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DIFFERENCE IN LEG LENGTH IN CHILDREN WITH COXA PLANA DURING AND AFTER TREATMENT USING UNILATERAL UNLOADING

A Study

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A shortening of the affected leg is often seen in children with unilateral coxa plana. This shortening has frequently been said to be caused mostly by the deformation of the caput collum part of the femur and has been calculated to be about 1–2 cm. However, on unloading the affected leg only, it was found that the measured difference in leg length was caused also by a shortening of the other parts of the femur and tibia (Edgren 1965, Morscher & Taillard 1965 and others).

Similar observations in unilateral coxa plana have been made in the present study. The purpose of this study was to observe the development of the difference in leg length throughout the treatment and afterwards. The observations have been made by means of orthoradiography.

MATERIAL

The material consisted of 55 children, 48 boys and 7 girls, who were treated for unilateral coxa plana by means of crutches and slings at the Orthopaedic Clinic, Central Hospital in Linköping. The observations were made from 1962 to 1968.

The occurrence of coxa plana in the right and left hips can be seen in Table 1.

The average age at the beginning of the illness was 6.1 ± 1.8* years for boys and 6.0 ± 1.6* years for girls.

The duration of treatment was 24.2 ± 7.6* months.

As growth rate is roughly constant among children between four and ten years of age, it is possible to look upon them as a homogenous group.

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* Average ± SD

Table 1. Occurrence of coxa plana in the right and left hips.

	Left-sided	Right-sided
Boys	27	21
Girls	4	3

In all cases the measurements were performed using the orthoradiographic method described by Goldstein & Dreisinger (1950). During the observations, hips, knees and ankles were exposed separately. Between the exposures the cassette with the X-ray film was moved so that only one third of the film was exposed at a time. During this procedure it was very important that the children lay motionless between the exposures and that the legs were parallel to the X-ray table. Consequently this method could only determine the presence of a difference in leg length and not the real length. Tupman (1962) stated the standard error of this method as 0.2 per cent.

To exclude the shortening of the affected leg which was caused by the deformation of the caput-collum part, the femur was measured from the distal part of the epiphysis of the trochanter major to the lateral condyle of the femur (a). The tibia was measured from the medial condyle to the medial malleole (b) (Figure 1).

The number of observations varied individually from 1–10 (Table 2). Twenty-two children were followed up for two years after the completion of the treatment.

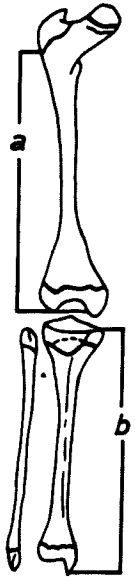

Figure 1. Measuring sites.

Table 2. Number of observations.

	1	2	3	4	5	6	7	8	9	10
Boys	11	10	5		5	6	4	3	2	2
Girls	2	1	2		1		1			

Table 3. Mean difference in leg length in children with unilateral coxa plana treated with slings and crutches.

	Duration of the treatment (months)					
	0	6	12	18	24	36
No. of cases	17	16	19	14	21	7
Mean (mm)	1.6	6.3	10.3	17.8	18.8	22.0
± SD (mm)	2.1	3.2	4.4	7.0	8.2	5.5
± SE (mm)	0.5	0.8	1.0	1.9	1.8	2.1

RESULTS

When the treatment started no observable difference in the leg length could be found in most of the cases. In five cases a shortening of the unaffected leg was noticed. As could be expected the affected legs of all the cases were shorter during the treatment and the first visible signs of a difference in leg length could be noticed within six months. This difference became more and more obvious as the treatment continued (Table 3).

After the treatment was terminated the children were allowed to use both legs. Then the following development could be observed. The difference in the leg length distal of the trochanter part diminished (Table 4). On the other hand, the shortening caused by the deformation of the caput femoris remained unchanged.

The proportion of the observed difference in leg length located in the femur, distal to trochanter major, was 8.0 ± 5.5 mm* and that in the tibia was 7.9 ± 4.8 mm* at the completion of the treatment. Thus the retardation of growth seemed to be equal in both bones.

In order to be able to study the importance of immobilization in the above-mentioned difference in leg length distal to the epiphysis of the trochanter major, two groups of children were observed. Those who followed the instructions as to the use of crutches and slings through-

* Average ± SD

Table 4. Mean difference in leg length after the end of the treatment.

	End of treatment	6	12	24	36	48	60
No. of cases	25	15	14	12	10	11	5
Mean (mm)	19.9	16.7	12.9	9.4	8.6	4.6	2.2
± SD (mm)	8.7	7.2	7.2	6.8	5.3	5.7	4.9
± SE (mm)	1.7		1.9	2.0	1.7	1.7	2.2

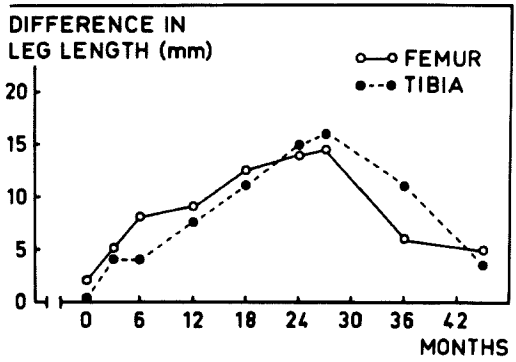

Figure 2. Six-year-old boy with a left-sided coxa plana diagnosed in April, 1963. Treated for 30 months with slings and crutches.

out their disease (group 1) were compared to those who had loaded their affected leg over longer periods (group 2). Here a statistically significant difference could be found. The difference in leg length was 21.9 ± 7.4 mm* in group 1 and 10.8 ± 3.5 mm* in group 2.

As an example of this development 2 cases which were observed from the start of the treatment to a few years after its completion are shown in Figures 2 and 3.

DISCUSSION

The existence of a difference in leg length in unilateral coxa plana has been recognized for a long time (Caan 1924, Carpenter & Powell 1960, Edgren 1965, Morscher & Taillard 1965).

Carpenter & Powell found that a shortening of the affected leg could be seen in every case of coxa plana with a deformed caput femoris. Edgren reported that the difference in the leg length was usually between 0.5 and 3.5 cm and asserted at the same time that this

* Average ± SD

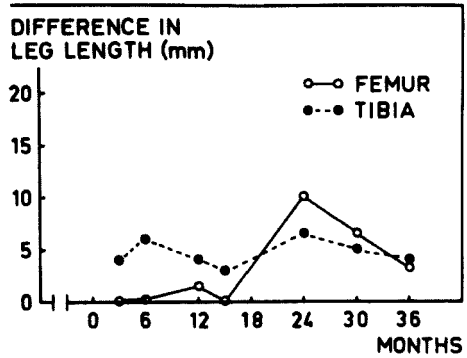

Figure 3. Four-year-old boy with a right-sided coxa plana diagnosed in May, 1961. Treated with slings and crutches for 24 months. During the first 15 months intermittent weightbearing of the affected leg.

shortening of the affected leg was caused not only by the deformation of the caput–collum part but also by the engagement of the rest of the leg.

The retarded growth of the affected leg, distal to trochanter major, is considered to be caused mainly by the immobilization of the leg and not by the illness itself (Ferguson 1963, Morscher & Taillard 1965, Edgren 1965). This observation is confirmed by this study.

Gullickson et al. (1950) for example pointed to the connection between skeletal growth and the activity of the muscles. The absolute strength of the muscles was of less importance. Ring (1961) was of the opinion that the muscles and skeleton of an extremity should be regarded as a functional unit. Sundén (1967) considered the blood circulation of the bone tissue to be dependent on the activity of the muscles. From this study it can be concluded that the difference in the leg length is caused by the lack of activity of the affected leg. The difference could in certain cases be as much as 3 cm.

An extremity that has been immobilized for a long time cannot begin to grow in a compensatory manner because of a premature closure of the epiphyses (Morscher & Taillard 1965). This study, however, shows that a few years' immobilization of a leg only delays the growth of the leg during the non-weightbearing period. When the affected leg is again taking weight an actual compensatory growth starts which leads to a significant reduction of the difference in the leg length within a year after the completion of the treatment. A residual difference, however, is noticeable for some years. Any signs of an earlier closure of the epiphyses have not been observed.

SUMMARY

In unilateral coxa plana a shortening of the affected leg can often be found. This shortening affects not only the caput-collum part of the femur but also the other parts of the femur and the tibia. In this study, however, the immobilization of the affected leg seemed to be the main reason for the observed difference in the leg length. Children who had not unloaded their affected leg as carefully as they should proved to have a smaller difference in leg length than those who had unloaded their affected leg according to the instructions. On the other hand compensatory growth of the affected leg was found when both legs were again taking weight. The difference in the leg length was significantly reduced one year after the completion of the treatment.

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