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Anterior instrumentation in idiopathic scoliosis: a minimum follow-up of 10 years

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Summary. *One hundred and thirty-four patients with idiopathic scoliosis were treated between 1973 and 1993 in our hospital, and 53 were followed for a minimum of 10 years in a retrospective study. Forty-five were female and 8 male with an average age of 32 years at follow up. Dwyer instrumentation was used in 17 and Zielke in 36. The curve was thoracic in 16, thoracolumbar in 27 and lumbar in 10. The average preoperative Cobb angle was 64°. The average angle at follow up was 21° with 62% of the average correction maintained (61% in the Dwyer and 65% in the Zielke). Most patients were satisfied subjectively and we recommend this type of operation.*

Résumé. *Entre 1973 et 1993, 134 patients atteints de scoliose idiopathique ont été traités selon une instrumentation antérieure a l'hospital National de Murayama. De ces patients, 53 ont été suivis avec un minimum de 10 ans. Il y avait 45 femmes et 8 hommes avec une moyenne d'age de 32,6 ans. 17 patients ont été traités selon l'instrumentation Dwyer, et 36 selon Zielke. La courbure était thoracique chez 16 patients, thoracolumbaire chez 27 patients et lombaire chez 10 patients. La moyenne de l'angle de Cobb préopératoire était 64.7°. La moyenne de l'angle à terme était 21.3°, c'est-à-dire 62.3% en moyenne de correction de la scoliose (61.7% dans l'instrumentation Dwyer et 65% dans l'instrumentation Zielke). La majorité des patients étaient satisfaits dans une estimation subjective. Avec cette étude nous sommes assez satisfaits de nos resultats et recommandons l'instrumentation antérieure pour la correction de la scoliose.*

Introduction

Anterior instrumentation for the correction of scoliosis was first described by Dwyer in 1969 [2] and the method was modified by a system of anterior derotation developed by Zielke and reported in 1975 [13]. We first used Dwyer's method in 1973 at our hospital and have used the Zielke method since 1979.

Many authors have described the efficiency of anterior instrumentation [3, 5, 10, 11], but little information is available about the long term effects of this type of procedure [7, 10]

We have carried out a retrospective study of patients with idiopathic scoliosis treated by anterior instrumentation with a minimum follow up of 10 years.

Fig. 1. a Anteroposterior radiograph of the spine of a girl, 14 years of age, with an idiopathic thoracolumbar scoliosis measuring 63°. **b** Good correction of the scoliosis and a normal thoracolumbar curve in the lateral radiograph were maintained 12 years after operation

Fig. 2. a Radiographs of the spine of a girl with idiopathic lumbar scoliosis measuring 57°. **b** 20 years after Dwyer instrumentation, there was no scoliosis but the lumbar lordosis had decreased to 26°

Fig. 3. a Preoperative CT scan of the apical vertebra. **b** CT scan 10 years after operation showing good correction of the rotational deformity and a diminished rib hump

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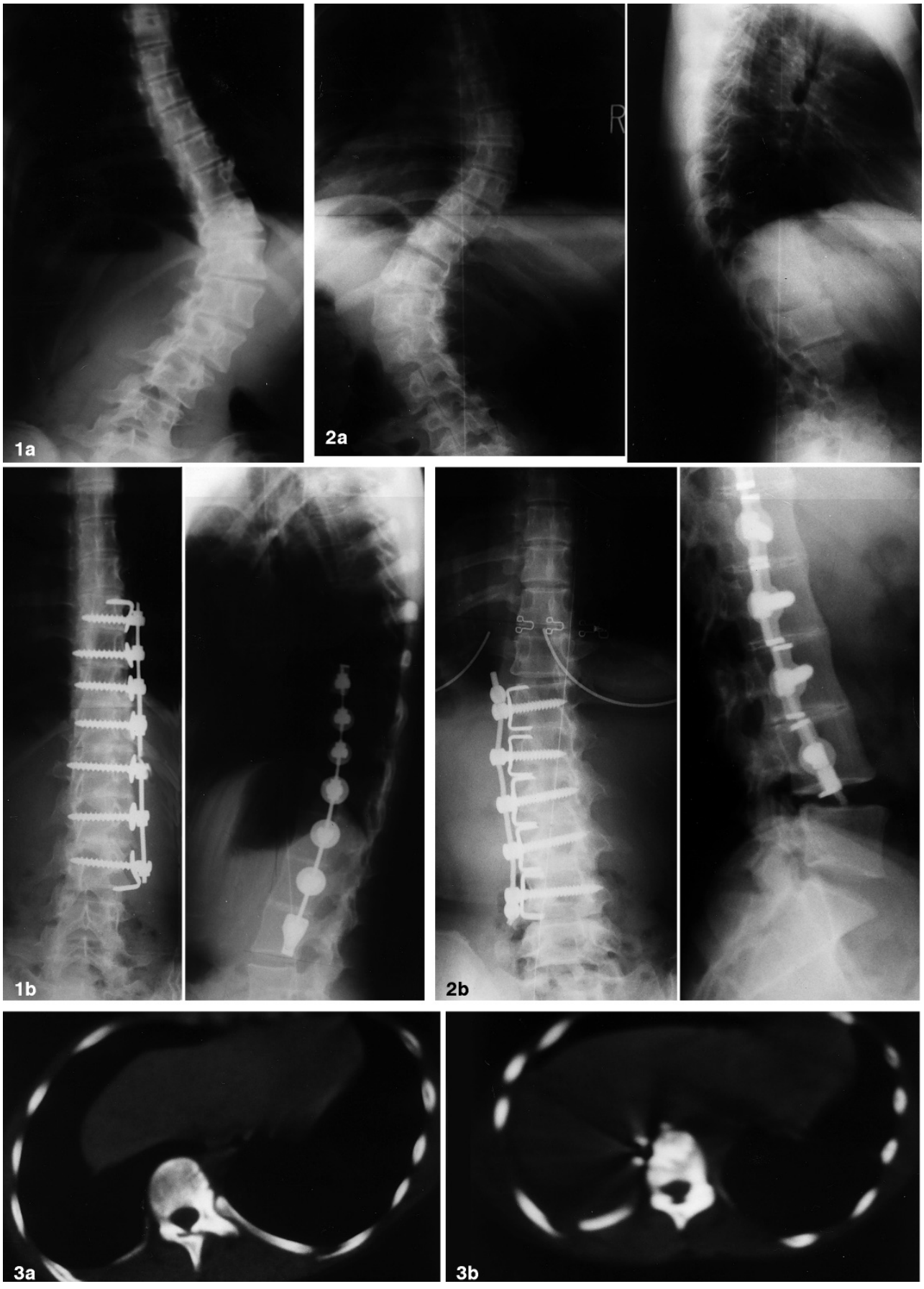
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Patients and methods

Between 1973 and 1993, 134 patients with idiopathic scoliosis were treated by anterior instrumentation at our hospital; 53 of them were followed for longer than 10 years and the results were evaluated by clinical examination and radiographs. There were 45 females and 8 males and the average age at follow up was 32.6 years (range 24 to 43 years). The first 17 had Dwyer procedures and the remainder Zielke's instrumentation. The average follow up was 14.6 years (range 10 to 20 years). The average age at operation was 17 years (range 14 to 40 years).

The average preoperative angle was 64° (range 46° to 82°). The area fused was thoracic in 16, thoracolumbar in 27 and lumbar in 10.

Information about occupation, back pain, marriage, child birth and activities of daily living (ADL) was recorded directly or by questionnaire.

Results

Radiographic evaluation

The Cobb angle was measured on standing anteroposterior and lateral radiographs. The average preoperative angle was 64.7° and at follow up the average was 21.3° (range 0 to 38°) with an average correction rate of 63% (range from 100% to 45%).

The average angle at follow up after Dwyer instrumentation was 24.3° with 62% correction, and after Zielke instrumentation the angle was 16° and 65% correction.

The follow up angles for thoracic curves ranged from 15° to 38° with average correction of 54%. The corresponding figures for thoracolumbar curves were 0 to 28° and 72% (Fig. 1), and for lumbar curves 0 to 31° and 62% (Fig. 2). Loss of correction between the immediate postoperative radiographs and those at follow-up was an average of 3.9° or 6% (range 0 to 23°) and correction 6%. The number of vertebra fused was an average of 7 for the Dwyer (range 5 to 9) and 6 (range 4 to 8) for the Zielke.

The angle of thoracic kyphosis at follow up was measured in the lateral radiographs and the average angle was 41.1° (range 32 to 47°) in the 9 Dwyer operations and 45.2° in the 7 Zielke operations. The lordotic angle between the upper border of L1 and the upper border of the sacrum was measured in the 37 patients with thoracolumbar and lumbar curves, the average angle being 31.8° (range 20 to 45°). The rotation angle of the apical vertebra was measured by CT scan using Aaro's method [1] in 12 patients; the average angle was 32.1° (range 20 to 42°), and at follow-up 16.1° (range 0 to 32°) with an average correction of 51% (range 100 to 46%) (Fig. 3).

Table 1. Assessment of low back pain by the criteria of the Japanese Orthopaedic Association

Subjective Symptoms		(9 points)
A.	Low Back pain	
	a. None	3
	b. Occasional mild pain	2
	c. Frequent mild or occasional severe pain	1
	d. Frequent or continuous severe pain	0
B.	Leg Pain and/or Tingling	
	a. None	3
	b. Occasional slight symptoms	2
	c. Frequent slight or occasional severe symptoms	1
	d. Frequent or continuous severe symptoms	0
C.	Gait	
	a. Normal	3
	b. Able to walk farther than 500 meters although it results in pain, tingling, and/or muscle weakness	2
	c. Unable to walk farther than 500 meters owing to leg pain, tingling, and/or muscle weakness	1

Marital status and child-bearing

Thirty-four (75%) of the women were married after their operation and one before. Of these, 27 (77%) gave birth subsequently, 5 (18%) having a Caesarean section, which was a higher rate than in the normal Japanese predicted average of 10%.

Late complications

Instrument failure occurred in 3 (6%) with breaking of the uppermost screws in 2 Dwyer operations and breakage of a rod in one Zielke. The fusion in these patients was consolidated at follow up.

Subjective assessment

The oral questions attempted to measure the patient's evaluation of back pain and ADL were those adopted as quantitative evaluation by the Japanese Orthopaedic Association (JOA) [6].

The scoring for back pain is shown in Table 1; 43 patients (81%) were calculated as 9 points, 6 (17%) as 8 points, 3 (6%) as 7, one (2%) as 6 points and no patients were below 5 points. No patients needed treatment for their back symptoms, and none had leg pain or tingling.

The scoring for ADL is given in Table 2; 31 patients were calculated as 14 points and having no problems, 3 (6%) as 13 points, 6 (11%) as 12, 5 (9%) as 11, 3 (6%) as 10 and 9 points respectively, and 2 (4%) as 8 points. Of the 45 women, 35 (78%) worked as housewives and the other 10 (22%) were students or employees; all the male patients were employed.

Table 2. Assessment of the activities of daily living (ADL) according to the criteria of the Japanese Orthopaedic Association

Restriction of ADL			(14 points)
ADL	Severe restriction	Moderate restriction	No restriction
a. Turn over while lying	0	1	2
b. Standing	0	1	2
c. Washing	0	1	2
d. Leaning forwards	0	1	2
e. Sitting (about 1 hour)	0	1	2
f. Lifting or holding heavy objects	0	1	2
g. Walking	0	1	2

Table 3. Marital status and childbearing

	Married	Childbearing	C-section
Otani et al. (1995)	75.6%	77.1%	18.5%
Kitahara et al. (1989)	61%	66%	
Moskowitz et al. (1980)	67%	84%	
Michel et al. (1980)	59%	68%	
Van Grouw et al. (1976)	49%		

Discussion

The correction of scoliosis approached a mean of 60% in the frontal curve and this was maintained. Anterior instrumentation may increase thoracic kyphosis or decrease lumbar lordosis in the instrumented segments. This was confirmed in our cases, and more so with the Dwyer instrumentation, although there were no clinical problems associated with this. Giehl et al. reported that lordosis can be maintained after the Zielke operation by placing a solid bone block on the convex anterior side of the intervertebral disc spaces and kyphosis can be created by omitting the bone graft [3, 4], and this was also confirmed by our experience.

Anterior instrumentation is also effective in correcting the rotational deformity [4, 5]. We achieved a mean 50% rotational correction which was maintained in our long follow-up.

Only the primary curve needs to be fused in anterior instrumentation, whereas one or two segments beyond the primary curve need to be fused in the posterior procedure [11]. The latter type of operation is usually used for double primary curves, both of which need to be fused. With anterior instrumentation, only the lumbar curve of a double primary curve needs to be fused when the thoracic curve corrects almost completely on lateral bending radiographs [2].

In our study there were no significant problems with ADL after operation in spite of the long fusion of the lumbar spine provided there was full movement of the hips. We also found that most patents did not have back pain, although a small number had a dull ache or tiredness after heavy work or when they maintained the same posture for a long time. Our data about marital status and child-bearing were similar to that reported by others (Table 3) [7, 8, 9, 12]. We do not know why the incidence of Caesarean section was higher than in our normal population.

The best correction achieved by anterior instrumentation is in the thoracolumbar and lumbar curves [10, 11] because placing the instruments is easy in the wide operative field which is obtained. The method can be satisfactory in thoracic curves below the sixth thoracic vertebra.

The technique is very effective with minimal operative intervention, blood loss is less than with posterior instrumentation [5, 10, 11], an average of approximately 500 ml in our cases, and there is less loss of correction subsequently.

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