

IS THE COTREL-DUBOUSSET REALY UNIVERSAL IN THE SURGICAL TREATMENT OF IDIOPATHIC SCOLIOSIS?

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I reviewed the results of 21 cases of C-D instrumentation, and 48 cases of posterior approach by Harrington instrumentation and modifications of Harrington procedure. Posterior spinal fusion and instrumentation by C-D provides better correction and stabilization in thoracic and balanced double major curves. I no longer use the Harrington procedure and its modification any more.

Harrington rod, which is one of the most important step in the treatment of idiopathic scoliosis is widely used all over the world for many years. With this technique a rigid fixation cannot be expected and the instrumented area should be protected with a cast brace as long as 6-9 months. Complications like pseudoarthrosis, hook or rod failure, and loss of correction are frequently encountered. Modifications of Harrington technique couldn't lessen these complications. (1-10)

With the Luque technique (SSW) much more rigid internal fixation can be obtained. With this technique cast brace immobilization is not needed but rotational deformity, which is one of the most important deformity of the scoliosis, can not be corrected effectively. Also risk of neurological complication is very high. (11-15)

Cotrel-Dubousset technique which became populer in the recent years can provide three plane correction of the deformity. Especially rotational deformity of the thoracic idiopathic lordoscoliosis can be corrected very effectivly. With the insertion of multiple hooks very rigid internal fixation can be obtained and immobilization with a cast brace is not needed. There are a lot of papers reporting an universal success in the treatment of idiopathic scoliosis. (16-20)

For that reason in this paper we tried to discuss if the Cotrel-Duboussel Instrumentation (CDI) is universal or not. We compared the results of our Harrington cases with the early results of our CD cases.

MATERIAL AND METHOD

In the 1st clinic of Orthopaedic and Traumatic Surgery of Ankara Social Insurance Hospital, from 1984 to 1988, we performed 48 Harrington operation for idiopathic thoracic and thoracolumbal scoliosis. 32 of the patients were female and 16 of them were male. Average age was 14,1 years (Range 10-17). 33 of the patients (68,8 %) had thoracic and 15 of them (31,2 %) had thoracolumbal scoliosis. 5 of them (10,4 %) had double major curve, 27 (56,3 %) had thoracic lordoscoliosis and 10 (33,3 %) had rigid kyphoscoliosis. All the patients with rigid kyphoscoliosis had halofcmoral traction with an average of 15 days (Range 13-21 days). All of the patients had primer fusion with autograft after the instrumentation. And all of the patients had Risser's localizing cast postoperatively with an average of 9 months (Range 7-11 months). Average follow up period was 54 months (Range 48-64 months).

Table-1: Results of The Patients Treated by Harrington Onstrumentation (All of the values are averages)

Preoperative Cobb angle	60,3° (40°-99°)
Correction degree	16,8° (2°-32°)
Correction rate	27,8 % (3,1 - 41,3 %)
Loss of correction	17° (5°-29°)
Loss of correction rate.....	89,7 % (65-99 %)
Pseudoarthrosis No.....	6
PSeudoarthrosis rate.....	12,5 %
Rod failure no	4
Rod failure rate	8,3 %
Hook failure no.....	3
Hook failure rate.....	6,3 %

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I entered to a course about CD technique which was held in France in 1988, and I performed this revolutionary technique to a lordoscoliotic patient on Dc-

cember 1988. This was the first CD operation in Turkey. After Dr. Daniel Chopin's visit to our hospital on June 1989 I continued with this technique.

22,8 %. From the remaining 18 patients, 12 (57,1 %) lordoscoliotic, 4 (19,0 %) kyphoscoliotic and 2 (9,6 %) double major curved had their preoperative planning according to the special CD techniques.

Table-2 : Preoperative, postoperative averages, correction rates and presentages of the different kinds of curvatures according to the Cobb method.

	PREOP	RANGE	POSTOP	RANGE	CORRECTION		CORRECTION		
					DEGREE	RANGE	DEGREE	RANGE	
LORDOSCOLIOSIS	40,8	30-68	21,4	4-40	18	2-32	46,9	6,6-90,9	
KYPHOSCOLIOSIS	61,3	40-92	36,1	21-56	21,3	10-43	39,9	25-67,1	
DOUBLE MAJOR CURVES	I. CURVE	51	40-92	37	22-52	14	10-18	47,5	45-50
	II. CURVE	45,5	35-56	27	26-28	18,5	9-28	37,9	25,7-50
TOTAL	48,8	28-92	30,9	4-56	22,4	4-40	46,1	6,6-93,3	

From December 1988 to December 1989 21 CD instrumentations were performed at the first orthopaedic and traumatology clinic of Ankara Social Insurance Hospital in order to correct idiopathic scoliosis. The follow up period was 6-12 months. During this short period we performed 48 CD instrumentations.

Table-3 : Distribution of the patients according to the preoperative thoracic and lumbar postural angles.

THORACAL

Degree	Number	%	Degree	Number	%
Negative	3	14,3	Negative	0	0,0
0-20	7	33,3	0-30	9	42,9
20-30	2	9,6	30-60	9	42,9
30-50	6	28,5	Over 60	3	14,2
Over 50	3	14,3			

9 patients were female (42,9 %) and 12 of them were male (57,1 %). Patients were grouped as infantile (0-2 years), juvenile (3-9 years) and adolescent (10-19 years) according to their ages at the time of diagnosis. Patients ages at the time of admission to our hospital were between 10-19 years (mean 14,2). Before admission to our hospital 4 of the patients (19,1 %) had been treated with braces and the other (80,9 %) had had no treatment for scoliosis.

19 of the patients had thoracic (90,5 %) and 2 of the patients had thoracolumbal (9,5 %) scoliosis. 3 of the patients had halofemoral traction before the operation (14,3 %). Average duration of the halofemoral traction was 12 days, average end-weight for halo was 13,7 kg and average correction after the traction was 17,6 degrees and their average correction ratio was

Preoperative planning according to 3 patients that had traction was same with the plan designed for rigid kyphoscoliosis. All the patients were operated according to the plans made before operation except one. All of the patients had posterior fusion after the instrumentation. We didn't make any cast brace after the operation.

Table-4 : Distribution of the patients according to postoperative correction of the thoracic and lumbar postural angles.

	THORACAL KYPHOSIS		LUMBAR LORDOSIS	
	Number	%	Number	%
Became to normal	20	95,7	20	95,7
0-10 Degrees deviation	1	4,8	1	4,8
Total	21	100,0	21	100,0

Both of the groups curve measurement was made with Cobb's method. These groups were compared to each other according to correction rates, effects on sagittal posture angles and complications.

RESULTS

Patients treated with Harrington technique had preoperative Cobb angles with an average of 60,3 degrees (Range 40-99°). Thoracic kyphosis and lumbar lordosis angles were not recorded exactly, but qualitatively. Average correction was 16,8 degrees (range 2-32°). Average correction rate was 27,8 % (Range 3,1 - 41,3 %). There was no correction in the sagittal plane. There was a minimal correction in the rib **hump** deformity

and radiologic rotation deformity. During the follow-up period there was an average of 17 degrees of loss of correction (Range 5-29°). This loss is 89,7 % of the correction obtained during the surgery (Range 65-99 %). 6 of the patients had pseudoarthrosis (12,5 %), 3 of them had hook loosening (6,3 %) and 4 of them had rod failure (8,3). We didn't see any neurologic complications.

In the group treated by CDI preoperative average Cobb angle was 48,8 degrees (Range 28-92°). Mean Cobb angle values are shown in Table 2 according to the types of curvature. Thoracic kyphosis angles were between -6 to 72 (mean 26,9). In their bending roentgenograms average correction was 42,5 % (Range 19,5 - 89,5 %). For all the patients in the postoperative period, analysis of X-rays showed that mean correction in the Cobb angle was 22,4 degrees (46,1 %) ranged from 4 degrees to 40 degrees (6,6 % - 93,3 %). In Table 2 the correction rates of flexible lordoscoliosis, rigid kyphoscoliosis and double major scoliosis are shown. Postoperatively, thoracic kyphosis angles were within the normal limits in 20 patients (95,7 %) and for 2 (4,8 %) patients it was deviated from the normal 0-10 degrees. Also lumbar lordosis angles were within the normal limits in 20 patients (96,7 %) and for 1 (4,8 %) patient it was 0-10 degrees deviated from the normal. (Table 3-4)

We neither saw preoperative or postoperative early complications nor neurologic complications in our series. All of the patients were encouraged to walk on the third postoperative day except one (95,3 %). 5 patients (23,8 %) were sent home between 10h-15h postoperative days. On 2 had a morbidity lasting more than 15 days (9,5 %). 2 patients returned to their schools before 30 days (9,5 %), 10 patients returned to their schools between 30-45 days (47,6 %) and 6 patients returned to their schools between 45-60 days. The remaining 3 returned to their school more than 60 days after the operation. None of the patients had subjective complaints during the controls, all of them were satisfied with the operation. In the postoperative period average height of the rib hump was 1,2 cm (Range 0-3 cm). All of the rib hump deformities were corrected as much as 2,3 cm (94,1 %) ranging between 1 to 4 cm (25 % - 100%).

On the control period only in one patient we saw loss of correction, it was 2 (5,3 %) degrees in third month, 8 degrees (15,8 %) in six month and 16 degrees (42,1 %) in twelfth month. This patient was the patient in whom we couldn't perform the preoperative planning because of the severe osteoporosis on the

convex side of the vertebral column. We could put only one rod to the concave side of the curvature. In the late postoperative period we saw wound dehiscence on the incision scar in 3 patients and after some debridement we resutured the wound. We didn't see any other complications like pseudoarthrosis, hook or rod failure.

When these two groups are compared statistically correction rates of patients treated with CD methods is much more better than that of Harrington method. In addition to that with CD technique there was a good correction in the sagittal plane. There were no complications like hook or rod failure with CD technique. Though we applied a plaster of Rissler cast postoperatively to the patients treated by Harrington method there was loss of correction rate up to 89,7 %.

DISCUSSION

The classical Harrington technique (1) is an important cornerstone of the surgical management. With this technique correction of the lateral curvature is achieved. But a lot of papers about Harrington technique, reported the risk, of pseudoarthrosis about 10 % and also the complications like rod and hook failure. In addition to this, postoperative casting remained as a necessity for 6 to 9 months. (1-10) Stability of internal fixation improves with the use of cross wires or cross bars between distraction and compression rods. (10, 13,21)

In the literature one can also find papers reporting that with the Luque technique and modifications of Harrington technique a good correction and stable internal fixation is gained. (11-15) However, Lcatherman et al (14), Winter and Anderson (15) and others have observed a significant loss of correction without the use of postoperative external immobilization in their series of Luque instrumentation. In addition to that with Luque technique his risk of neurologic impairments is also reported. (11-15)

Colrel-Dubousset technique, with the use of multiple hooks and DTT system, gives the chance of rigid internal fixation and also the correction of rotational deformity that cannot be corrected by means of other techniques. Morbidity is low and there is no need for the postoperative casting. Patient can return to his job or school in a short period of time. Lateral curvatures are corrected in high rates. Because of the correction in three planes, thoracic deformities are corrected, therefore the scapular hump and rib hump deformities can be overcome as well. Complications like pseudoar-

throsis, neurologic deficit, hook and rod failure are not reported yet. On the long follow up loss of correction is minimal. And CDI technique has a risk of neurological compromise but it is less than the risk with Luque technique. (16-25)

in this study after 54 months follow-up 48 patients. We concluded that, Harrington technique cannot provide a significant correction of the curve. (27,8 %) In addition to this, it has the risk of pseudoarthrosis (12,5 %), hook loosening (6,3 %), rod failure (8,3 %) and loss of correction (17°, 89,7 %). Technique also necessitates postoperative cast immobilization. We also concluded that this technique does not effect the rotational deformity, rib hump deformity and lateral postural angles.

In the group treated with CDI there was a marked reduction (48,8 %) in the anteroposterior plane of the curve. Sagittal postural angles were within the normal limits in 95,7 % of patients. Correction rate of the rotational deformity was 33,7 %. We had loss of correction except one patient (95, 2 %). We had no complications like rod or hook failure or pseudoarthrosis.

According to these results we draw the following conclusions :

- CDI performs a very rigid internal fixation when compared with Harrington technique
- Harrington technique provides a one plane correction but CDI provides a three plane correction.
- CDI has less postoperative complication.
- CDI drops the necessity of postoperative cast bracing and provides big advantages.
- Although CDI is much more expensive, as it doesn't need to recoperate for the previously mentioned complications, and, as it reduces the time of hospitalization and beginning to his job with it's perfect correction, we think it is economic. According to these results we suggest that CDI is universal.

REFERENCES

1. Harrington PR. Treatment of scoliosis: Correction and internal fixation by spine instrumentation. *JHJS (Am)*; 44: 591-610, 1962.
2. Harrington PR. Surgical instrumentation for management of scoliosis. *Spine*; 7:256-9, 1960.
3. Harrington PR. Technical details in relation to the successful use of instrumentation in scoliosis. *Orthop Clin North Am*; 3: 49-67, 1972.
4. Harrington PR. The history and development of Harrington instrumentation. *Clin Orthop*; 93: 110-2, 1973.
5. Lealherman KD, Dickson RA. The Management of Spinal Deformities. Wright, London, pp: 72-7, 439-44, 1988.
6. Bergoin M, Bollini G, Ilorung I et al. Is the Cotrel - Dubouset really universal in the surgical treatment of idiopathic scoliosis? In: 4th proceeding of the international congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, pp: 167-70, 1987.
7. Silverman BJ, Greenberg PE. Idiopathic scoliosis posterior spine fusion with Harrington Rod and Sublaminar wiring. *Orthop Clin North Am*; 19 (2): 269-79, 1988.
8. Drummond DS. Harrington Instrumentation with spinous process wiring for idiopathic scoliosis. *Clin Orthop North Am*; 19(2): 281-9, 1988.
9. Hrwirn WD, Dickson JH. Cotrel-Dubouset spinal instrumentation and fusion. In: 4th proceeding of the international congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, pp: 18-20, 1987.
10. Armstrong GWD, Connock SHG. A transverse loading system applied to a modified Harrington Instrumentation. *Clin Orthop*; 108: 70-5, 1975.
11. Dove J. Segmental spinal instrumentation. British scoliosis society morbidity report. *JBIS (Br)*; 68: 680, 1986.
12. Luque ER. The anatomic basis and development of segmental spinal instrumentation. *Spine*; 7: 256-9, 1982.
13. Luque ER, Cordosa A. Segmental correction of scoliosis with rigid internal fixation. Annual Meeting, Scoliosis Research Society, Ottawa, Ontario, Canada, September, 1976.
14. Lealherman KD, Johnson J, Hold R et al. A clinical assessment of 357 cases of segmental spinal instrumentation. Luque (Ed.): Segmental instrumentation. Thoroughfare, NJ, Slack, 1984.
15. Winter RB, Anderson MB. Spinal arthrodesis for spinal deformity using posterior instrumentation and sublaminar wiring: 100 consecutive personal cases, intern *Orthop (SIGOT)*; 9: 239-45, 1985.
16. Akbarnia BA. Experience with Cotrel-Dubouset Instrumentation. In: 3rd Proceeding of the international congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, p: 106, 1986.
17. Ilopf C, Mallhiab H111, Heine J. Experience with surgical treatment of scoliosis by means of the CD instrumentation. In: 3rd proceeding of the international congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, pp:107-11, 1986.
18. Birch JG, Herring JA, Roach JW et al. Cotrel-Dubouset Instrumentation in idiopathic scoliosis: A preliminary report. In: 3rd proceeding of the international congress on Cotrel-Dubouset instrumentation. Sauramps Medical, Montpellier, pp:112-6, 1986.
19. Bilan F, Morel G, Morin C. A two years experience with CD instrumentation in a pediatric population. In: 3rd Proceeding of the international congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, pp:117-21, 1986.
20. Shuffelberger III, Oepstein LR, Clark C. Recovery of pulmonary function after Cotrel-Dubouset Instrumentation. In: 3rd Proceeding of the international congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, pp:144-7, 1986.
21. Cotrel Y, Dubouset J. New segmental posterior instrumentation of the spine. *Orthop Trans*; 9:118, 1985.
22. Lambert E, Tuo N, Sleib JP et al. 50 cases of idiopathic dorsal scoliosis treated by CD instrumentation. A study of respiratory function before and one year after surgery. In: 6th International congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, p:3, 1989.
23. Bridwell Kit, Capelli A, Franken C et al. Sagittal plane analysis in idiopathic scoliosis patients treated with Cotrel-Dubouset Instrumentation. In: 6th International congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, p: 14, 1989.
24. Sleib JP, Lang G, Leculce M. Experiment of 150 scoliosis operated on for 4 years with CD instrumentation. In: 6th International Congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, pp:3) - 2, 1989.
25. Vandeu Berghc A, Vercauteren M, Uyttendacle D et al. CD Instrumentation in the operative correction of scoliosis. In: 6th International Congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, pp:3)-
26. Royc DP, Farcy JPC, Schwab F. Cotrel-Dubouset Instrumentation and idiopathic scoliosis. In: 6th international Congress on Cotrel-Dubouset Instrumentation. Sauramps Medical, Montpellier, pp:32-3, 1989.