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RESECTION OF VERTEBRAL TRANSVERSE PROCESSES IN IDIOPATHIC SCOLIOSIS

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At least two mechanisms for the deformity in idiopathic scoliosis are conceivable, namely "skew" growth due to genetic or some other disturbance of normal growth, and, secondly, the action of *mechanical forces*, by which the various vertebrae are gradually deformed during the time they are developing. The former theory of a primary disturbance of growth seems to be the less plausible, since it implies that the growth disturbance varies specifically for each vertebra, and that it acts in opposite directions above and below the middle of the primary curve. The theory relying on the action of external forces seems to be more acceptable, as the skeleton is known to be easily deformed during growth if it is subjected to abnormal external forces that interfere with natural development.

An analysis of the location of possible forces that, from a purely mechanical point of view, can produce the various deformities typical of idiopathic scoliosis has been performed by *Lindahl & Raeder* (4). It was concluded that in order to produce a combination of bending and rotation the hypothetical forces would have to be situated in a quadrant posterior and lateral to the involved vertebral bodies (XOY in Figure 1). Within this quadrant lie the transverse processes, the posterior parts of the ribs and some of the long muscles. A restriction of the vertical growth of some or all of these structures on one side might account for the scoliosis.

In order to test this hypothesis an attempt has been made to divide some of these structures, namely the ligaments and muscles that are attached to the transverse processes.

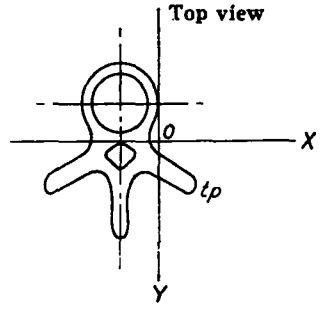


Figure 1. Model of the spinal column.

MATERIAL

The operation was performed on 13 cases of idiopathic scoliosis. The age and sex distribution, the direction on the convexity and the angle of scoliosis are given in Table 1.

Table 1. Age, sex and clinical data of the patients undergoing operation.

Case	Age	Concave side	Scoliosis angle	Resected transverse processes
1	14	left	114	Th 6–10
2	12	left	117	Th 6–11
3	10	left	114	Th 6–12
4	14	left	69	Th 7–12
5	15	right	65	Th 10–L1
6	10	left	80	Th 11–L3
7	17	left	26	Th 11–L2
8	12	left	50	Th 5–L1
9	16	right	43	Th 12–L4
10	12	left	53	Th 8–12
11	11	left	46	Th 6–12
12	11	left	61	Th 6–12
13	13	left	40	Th 5–11

Operation Technique

Under general anaesthesia a 10–15 cm long incision was made 3–5 cm on the concave side of, and parallel to, the curve formed by the spinous processes. The long dorsal muscles were divided in the fibre direction so that the transverse processes were easily accessible. These were resected to a length of 1–2 cm, and as much as possible of the ligamentous and muscular attachments was removed at the same time. The bleeding was usually negligible, and after the resection the wound was closed.

After-Treatment

The patients were able to get up the day after the operation and were usually home in 1–2 weeks. They were instructed to exercise the back muscles for a short period, and to bend the back so that the concave side was stretched. No great emphasis was placed on this after-treatment. No corset was worn.

The follow-up period was 6–15 months with a mean of 10 months.

METHODS OF EVALUATION

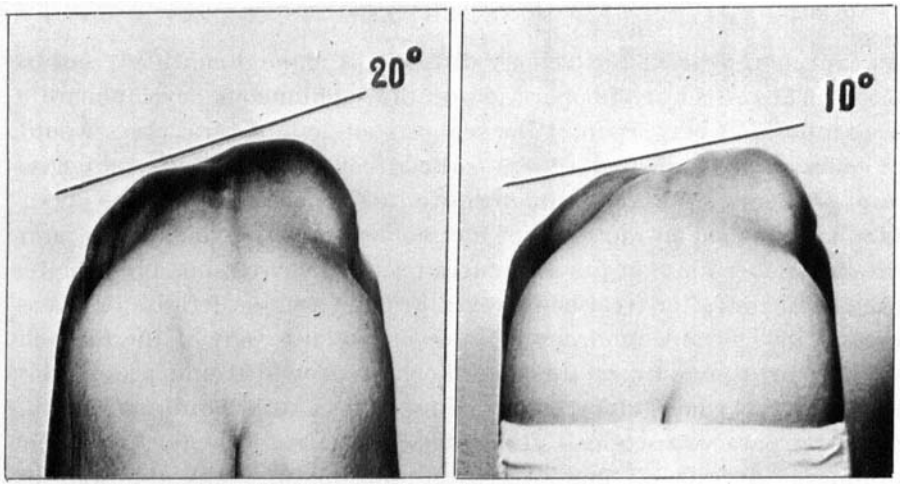
As has been pointed out by *Cobb* (1), among others, it is extremely difficult in the individual case to know whether at a certain time the scoliosis will he stationary or progressive, and how rapid any progress will be. It is therefore difficult to decide whether a particular form of treatment has affected the natural course of the scoliosis because after the operation this will not be known. However, any reduction in the scoliosis curve obtained without resorting to stretching or any active corrective treatment would be fairly reliable evidence that the treatment given has been effective, since no spontaneous regression seems to have been observed by other workers. If regression is not obtained the only entirely satisfactory method for resolving this problem is to perform the operation on a randomly selected half of a large series, the other half remaining untreated. No such study seems to have been reported, and it would be difficult to realise in practice.

In addition to signs of regression as a criterion of improvement, the author has also calculated the mean rates at which the scoliosis angle increased before and after the operation. The monthly increase in the angle was determined for approxi-

Table 2. Pre- and postoperative increase in the scoliosis angle and subjective and objective improvement.

Case	*Before operation* Scoliosis angle	Increase in angle, degr./mo	Change + —	Post-op. increase in angle, degr./mo	*Improvement* Subj.	Object.
1	114	0.7	—	0.6	—	—
2	117	1.6	—	0.2	—	+*
3	114	0.6	—	0.5	—	—
4	69	0.5	+	2.2	+	—
5	65	1.6	—	0	+	+*
6	80	0	+	0.8	+	—
7	26	0.04	+	0.9	+	—
8	50	1.5	—	0.7	—	+§
9	43	1.0	—	0.2	+	—
10	53	3.0	—	1.4	+	+§
11	46	0.4	+	0.8	+	—
12	61	0.5	+	1.2	+	—
13	40	not known		2.7	+	—

* Evidence of dressmaker. § Photograph.



Before the operation. 8 months after the operation.

Figure 2. The back in forward bending.

mately the same time pre-operatively as the patient was followed after the operation, and the two figures were compared. The angle was determined by *Fergusson*'s method (2). An error is incurred in this method—as in others—through the difficulty of obtaining a pure frontal view at the examination, and of defining the frontal plane in these patients so as to obtain the same projection in several different examinations. Small discrepancies in rotation at different examinations can have a great effect on the scoliosis angle. If the rotation of the spine is affected by the operation, it will be still more difficult to determine the angle.

RESULTS

In 9 of the 13 cases the patient stated—several times quite spontaneously—that the rotation of the thorax had regressed and that the back felt easier (Table 2). In 2 of these cases the reduction of the rotation was confirmed by the dressmaker, who had had to alter the patient's clothes, and in 2 other cases by photographs of the back, on which the rotation could be estimated (Figure 2). In no case was it possible to detect any reduction in the scoliosis angle on radiographs. In 8 of the cases there was a reduction in the mean rate of increase in the angle after the operation; in 4 there was an increase and in one no value could be obtained before the operation.

DISCUSSION

As expected, it proved extremely difficult to make a confident assessment of the effect of the operation on the spontaneous development of the scoliosis. A regression of the scoliosis angle in several cases would, of course, have indicated a therapeutic effect. In view of the subjective improvement of the rotation deformity it is conceivable that the operation had touched on the cause of the scoliosis. It is possible that a more extensive operation on the structures on the concave side and a better programme of after-treatment would provide a more definite improvement. The relevant quadrant (Figure 1) contains part of the thoracic wall, a corresponding retardation of whose growth would presumably have the same mechanical effect. That this is so is borne out by the study on paralytic scoliosis conducted by *James* (3), who found that unilateral paresis of the intercostal musculature was followed by scoliosis. In the present study an attempt was made to prolong the thorax wall on the concave side by a thoracoplastic operation in an advanced case with a scoliosis angle of 125°. There was, however, no change in the angle over a period of 6 months.

SUMMARY

To examine the validity of a theory reported earlier that scoliosis is due to a unilateral reduction in the longitudinal growth of structures laterally and dorsally of the vertebrae, the author has resected 4–7 transverse processes on the concave side of the curvature in 13 cases of idiopathic scoliosis. No other treatment was performed at the same time. In 9 of the patients a subjective reduction in the rotation deformity was found, but in none of them was there any reduction in the scoliosis angle as seen on radiographs. It is probable that the operation altered the natural development of the scoliosis, but conclusive proof is lacking.

RESUME

Pour examiner la validité d'une théorie rapportée antérieurement selon laquelle la scoliose est due à une réduction unilatérale de la croissance longitudinale des structures latérales et dorsales des vertèbres, l'auteur a opéré la résection de 4 à 7 processus transversaux sur le côte concave de la courbure dans 13 cas de scoliose idiopathique. Aucun autre traitement n'a été applique simultanément. Chez 9 des malades une réduction subjective de la déformité de rotation a été trouvée, mais il n'y avait

chez aucun une réduction de l'angle de la scoliose comme montré par la radiographie. Il est probable que l'opération altère le développement naturel de la scoliose, mais il n'existe aucune preuve concluante.

ZUSAMMENFASSUNG

Um die Gültigkeit einer früher mitgeteilten Theorie, dass die Skoliose einer einseitigen Herabsetzung des Längenwachstums der Gebilde lateral und dorsal von der Wirbelsäule beruht, hat der Verfasser 4–7 processi transversi an der konkaven Seite der Kurvatur in 13 Fällen von idiopatischer Skoliose reseziert. Keine andere Behandlung wurde zur gleichen Zeit vorgenommen. Bei 9 der Patienten wurde eine subjektive Verminderung der Rotationsdeformitet gefunden, aber bei keinen wurde eine Verminderung des Skoliosenwinkels im Röntgenbilde gesehen. Es ist wahrscheinlich, dass die Operation den naturgemässen Verlauf der Skoliose verändert hat, aber en endgültiger Beweis fehlt.

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