# SELECTION OF FUSION AREA IN THE SURGICAL TREATMENT OF KING TYPE II CURVES

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*One of the most important problems with instrumentations doing 3D correction in the surgical treatment of idiopathic scoliosis is decompensation which especially develops following selective thoracic fusion performed for King type II curves.*

*Between 1990 and 1993, in our clinic selective thoracic fusion and instrumentation was performed in 19 (15.4%) of 26 (21.1%) cases with King Type II curves out of 123 surgically treated idiopathic scoliosis patients.*

*In the selection of fusion area, standing standard AP and lateral radiograps, supine bending radiographs and sometimes traction radiographs at Risser table were taken. In the selection of distal fusion level, stable and neutral vertebra was used and intraoperative X-rays were taken to avoid overcorrection of the curve.*

*Mean follow-up was 16 months (min 6 months, max. 3 years). There was no postoperative decompensation in any of King Type II cases, who had selective thoracic fusion. In cases with Risser 0-1 (immature), a brace was used postoperatively for the lower curve.*

*We think that, in King type II curves, it is sufficient to end the fusion at stable and neutral vertebra when the flexibility of the lumbar curve is over 50% and in absence of kyphotic deformity at the thoracalumbar junction. In these cases, no decompensation is seen when the amount of correction of the thoracic curve does not exceed the flexibility of the lumbar curve seen on preoperative bending radiographs.*

*Our results confirm the validity of selective thoracic fusion for King Type II curves.*

***Key Words:*** *Selective fusion, thoracic curve, idiopathic scoliosis.*

King, Moe Bradford ve Winter developed a new classification system regarding types of curces in idiopathic scoliosis cases and selection of fusion area in these types in 1983 (4). This classification by King et al. has been used worldwide since 1983. Currently, most spine surgeons cannot determine King type II and V curves and select the fusion area according to King's classification. After 1987, with the use of new instrumentations, that allow 3D correction in idilumbar curve following instrumentation in the selected thoracic area and fusion especially in King type II curves (1, 2, 3, 6, 7, 9, 11, 12, 14).

In this study, we investigated our cases who had selective thoracic fusion and the results in the light of literature.

## PATIENTS AND METHOD

Between 1990 and 1993, in our clinic selective thoracic fusion and instrumentation was performed in 19 (15.4%) of 26 (21.1%) cases with King Type II curves out of 123 surgically treated idiopathic scoliosis patients.

There were 18 girls and one boy and the mean age was 14.1 (10-17). Mean follow-up was 16 months (min 6 months, max. 3 years).

In the selection of fusion area, standing standard AP and lateral radiograps, supine bending radiographs and sometimes traction radiographs at Risser table were taken. In the selection of distal fusion level, stable and neutral vertebra was used and intraoperative X-rays were taken to avoid overcorrection of the curve.

Flexibility of the lumbar curve varied between 41% and 100%.

Fusion ended at T11 in 2 cases, at T12 in 16 cases, and at L1 in 2 cases.

Compression hook system was used between T11-12 or T12-L1 in order to avoid thoracolumbar junctional kyphosis in the convex side.

In cases with Risser 0-1 (immature), a brace was used postoperatively for the lower curve.

## RESULTS

The average frontal Cobb angle of the thoracic curve was 60. preoperatively and 21.9 postoperatively, and these values were 49.4 and 27.2 for the lumbar curve (Table 1).

There was no junctional kyphosis in any cases both pre- and postoperatively.

There was no postoperative decompensation in any of King Type II cases, who had selective thoracic fusion.

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**Table 1:** Radiographic data of our cases

| | Preop. | | Postop. | |
|---|---|---|---|---|
| Thoracal Cobb | 60.3° | (45-76) | 21.9° | (11-40) |
| Lumbar Cobb | 49.4° | (37-70) | 27.2° | (10-40) |
| Junc. kyphosis | - | - | | |
| Imbalance (C7-S1 > 1.5 cm) | 3 cases | | | |

## DISCUSSION

In their new classification on types of curves and selection of fusion area in idiopathic scoliosis, King et al. suggest selective thoracic fusion especially in King Type II curves (4, 5). King et al. determine the fusion area according to standing AP, lateral and bending radiographs and they end the fusion at the stable and neutral vertebra inferiorly (4, 5, 8, 13). They report that trunk decompensation would develop and lumbar curve would increase in cases with fusion ending above or below the stable and neutral vertebra inferiorly.

When Harrington and Luque methods were widely used in the surgical treatment of idiopathic scoliosis, both clinically and radiographically good results were obtained with selective thoracic fusion for well-defined King type II curves (4, 5, 8, 1). With introduction of methods that do (3) D correction and allow more correction in the surgery of idiopathic scoliosis, complication rate with regard to trunk imbalance, especially in King type II curves, started to increase and this brought to our attention whether King's classification is valid or not.

Shufflebarger ve Clark (11) pointed out that in CD application in King type II curves, they ended the fusion level one below the stable vertebra inferiorly and they used modified hook system that does compression at the site of thoracolumbar junction. We believe that extension of fusion below the stable vertebra increases the lumbar curve and decompensation in cases with King type II curves with a lumbar curve that has more than 50% flexibility, except in cases with preoperative

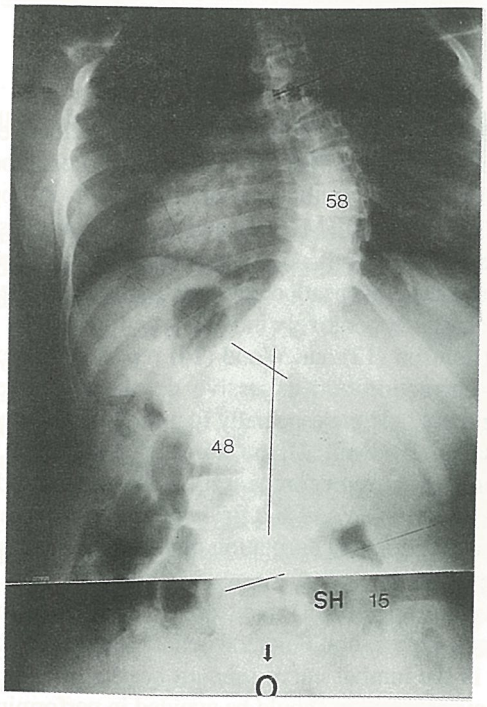


Figure 1a

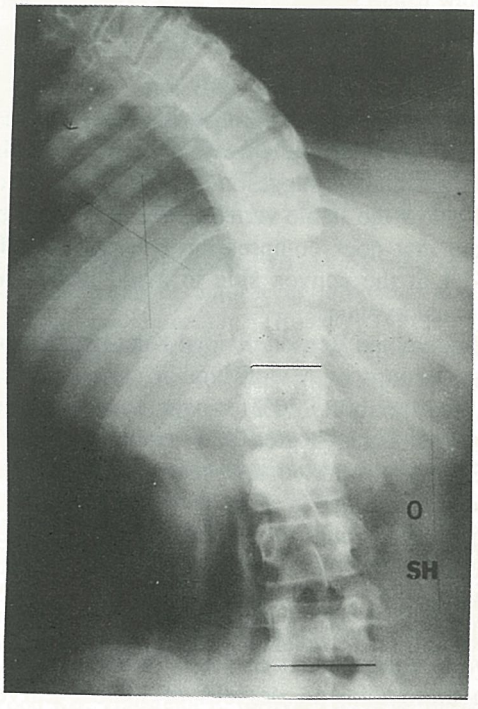


Figure 1b

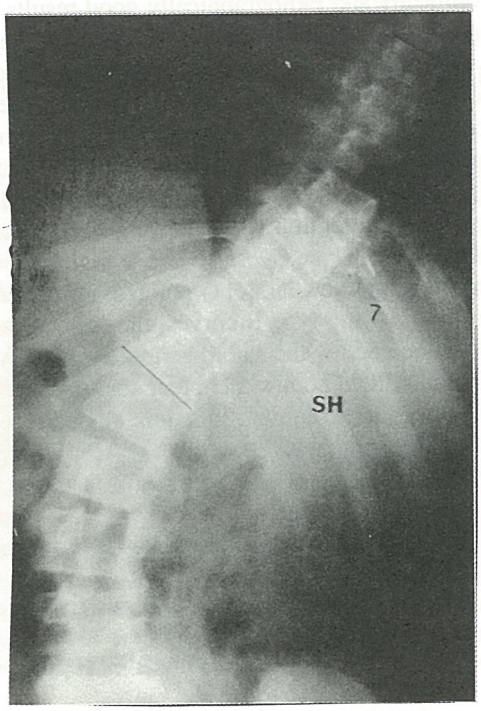


Figure 1c

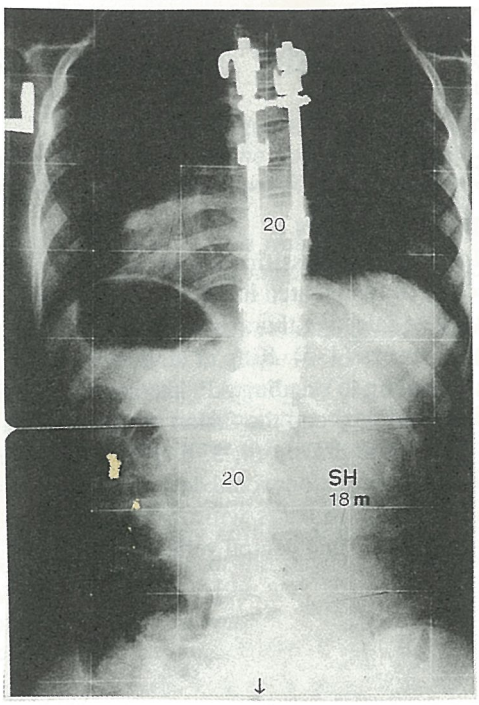


Figure 1d

kyphosis at the thoracolumbar junction or upper lumbar area. Because of this we do not agree with Shufflebarger and Clark's suggestion of ending the fusion one level below the stable vertebra. We only use the hook system that does compression between T11-T12 or T12-L1 at the convex side to avoid thoracolumbar junctional kyphosis.

İbrahim and Benson divided King type II curves to two subgroups as A with lumbar curve 5 degrees or less, and flexibility 70% or over, and B with lumbar curve more than 5 degrees and flexibility less than 70% (2, 3). They reported that selective thoracic fusion could be performed in group A, whereas in group B decompensation could develop if the lumbar curve is not included in the fusion area. Later Bridwell, McColl, Lenke (1, 6, 7, 9) supported İbrahim and Benson's suggestion and reported that fusion of selected thoracic curve in King type II curves is problematic in cases with more than 45 degrees of lumbar curves and claimed that lower lumbar curve should be included in the fusion. Although the lumbar curve was 45 degrees or more in 8 of our 19 patients who had selective thoracic fusion, there was no postoperative decompensation or increase in the lumbar curve. We, in opposition to Bridwell, McColl and Lenke's suggestion, believe that there is no direct relation between postoperative decompensation and the magnitude of the lumbar curve preoperatively in King type II curves.

Thomson (12) and Wood (14) reported that excessive correction and excessive derotation maneuver should not be done especially in order to avoid decompensation. Bridwell (1), too, agrees that excessive derotation can cause decompensation. We, in accordance with Thomson, Wood and Bridwell, believe that excessive correction and derotation maneuvre can cause decompensation.

Winter et al. (13) suggest that correction of the thoracic curve should not exceed the degree of correction in the lumbar curve seen on bending radiographs and overcorrection should be avoided in performing selective thoracic fusion in King type II curves treated with CD. They also suggest that intraoperative radio-

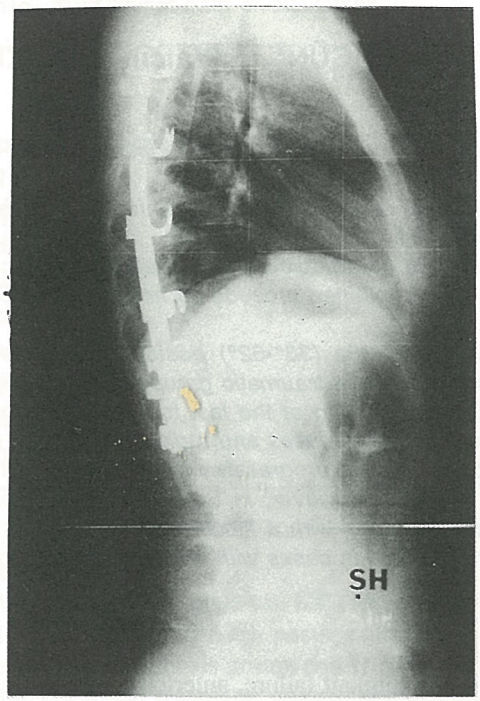


Figure 1e

**Figure 1:** Pre and postoperative radiographs of a case with King type II curve

graphs are taken to avoid overcorrection and postoperative decompensation. We agree with Winter et al. in that the main problem in selective thoracic fusion in King type II curves is overcorrection of the upper thoracic curve.

According to our experience and idea, in well-defined King type II curves, with no preoperative thoracolumbar and upper lumbar kyphosis selective thoracic fusion should be done in cases with 50% or more flexibility of the lumbar curve, irrespective of the preoperative magnitude of the lumbar curve. If the method is performed so that of lumbar curve in the bending radiographs, the results are both radiographically and clinically successful and spontaneous correction of the lumbar curve is observed.

It will be appropriate to use a brace for the treatment and correction of the lower lumbar curve until they are Risser 4 in cases with King type II curves, who had selective thoracic fusion and who are Risser 0 and 1 with immature skeletal development.

## REFERENCES

1. Bridwell KH, McAllister JW, Betz R et all.: Coronal decompansation produced by Cotrel-Dubousset "Derotation maneuver for idiopathic right thoracic scoliosis "Spine 16: 769-777, 1991.
2. İbrahim K, Benson L: Cotrel Dubousset instrumentation for double major right thoracic left lumbar scoliosis, the relation between frontal balance hook configuration and fusion levels. Orthop. Trans 15 (1): 114, 1991.
3. İbrahim K, Benson L, Goldberg B et al: Dansereau J. (ed): Proceedings of International Symposium D Scoliotic Deformities. June 92. Stuttgart, Gustav Fischer Verlag. Germany, 1992
4. King HA, Mou JH, Bradford DS et al: The selection of fusion levels in thoracic idiopathic scoliosis. J. Bone Joint Surg. 65A: 1302-1313, 1983.
5. King HA: Selection of fusion levels for posterior instrumentation and fusion in idiopathic scoliosis. Orthop. Clin. Noth Am. 19: 247-255, 1988.
6. Lenke L, Bridwell KH, Baldus C et al: Cotrel-Dubousset instrumentation for adolescent idiopathic scoliosis. J. Bone Joint Surg. 74A: 1056, 1992
7. Lenke L, Bridwell KH, Baldus C et al: Preventing decompensation in King Type II curves triated with Cotrel-Dubousset instrumentation. Spine 17: 274-281, 1992
8. Lonstein JA: Decompansation with Cotrel Dubousset instrumentation. Orthop. TRans. 16: 158, 1992.
9. McCall RE, Bronson W: Criteria for selective fusion in idiopathic scoliosis using Cotrel Dubousset instrumentation. J. Pediatr. Orthop. 12: 475-479, 1992
10. Roye DP, Farcy JP, Rickert JB et al: Results of spinal instrumentation of adolescent idiopathic scoliosis by King type. Spine 17: 5270-5273, 1992.
11. Shufflebarger H, Clark CE: Fusion levels andhook patterns in thoracic scoliosis with Cotrel Dubousset instrulmentation. Spine 15:916-920, 1990.
12. Thomson JP, Transfeldt EE, Bradford DS: Decompensation after Cotrel-Dubousset instrumentation of idiopathic scoliosis. Spine 15: 927-931, 1990
13. Winter RB, Masssey TB, Lonstein JE et al: Selection of fusion levels with special reference to coronal and sagittal balance in right thoracic adolescent idiopathic scoliosis using Cotrel-Dubousset instrumentation. Proceedings, SRS. Honolulu, Hawaii, September, 1990.
14. Wood KB, Transfeldt E, Ogilvie JW, et al: Rotational changes of the vertebral pelvic axis following Cotrel-Dubousset instrumentation. Spine 16: 5404-5408, 1991.