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## FOLLOW-UP STUDY OF HIP JOINT DYSPLASIA TREATED FROM THE NEWBORN STAGE

*By*

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In a previous paper I described the management of 50 babies with hip joint dysplasia (hd) treated primarily with a Frejka pillow splint. These children were followed up to a stage where, in my opinion, their hip joints showed normal development. At that time none had clinical signs of hd.

Hip joint dysplasia in this connection means cases with luxation and subluxation as well as cases with a defective development of the hip joint without dislocation.

The X-rays for a routine examination would have been regarded as normal. However, on a meticulous geometrical examination of the X-rays, I was in some doubt and divided the results into the following subgroups:

|                              |             |
|------------------------------|-------------|
| (1) "Normal" hips .....      | 24 children |
| (2) "Normal?" hips .....     | 14 children |
| (3) "Dysplastic?" hips ..... | 10 children |
| (4) "Dysplastic" hips .....  | 1 child     |
| Not fully followed up .....  | 1 child     |

In the literature there is little general agreement as to the radiological appearance of the normal hip-joint in young children. There are several methods of measuring the hip joints in an A-P view of the pelvis using different accessory lines. In practice most of these methods are difficult to apply and the placement of the accessory lines seems inexact.

*Wiberg* describes a method of evaluation of the X-ray appearance of the hip joint in young individuals based on the center-edge (CE) angle. In my opinion this method is suitable for practical use. Furthermore, *Severin* has—in his monograph—given a description of the normal hip joint in children at the age of 6 years according to this method.

*Massie & Howorth* have shown that the same limits of the CE-angle are valid down to the age of 3 years.

Because of my own doubts as to the radiological result of the treatment with a Frejka splint, I have felt it desirable to do a follow-up examination of these 50 cases, as the children now have reached the age of 5–7 years and the radiological appearance of their hip joints should be comparable to the normal series of *Severin*.

#### METHOD OF FOLLOW-UP EXAMINATION

Each of the children was accompanied to the examination by one of the parents.

- 1) The mother or father was questioned thoroughly as to symptoms of hip disorders or of disorders of the lower extremities.
- 2) A clinical examination of the lower extremities was performed. Great emphasis was put on the range of rotational movements of the hip joint in order to detect any clinical signs of anteversion of the neck of the femur.
- 3) Two X-rays were taken of each child:
  - a. A-P view of pelvis with both femurs in neutral rotation.
  - b. A-P view of pelvis with both femurs in maximal internal rotation.

The combination of these two X-rays will give an impression of the anteversion, but definitely no accurate measurements of the same.

Of the 50 patients, 48 had a complete examination as described above. One was clinically examined but no X-rays were taken, and one child did not come to the examination because of mental instability. Therefore, the results of clinical examination refer to 49 children and the roentgenological part to 48 children.

#### FINDINGS AT FOLLOW-UP EXAMINATION

##### *Symptoms.*

None of the children had any symptoms of previous hip joint dysplasia. Their parents assured me that none was physically handicapped in comparison to other children of the same age and sex. None had found reason to see a doctor because of the lower extremities after the treatment was ended.

*Signs.*

The Trendelenburg sign was negative in all children. No inequality in leg length was observed judging by the pelvic position when standing. No muscular atrophy of the lower extremities was found. 10 children had increased valgus position of the knees, most likely a physiological valgus in relation to age and sex. Definite planovalgus of the feet was found in 2 children, aplanation of the foot without valgus of the heel was found in 3 children.

Of other pathological conditions concerning the musculo-skeletal system, one was noted: an asymmetric funnel-deformity of the thorax.

The gait was observed and the parents were asked about certain abnormalities in gait. The conclusion was that one child (TH) walked with definite intoeing, 4 children had a slight degree of intoeing. None was in any way incapacitated because of this in walking or running.

The passive range of motion of the hip joints was measured as exactly as possible.

The flexion, abduction and adduction were measured in supine position and the extension, internal and external rotation were measured in prone position.

The upper and lower margins of the different excursions were found to be:

|                 |          |
|-----------------|----------|
| Flexion .....   | 160-130° |
| Extension ..... | 35- 20°  |
| Abduction ..... | 80- 40°  |
| Adduction ..... | 40- 35°  |

The rotational excursions are shown graphically in Fig. 1.

The curves show that the average total rotation is 97° with an average internal rotation of 62° and external rotation of 35°, which most likely is normal for this age-group. In no case did the excursion of rotation differ more than 10° from rt. to lt. hip.

The total range of rotation, which in none of the children exceeds 120° does not indicate laxity of the hip joints.

It is generally accepted that an internal rotation exceeding 70° is indicative of increased anteversion of the neck of the femur.

In this series an internal rotation of 70-80° is found in 7 hips in 4 patients. In 2 of these there was observed intoeing when walking, but the other 2 showed no signs of this walking habit. In none of these 4 cases did the intoeing give subjective symptoms, such as frequent stumbling, fatigue or muscular pain in the lower extremities.

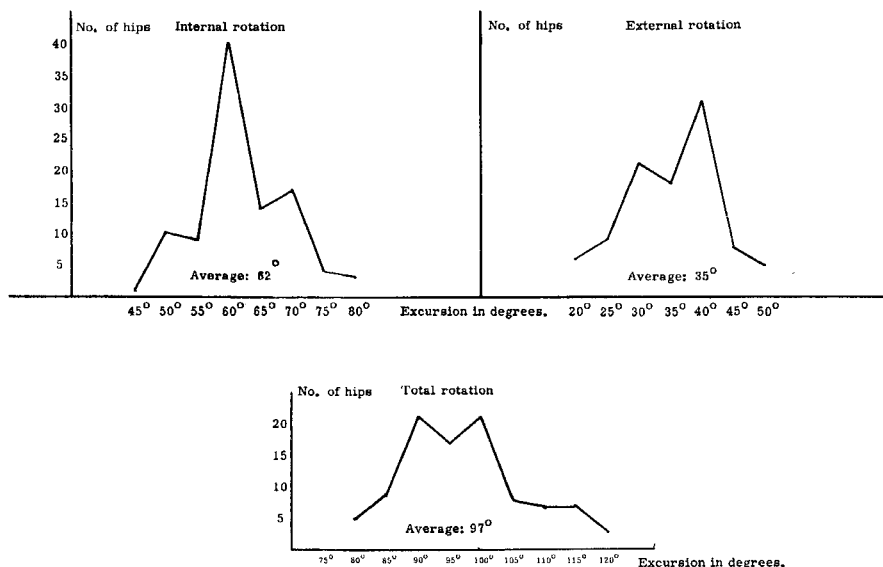


Fig. 1.

The passive rotation of 98 hip joints measured in prone position.

### Roentgenological Examination.

As mentioned previously, there is little general agreement as to the X-ray appearance of the normal hip joint in children of this age group.

I have chosen to use the method of *Wiberg* with *Severin's* correction for younger children. The CE-angles of the 96 hips are shown in Table 1 in relation to the normal values of *Severin*:

According to this table the distribution of the CE-angle is practically identical in the two series up to 25°. Above this level there is some difference, but not more than expected in two groups of this size.

In this series of 50 children with hd the result of treatment so far is that the roentgenological appearance is within normal limits. I think that this is to regard the problem too easily or optimistically.

*Severin* says in his monograph that a hip joint with a CE-angle 20° or more is definitely normal in a 6 year old child. CE-angles below 15° are definitely pathological. CE-angles between 15° and 20° are uncertain.

In this series there are 2 hips in different children with a CE-angle less than 20°. The CE-angles in these are as follows:

|                |             |            |
|----------------|-------------|------------|
| Case SMA ..... | Rt. hip 16° | Lt hip 29° |
| Case HMV ..... | Rt. hip 15° | Lt hip 24° |

TABLE 1  
*The CE-Angle of 96 Hip Joints Compared with Normal Values.*

| CE-angle | Normal values (Severin)<br>age 6-13 yrs. |     | This series<br>Age 5-7 yrs. |      |
|----------|------------------------------------------|-----|-----------------------------|------|
|          | No. of hips                              | %   | No. of hips                 | %    |
| 15°      | 1                                        | 2   | 1                           | 2.1  |
| 16°      | —                                        |     | 1                           |      |
| 17°      | 1                                        |     | —                           |      |
| 18°      | 1                                        |     | —                           |      |
| 19°      | —                                        |     | —                           |      |
| 20°      | 8                                        | 34½ | 3                           | 34.3 |
| 21°      | 5                                        |     | 6                           |      |
| 22°      | 6                                        |     | 5                           |      |
| 23°      | 7                                        |     | 4                           |      |
| 24°      | 9                                        |     | 6                           |      |
| 25°      | 12                                       |     | 9                           |      |
| 26-30°   | 42                                       | 31  | 34                          | 35.4 |
| 31-35°   | 38                                       | 28  | 19                          | 19.8 |
| 36-40°   | 6                                        | 4½  | 5                           | 5.3  |
| 41-45°   | —                                        | —   | 2                           | 2.1  |
| 46°      | —                                        | —   | 1                           | 1.0  |

In only one additional case I have found a marked difference of CE-angle from rt. to lt. hip, case GF. rt. hip 28° lt. hip 41°.

The only patient who had a definite dysplasia in one hip (rt.) when treatment was finished at the age of 2 years 6 months (case TH) had at follow up a CE-angle of 20° (rt.) and 25° (lt.).

#### DISCUSSION

Symptoms: No child is suffering any sequelae of his previous hip joint dysplasia.

Signs: The follow-up showed very few signs of a previous hip joint dysplasia.

In one case (TH) there was marked intoeing when walking. The range of rotation was:

Internal ..... 65°-70° (rt.-lt.)  
 External ..... 20°-20° (rt.-lt.)

In 4 cases there was found a slight intoeing when walking. This walking habit, however, did not seem necessarily to be related to an

increased internal rotation of the hip joint and was no handicap in walking or running.

Upon clinical examination, no other sequel of previous hip joint dysplasia was found. The few cases of flat feet are not uncommon in a group of children of this type and the valgus position of the knees observed in 10 cases is, as mentioned, most likely physiological in this age group.

### *Roentgenological Signs.*

Judged by the CE-angle the whole group is within the normal limits established for this method of evaluation of hip joints.

The few cases mentioned with regard to marked difference in CE-angle from rt. to lt. hip, or with regard to abnormality of hip joint by general appearance need further comment:

In one of the cases there was, at the time of follow-up, definite signs of a healed avascular necrosis of the head of the femur on one side. This necrosis most likely had taken place when weightbearing started, but had presented such slight symptoms that neither the child nor the parents had noticed them. (Case SMA).

In the rest of the cases I can find no reason for the difference in CE-angle from rt. to lt. hip, and feel that all the joints must be within the normal limits of variation.

In view of these cases, I feel that *Severin* was right in establishing an uncertain lower limit for the CE-angle in children of this age.

### *Previous Reading of X-rays.*

In my first paper based on the standard of the hips in these 50 children at the close of treatment, most often when the child was about 1 year old, I was uncertain of my X-ray readings.

I divided the hips in four groups:

- (1) "Normal"
- (2) "Normal?"
- (3) "Dysplastic?"
- (4) "Dysplastic"

By reviewing X-rays of the hips of these children at the age of 5-7 years, I could have relieved any doubt. The follow-up shows that 22 children in group "Normal" have an average CE-angle of  $28\frac{1}{2}^{\circ}$ , 14 children in group "Normal?" have an average CE-angle of  $26\frac{1}{2}^{\circ}$ , and 10 children in group "Dysplastic?" have an average CE-angle of  $27\frac{1}{2}^{\circ}$ .



*Fig. 2. Case LS.*

a. Age 5 days. Ortolani's sign positive bilaterally.

b. Age 9 mths. Treatment finished. Rated: "Normal" hips.

c. Age 5 years. CE-angles, Rt: 21°, Lt: 24°.



*Fig. 3. Case LR.*

a. Age 3 days. Ortolani's sign positive bilaterally.

b. Age 10 mths. Treatment finished. Rated: "Normal?" hips.

c. Age 5 years 3 mths. CE-angles, Rt: 22°, Lt: 22°.

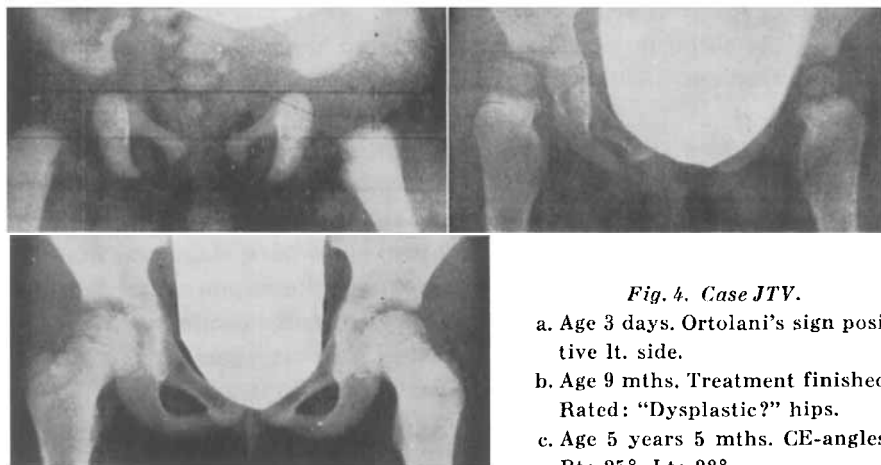


In the single case where a dysplastic rt. hip was diagnosed at the close of treatment, I still find the same hip joint dysplastic with CE-angle 20°.

The follow-up thus shows that all the doubtful cases have shown normal development, with a single exception.

a

b



*Fig. 4. Case JTV.*

a. Age 3 days. Ortolani's sign positive lt. side.

b. Age 9 mths. Treatment finished. Rated: "Dysplastic?" hips.

c. Age 5 years 5 mths. CE-angles, Rt: 25°, Lt: 28°.

c

#### ROENTGENOLOGICAL SIGNS OF INCREASED ANTEVERSION

The clinical examination shows a few cases with a trend of gait indicating increased anteversion of the neck of the femur. The examination for rotational movement of the hip joints also reveals few cases with an internal rotation of the hip joints indicating the same dysplastic sign. However, some of the children with intoeing have a normal range of rotational movement, and some of the children with increased passive internal rotation have a completely normal gait.

Roentgenological examination of the hip joints in these cases does not give any definite impression of increased anteversion of the neck of the femur nor of a better position of the head in the acetabulum in an internally rotated than in a neutral position. I therefore feel that a rotational osteotomy of the femur should be performed only in cases where clinical examination shows a marked intoeing gait with clumsiness in walking and running, or where the X-ray examination reveals a definite improvement of the position of the femoral head in relation to the acetabulum with internal rotation of the hip joints.

#### SUMMARY AND CONCLUSIONS

50 children with clinical and roentgenological signs of hipjoint dislocation or dysplasia were treated from the newborn stage with a

Frejka pillow-splint. Active treatment was in most cases finished at the end of the first year of life.

49 of the children were reexamined at an age of 5 to 7 years. Based on the findings at the reexamination, following conclusions were reached:

1. A correctly treated hipjoint dislocation or dysplasia in the newborn stage leads to development of perfectly normal hipjoints including normal anteversion of the femoral neck.

2. Even if the treatment is started in the newborn stage and the first year of life shows normal development of the hipjoints, a periodic follow-up of these children should be performed in subsequent years. In this way one should be able to detect further signs of the disease and start the treatment at such an early stage that a deformity of the hip joint may be prevented.

#### RESUME ET CONCLUSIONS

50 enfants présentant des signes cliniques et radiologiques d'une dislocation ou dysplasie de l'articulation de la hanche ont été traités à partir de la naissance au moyen d'une coussin-attelle Frejka. Le traitement actif a été achevé dans la plupart des cas à la fin de la première année d'âge.

49 de ces enfants ont été réexaminés entre 5 et 7 ans. En se basant sur les trouvailles de ces réexamens, les conclusions suivantes ont été tirées:

1. Une dislocation ou dysplasie de l'articulation de la hanche correctement traitée depuis la naissance mène au développement d'articulations de la hanche parfaitement normales y compris l'antéversion du col fémoral.

2. Même si le traitement est entrepris chez le nouveau-né et qu'il y ait un développement normal des articulations de la hanche pendant la première année de vie, un examen périodique de ces enfants doit avoir lieu dans les années suivantes. De cette manière, on a la possibilité de détecter de nouveaux signes de la maladie et d'entreprendre un traitement suffisamment tôt pour prévenir une déformation de l'articulation de la hanche.

#### ZUSAMMENFASSUNG UND SCHLUSSFOLGERUNGEN

50 Kinder mit klinischen und röntgenologischen Zeichen einer Hüftverrenkung oder Dysplasie wurden seit der Geburt mit Frejkas Polster-

schiene behandelt. Die Aktive Behandlung war in den meisten Fällen am Ende des ersten Lebensjahres abgeschlossen. 49 Kinder wurden im Alter von 5 bis 7 Jahren nachuntersucht. Auf Grund der Befunde bei der Nachuntersuchung kommt man zu folgenden Schlussfolgerungen:

1. Eine richtig behandelte Hüftverrenkung oder Dysplasie beim Neugeborenen führt zur Entwicklung einer vollkommen normalen Hüfte mit normaler Anteversion des Schenkelhalses.

2. Selbst wenn die Behandlung am Neugeborenen begonnen wird und die Hüfte im ersten Lebensjahre eine normale Entwicklung zeigt, sollte eine zeitweilige Nachuntersuchung dieser Kinder in den folgenden Jahren vorgenommen werden. In dieser Weise sollte man im Stande sein, weitere Zeichen der Erkrankung zu entdecken und mit der Behandlung zu einem so frühen Zeitpunkt zu beginnen, dass die Verbildung des Hüftgelenkes verhindert werden kann.

#### REFERENCES

- Alvik, I.*: Increased Anteversion of the Femur as the Only Manifestation of Dyspl. of the Hip. Clin. Orthop. No. 22, p. 16–20, J. B. Lippincott Co., 1962.
- Massie, W. K. & Howorth, M. B.*: Cong. Dislocation of Hip. J. Bone Jt Surg. 32-A: 519–531, 1950.
- Medbø, I. U.*: Early Diagnosis and Treatment of Hip Joint Dyspl. Acta orthop. Scandinav. 31, 282–315, 1961.
- Severin, E.*: Contribution to the Knowledge of Cong. Disloc. of the Hip Joint. Acta chir. Scandinav. 84, (Suppl. 63), 1941.
- Wiberg, G.*: Studies on Dyspl. Acetab. and Cong. Sublux. of the Hip Joint. Acta chir. Scandinav. 83, (Suppl 58), 1939.