tomography evaluation of Cotrel-Dubousset instrumentation in idiopathic scoliosis. *Spine* 13: 1141-1144, 1988.
5. King H. A., Moe J.H., Bradford D.S., Winter R.B., Lonstein J.A.: The selection of fusion levels in thoracic idiopathic scoliosis. *J. Bone Joint Surg.* 65A: 1302-1313, 1983.
6. Nash C.L., Moe J.H.: A study of vertebral rotation. *J. Bone Joint Surg.* 51 A: 223-229, 1969.
7. Perdriolle R., Vidal J.: Morphology of scoliosis: Three - dimensional evolution. *Orthopaedics* 10: 909-915, 1987.
8. Zarzycki D., Tesiorowski M., Zarzycka M., et al: Wczesne wyniki leczenia bocznych idiopatycznych skrzywień kregoslupa metoda Cotrel-Dubousset. *Chir. Narz, Ruchu i Ortop. Pol.* 57, Supl. 1: 123-125, 1993.