An attempt to explain the causes of hip development normalization in children with developmental dislocation, whose parents discontinued non-surgical treatment

Grzegorz Kandzierski1, Paweł Jakubowski1, Marcin Romanowicz2, Jarosław Kałakucki1

1 Pediatric Orthopedics and Rehabilitation Department of Medical University of Lublin, Poland
2 Pediatric Orthopedics Department of Medical University of Lublin, Poland

Abstract

Despite the discontinuation of non-surgical treatment of children with DDH, the development of the hip after a few years or a decade or so turned out to be correct in about 50% of the subjects. The authors present examples and analyze the reasons for effective stimulation of the acetabulum roof and proximal femoral roof growth zones in these children. They emphasize that after a closed reduction, the femoral head does not press against the edge of the roof, thus allowing it to grow. Similarly, the growth zones of the proximal femur after reduction have become active again, and the femoral head has a spherical shape fitted to the acetabulum. However, in a few-year-old children with a developmental dislocation of the hip, the femoral head shows deformations similar to those observed in tibial epiphysis in Blount’s disease.

Key words: developmental dislocation of the hip (DDH), growth zone of the acetabular roof, growth zones of proximal femur, outcomes of nonsurgical treatment in infants with DDH

Streszczenie

Mimo przerwania bezoperacyjnego leczenia dzieci z DDH, rozwój stavu biodrowego po kilku lub kilkunastu latach okazał się prawidłowy u około 50% badanych. Autorzy przedstawiają przykłady i analizują przyczyny skutecznego pobudzenia stref rośnięcia dachu panewki i bliższego końca kości udowej u tych dzieci. Podkreślają, że po zamkniętej repozycji, głowa kości udowej nie uciska na krawędź dachu umożliwiając jego rosnieć. Podobnie, strefy wzrostowe bliższego końca kości udowej po repozycji odzyskały prawidłową aktywność, a głowa kości udowej sferyczny kształt dopasowany do panewki. Natomiast, u kilkuletnich dzieci z rozwojowym zwinięciem stavu biodrowego, głowa kości udowej wykazuje deformacje analogiczne do obserwowanych w nasadzie kości piszczołowej w chorobie Blount’a.

Słowa kluczowe: rozwojowe zwinięcie stavu biodrowego (DDH), strefa wzrostowa dachu panewki, strefy wzrostowe bliższego końca kości udowej, wyniki leczenia bezoperacyjnego niemowląt z DDH
Non-surgical treatment of infants with developmental dislocation of the hip

Infants with a developmental dislocation of the hip require long-term non-surgical treatment – use of Bryant’s traction for about 6 weeks while gradually abducting the thighs, ending with a closed reduction usually under general anesthesia. Plaster in human position is kept for about 4 weeks, and then the so-called Jordan-Hohmann apparatus is used until full hip stability is achieved. After a few months, in children with a stable dysplastic joint, the Koszla abduction brace is usually used. It is a widely accepted method of treatment of infants with DDH (dislocation), reducing the risk of the most severe and the most common complication that is avascular osteonecrosis of the femoral head [2-5, 7-11, 13, 15, 16].

This method was introduced in the Department of Pediatric Orthopedics in Lublin in 1973 [3, 16].

The development of hip joints in children with DDH after their parents discontinued treatment

The analysis of 281 medical histories of children with DDH treated non-surgically at the Department in 1980-1988 revealed that there were 98 (29%) cases when no follow-up observation in the outpatient clinic was present. Of the 98 children invited, 27 were examined, the parents of 5 children confirmed the continuation of treatment in another clinic, and six invitation letters were not delivered. To our surprise, it turned out that in 14 examined children there was a favorable further development of the joint or full recovery despite the discontinuation of treatment; in 2 children with bilateral dislocation or subluxation, one joint developed properly.

The examples below are presented based on the following scheme: 1 radiograph – the first in clinical documentation, 2 radiograph – the last in the clinical documentation – approximate time of treatment discontinuation, 3 radiograph will be taken after the patient reports back after a few years or a decade or so after treatment discontinuation.

The presented examples of hip development after discontinuation of treatment differ significantly, and the positive outcomes, in particular, force us to try to explain the reasons for the proper development of hip joints in a significant number of children.

Fig. 1. Female patient with a bilateral dislocation of the hip; at 2 years old, the patient’s parents discontinued treatment – hip dysplasia, incomplete cover of femoral heads; at 13 – fully developed hip joints.

Fig. 2. Female patient with left-sided developmental dislocation of the hip; at 4 years old – a recommendation was made for surgical treatment due to severe, persistent dysplasia, the parents did not consent; at 18 – normal joint development.
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Fig. 3. Male patient with a bilateral low hip joint dislocation. At 2 years old, when the parents discontinued the treatment, severe dysplasia of both joints occurred, at 17 – fairly good development of the right joint, and properly developed left joint.

Fig. 4. Female patient with right-side dislocation of the hip; at 5 years old, the patient’s parents did not agree to surgical treatment due to joint subluxation; at 17 – the X-ray result was unsatisfactory, despite the lack of clinical symptoms.

Fig. 5. Female patient with a right-sided dislocation, left-sided hip subluxation; discontinuation of treatment at the age of 8 months; 8th years old – the sequelae of necrosis grade II/III according to Bucholz and Odgen classification: shortening of the femoral neck, hypertrophy of the greater trochanter. The child has a limp in the left leg, limb shortening by 2 cm, normal development of the left hip joint.

Fig. 6. Female patient with a bilateral dislocation of the hip joints; treatment discontinuation at the age of 12 months when the joints were subluxated, at 18 years old the sequelae of grade III necrosis according to Bucholz and Odgen classification. Greater trochanters hypertrophied above the femoral heads.
Examples of development inhibition of the acetabular roof and femoral head in few-year-old children with DDH

Based on the collected material on treating the children with DDH after 2 years of life in 1975-2000, we found many radiographs confirming the disorder – the inhibition of cartilage of in the acetabular roof, femoral head and neck.

The outer edge of the acetabular roof was heavily pressed by the femoral head in children with developmental subluxation and low dislocation. The roof gradually became shorter and slanted (Figs 7, 8).

The femoral head was flattened on the medial side, i.e. the femoral head growth was stunted (growth cartilage activity, i.e. the basic part of the articular cartilage of the head). The subcapital cartilage (epiphysal cartilage) was bent at 90 degrees, as per the principle of its perpendicular orientation in relation to the main direction of the forces (Figs 7, 8).

In the case of an early-age high dislocation in a child (e.g. in the first year of life), the roof could grow more freely, but the femoral head was small (Fig. 9).

Activity of growth cartilages and pressure (stress) forces

There are known mechanisms regulating the activity, stimulation and inhibition of growth zones associated with the so-called mechanism of feedback compression. Symmetrical stresses on both sides of the tibia cause symmetrical stimulation of these growth cartilages. Slightly increased stresses, but not exceeding the possibility of growth cartilage response, cause their stimulation. The larger amount of newly formed bone causes the correction of the axis of the limb in children in the second year of life, when the “physiological varus” of the lower limbs from the infancy changes into “physiological valgus” after a few months after starting to walk.

X-ray images of the abnormal shape of the proximal femur in older children with DDH are similar to those seen in Blount’s disease. In this disease, there is also a disturbance of activity of the growth cartilages of the epiphysis and the epiphysial cartilage of the proximal tibia. X-ray image shows changes in the form of the beaking flattening and atrophy of the medial epiphysis and metaphysis [1, 14] (Fig. 10). According to Langenskiöld the non-surgical correction can be expected only in the first stages of Blount disease development [6].
Growth cartilages of the hip (acetabular roof and proximal femur)

Within the proximal femur (head and neck) there are two growth zones that determine its development and growth. The first is the well-known subcapital epiphyseal cartilage, the activity of which determines the growth of the metaphysis (femoral neck). The growth of the femoral head, epiphysis, is determined by the activity of the basic part of the articular cartilage [5].

The growth zone of the acetabular roof is the basic part of the articular cartilage, adhering directly to the bony roof (Fig. 11).

Discussion

After a closed reduction in children with developmental dislocation of the hip, the femoral head moves towards the bottom of the acetabulum, and maintaining the hip in the flexion-abduction position provides relief to the growth zones, both in the acetabulum roof and femoral head and neck. In other words, after the reduction, the roof edge can freely grow sideways, which lengthens the roof and reduces its slant position. The femoral head placed deeply in the acetabulum can reproduce its natural, spherical shape.

In the case of the children discussed above, there was a further, beneficial remodeling of the hip despite the discontinuation of treatment. This can only be explained by the
fact that the reduction and several-month maintenance of the flexion-abduction position has stimulated the activity of the hip growth zones of both the acetabulum and femoral head. The restoration of growth cartilage function, despite the “discontinuation” of further treatment, was permanent. There were no follow-up examinations in the clinic, but the parents usually assured us that they remembered the preventive recommendations, the need for wide (astride) carrying of the children and seating them astride on toys (e.g. a rocking horse, etc.).

In this paper we discuss the unexpectedly beneficial development of the hip joint in children with a developmental dislocation after closed reduction, despite the discontinuation of treatment.

A question may be raised on how to explain similar observations in children over 2 years old with DDH treated surgically. Seemingly insufficient outcome of surgical treatment based on the first X-ray scans improved gradually, and after a few years the clinical and radiological outcome was positive. In none of these cases, the Salter or Dega pelvic osteotomy did not damage the growth zone of the acetabular roof, and the plaster dressing and postoperative management forced long-term abduction of the thighs. This requires a separate analysis and presentation of the material.

Conclusions

1. In about 50% of children with DDH who had stopped nonsurgical treatment, the hip development progressed properly.

2. In these children, after dislocated joint reduction, the normal activity of the growth zones of both the acetabular roof and proximal femur was restored.

3. In the developmental subluxation and low dislocation of the hip joint, the most extensive changes are observed in the shape of the acetabulum and the femoral head caused by the inhibition of the growth zone activity.

4. Abnormalities in the vasculature of the femoral head and growth zones in the proximal femur are the main reason why the non-surgical treatment of children with DDH fails.

References


