



THE RESULTS OF COTREL-DUBOUSSET INSTRUMENTATION IN IDIOPATHIC SCOLIOSIS*

İDİOPATİK SKOLYOZDA COTREL-DUBOUSSET ENSTRÜMANTASYONU SONUÇLARI*

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SUMMARY:

From December 1988 to December 1989, 21 Cotrel-Dubousset instrumentations were performed at the First Clinic of Orthopedics and Traumatology of Ankara Social Security Hospital, in order to correct idiopathic scoliosis.

The follow-up period was between 6–16 months. Nine of the patients were female (42.9%) and 12 of them were male (57.1%). One patient had infantile idiopathic scoliosis (4.8%) and two patients had juvenile idiopathic scoliosis. The other eighteen patients had adolescent idiopathic scoliosis. All of the patients were between 10 and 19 years old at the time of surgery. 17 of the patients did not have any treatment before admission to our hospital, while four of them had had brace treatment.

The results of this study suggest that Cotrel-Dubousset instrumentation, which supplies three-dimensional correction, can be successfully used for the treatment of idiopathic scoliosis.

Key Words: Idiopathic scoliosis, surgical treatment, instrumentation

Level of Evidence: Retrospective clinical study, Level III

ÖZET:

Aralık 1988 ile Aralık 1989 tarihleri arasında SSK Ankara Eğitim ve Araştırma Hastanesi, 1. Ortopedi ve Travmatoloji Kliniği'nde idiopatik skolyoz korreksiyonu için 21 Cotrel – Dubousset enstrümantasyonu uygulanmıştır.

Takip süresi 6-16 ay arasında değişmektedir. Hastalardan 9'u kadın (% 42.9) ve 12'si erkektir (% 57.1). Bir hastada (% 4.8) infantil ve 2 hastada juvenil idiopatik skolyoza mevcuttur. Geri kalan 18 hasta ise adolesan idiopatik skolyoza sahiptir. Tüm hastalar operasyon sırasındaki yaşları 10-19 arasında değişmektedir. Hastaların 17'sinin daha önce hiçbir tedavi görmediği 4'ünün ise korse tedavisi gördüğü belirlenmiştir.

Bu çalışmanın sonuçları, Cotrel- Dubousset enstrümantasyonun, idiopatik skolyozun cerrahi tedavisinde üç düzlemlile düzeltmede oldukça başarılı olduğu fikrini vermektedir.

Anahtar Kelimeler: İdiopatik skolyoz, cerrahi tedavi, enstrümantasyon

Kanıt Düzeyi: Retrospektif klinik çalışma, Düzey III

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INTRODUCTION:

There have been many achievements in the management of scoliosis in recent years. One of the important achievements is the development of the Cotrel-Dubousset (C-D) technique, described by Cotrel and Dubousset in 1984. The classical Harrington technique¹⁴ is an important corrective surgical management. With this technique, correction of the lateral curvature is achieved. However, many papers discussing the Harrington technique have reported the risks of pseudoarthrosis as about 10%, and also other complications such as rod and hook failure²¹. In addition to this, postoperative casting remains a necessity for 6–9 months^{3,14,21}. The stability of internal fixation can be improved with the use of cross wires or cross bars between the distraction and compression rods^{2,10,20}.

In the literature, it has also been reported that with the Luque technique and modifications to the Harrington technique, good correction and stable internal fixation can be achieved^{12,26}. However, Leatherman et al.¹⁸, Winter and Anderson³⁰, and others, have observed a significant loss of correction without the use of postoperative external immobilization in their studies on Luque instrumentation. Additionally, with the Luque technique, a risk of neurological impairment has also been reported^{12,26}.

The C-D technique, with the use of multiple hooks and DTT system, provides the possibility of rigid internal fixation, and also correction of rotational deformities, which cannot be corrected with other techniques. Morbidity is low and there is no need for postoperative casting. The patient can return to work or school after a short period of time. Pseudoarthrosis with the C-D technique gives a risk of neurological compromise, but this is less than the risk with the Luque technique.

Here, we present the short-term results of 21 patients with thoracic idiopathic scoliosis treated by the C-D technique.

PATIENTS AND METHOD:

From December 1988 to December 1989, 21 C-D instrumentations were performed at the First Clinic of Orthopedics and Traumatology of Ankara Social Security Hospital, in order to correct idiopathic scoliosis alone. The number of whole C-D operations that we performed before December 1989 was 48. The follow-up period was 6–12 months. Nine patients were female (42.9%) and 12 of them were male (57.1%). Patients were grouped as infantile (0–2 years), juvenile (3–9) and adolescent (10–19), according to their age at the time of diagnosis.

Their anamnesis, previous therapies and accompanying pathologies were recorded. In the clinical examination, the location and the direction of the curvature, rib hump deformity, and location of the center of gravity line were assessed. In the radiological examination, the thoracic kyphosis angle and lumbar lordosis angle were assessed, and with bending radiographs the amount of correction of the deformities was measured, preoperatively, postoperatively, and during routine follow-up. The amount of correction in the early postoperative period was also assessed, and any loss of correction was evaluated in the routine follow-up.

Lung function tests and neurological examinations were performed in the postoperative period. For patients with suspicious neurological examinations, EMG tests were also done when necessary. Halo–femoral traction was performed for three of the patients, who had rigid kyphoscoliosis. According to the preoperative plan, closed and open hooks were placed into the sites on the vertebrae, and the hooks were connected with rods. We performed derotation for a patient with thoracic lordoscoliosis. For the rigid kyphoscoliosis patients, we used three rods. All of the rods were attached with two DTTs. Before grafting, the laminae were decorticated and the facet joints were opened. For three patients we used a banked bone graft, and for four of the remaining patients we used an autogenous bone graft taken from the ilium for posterior fusion. Immediately after surgery we routinely performed neurological examination.

On the first day postoperatively, the patients were instructed to lie on their back, on the second postoperative day they were turned in the bed, on the third postoperative day they were allowed to sit in their bed, and on the third or fourth postoperative day they were encouraged to walk. Sutures were taken between the 13th and 15th postoperative day, and one day after that the patients were sent home. Patients were called for routine follow-up on the 1st, 3rd, 6th and 12th month postoperatively. In the follow-ups, we performed clinical and radiological examinations, as well as lung function tests.

RESULTS:

The patients included in this study were grouped as follows: one case of infantile, two juvenile, and 18 cases of adolescent idiopathic scoliosis (Table-1). The patient ages at the time of admission to our hospital were between 10–19 (mean 14.2) years. Two of the patients (9.5%) complained about pain, nine of the patients (42.9%) complained about both pain and deformity, and ten of the patients (47.6%) complained about deformity alone.

Table-1. Classification according to age at the time of diagnosis

AGE	NUMBER	%
0-2 (Infantile)	1	4.8
3-9 (Juvenile)	2	9.6
10-19 (Adolescent)	18	85.6
TOTAL	21	100.0

In addition to this, nine of the patients (42.9%) had dyspnea, and three of the patients (14.3%) had effort-induced tachycardia.

None of the patients had an accompanying deformity. Before admission to our hospital, four of the patients (19.1%) had been treated with braces, while the rest (80.9%) had had no treatment for scoliosis. 19 patients had thoracic (90.5%) and two of the patients had thoracolumbar (91.5%) scoliosis. The direction of the curvature was to the right in 18 patients (85.7%), and to the left in three patients (14.3%). We detected a scapular hump of 0-3 cm for four patients (19%), 3-6 cm for three patients (14.3%), and more than 6 cm for two patients (9.5%). 12 of the patients had no scapular hump. We also detected a rib hump of 0-3 cm for eight patients (37.9%) and more than 6 cm for five patients (28.8%). The center of gravity line was in the intergluteal region for ten patients (47.6%), so they had balanced scoliosis. There was deviation from the intergluteal region of 0-2 cm for six patients (28.8%), and 2-4 cm for five patients (23.6%).

In the radiological examination, proximal and distal end vertebrae were assessed with King's method, and the angle of curvature was measured according to the Cobb method. Preoperative curvature ranged between 28-92° (mean 48.8°). The mean Cobb angle values are shown in Table-2, according

to the type of curvature. The thoracic kyphosis angles were between 6-72° (mean 26.9°) (Table-3). The lumbar lordosis angles were as follows: nine patients had 0-30° (42.0%), nine patients had between 30-60° (42.9%), and three patients had more than 60° (14.2%). Two of the patients had double major scoliosis, 12 of the patients (57.2%) had thoracic lordoscoliosis, and seven of them (33.3%) had rigid kyphoscoliosis.

In bending roentgenograms, the average correction was 42.5% (range: 19.5-89.5%). Three of the patients had halo femoral traction before surgery (14.3%). The average duration of halo femoral traction was 12 days (11 days/15 days/15 days). The average final halo weight for halo traction was 13.7 kg (11 kg/15 kg/15 kg), the average correction after traction was 17.6° (6°/22°/25°), and their average correction ratio was 22.8% (6%/23.9%/38.5%). Of the remaining 18 patients, 12 (57.1%) had lordoscoliosis, four (19.0%) had kyphoscoliosis, and two (9.6%) had a double major curve, and they had preoperative planning according to special C-D techniques. The preoperative plan for the three patients who had traction was the same as the plan designed for rigid kyphoscoliosis. All the patients received surgery according to the plan made preoperatively, except one. In the postoperative period, X-ray analysis of all patients showed that the mean correction in the Cobb angle was 22.4°(46.1%), ranging from 4° to 40° (6.6-93.3%). In Table-2, the correction rates for flexible lordoscoliosis, rigid kyphoscoliosis and double major scoliosis are shown.

Postoperatively, the thoracic kyphosis angles were within the normal limits for 20 patients (95.7%), while for two (4.8%) patients this deviated from the normal by 10°. The lumbar lordosis angles were also within the normal limits for 20 patients (96.7%), while for one (4.8%) patient it deviated from normal by 0-10° (Tables-3,4).

Table-2. Preoperative and postoperative averages, correction rates and percentages 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°	6.6-90.6°
KYPHOSCOLIOSIS		61.3°	40-92°	36.1°	2-56°	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°	22.5°	4-40°	46.1°	6.6-93.3°

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

THORACIC			LUMBAR		
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			

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

	THORACIC KYPHOSIS		THORACIC LORDOSIS	
	NUMBER	%	NUMBER	%
BECAME NORMAL	20	95.7	20	95.7
0–10° DEVIATION	1	4.8	1	4.8
TOTAL	21	100.0	21	100.0

In this study, we saw no preoperative or postoperative early complications or any neurological complications. All of the patients were encouraged to walk on the third postoperative day, except one (95.3%). Five patients (23.8%) were sent home between the 10th and 15th day postoperatively. Only two patients had morbidity lasting more than 15 days (9.5%). Two patients returned to school before 30 days postoperatively (9.5%), ten patients returned to school 30–45 days postoperatively (47.6%), and six patients returned to school 45–60 days postoperatively. The remaining three patients returned to school more than 60 days after the operation.

When compared with their preoperative heights, one patient (4.8%) was 0–2 cm, nine patients (42.9%) were 2–4 cm, seven patients (33.3%) were 4–6 cm, and four patients (19%) were more than 6 cm taller in the postoperative period.

None of the patients had subjective complaints during follow-up and all of them were satisfied with the operation.

In postoperative measurements, four patients (19%) had 0–1 cm, eight patients (38.1%) had 1–3 cm, three patients (14.3%) had 3–5 cm, and five patients (23.5%) had more than 5 cm correction of the rib hump deformity. For nine patients (47.6%), correction of the scapular hump deformity was 100%, and for 20 patients the center of gravity line was within the intergluteal region.

In the follow-up period, loss of correction was seen for only one patient. This was 2° (5.3%) in the third month, 8° (15.8%) in the sixth month, and 16° (42.1%) in the twelfth month. No preoperative planning was able to be performed for this patient, due to severe osteoporosis on the convex side of the vertebral column. We were only able to place a single rod at the concave side of the curvature. In the late postoperative period, we saw wound dehiscence on the incision scar of three patients, and after some debridement we re-sutured the wound. We saw no other complications. In the follow-up, we observed improvement in respiratory function tests.

For the double major cases, 47.5% of correction of the first curve and 37.9% of correction of the second curve were established. This correction rate was higher than the values for the preoperative bending roentgenograms. In 95.7% of the cases there were normal thoracic and lumbar posture angles. There was a very good rotational deformity correction, especially in the cases of thoracic lordoscoliosis, therefore, there was 47.6% rib hump and 76.2% scapular hump deformity correction. The center of gravity line was in the intergluteal region in 95.2% cases. We saw loss of correction in only a single case. We saw no neurological dysfunction or hook or rod failures.

DISCUSSION

The C-D technique for the treatment of idiopathic scoliosis is one of the most recently developed techniques. In spite of this, many papers report favorable early results with this technique^{1,4-9,11,13,15-17,21,23-25,27-29}. Lateral curvatures are corrected at high rates. As this technique provides correction in three planes, thoracic deformities, as well as scapular hump and rib hump deformities, can be corrected. Morbidity of the patients is shortened, and the patient can return to school or work after a short period of time. There is no need for a postoperative cast or brace. Complications such as pseudoarthrosis, neurological deficit, or hook and rod failure have not yet been reported. Over a long follow-up, the loss of correction is minimal^{1,4,9,11,13,15-17,19,21,23-25,27-29}.

In our study, 46.9% of correction in the frontal plane was achieved, and in 39.9% of patients, normal physiological thoracic kyphosis was maintained.

In the light of these observations, we conclude that the C-D technique is satisfactory and reliable for the treatment of idiopathic scoliosis, because it enables correction in three planes, performs a very rigid internal fixation, and removes the need for a cast or brace. In the postoperative period, this technique causes less morbidity and lowers the minimal loss of correction.

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