Editorial

Acetabular remodelling after reduction in developmental dysplasia of the hip

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Normal development of the hip joint requires the formation of a balanced and harmonious relationship between the growth of the acetabular and triradiate cartilages and the femoral head. Developmental dysplasia of the hip (DDH) is a specific condition, in which the harmonious relationship is shattered. The most important concept in the management of DDH is the reduction of the femoral head into the true acetabulum by closed or open reduction to restore this relationship. It is generally assumed that following a stable reduction, various components of the abnormal joint in infancy will develop satisfactorily into a normal joint. Accordingly, every effort is made to reduce the dislocation as soon as possible for the development of a normal hip joint. Because of the maximum growth potential in infancy and early childhood, the upper age limit for open reduction is generally accepted as 8 years or less, which has been proved by many published articles. However, from our experiences of the surgical treatment, we have a different view of the optimal age for DDH treatment. We observed that acetabular remodelling continues throughout the bone maturation period if adequate relocation of the femoral head in the acetabulum is obtained by open reduction, even after the age of 10 years.

Before discussing the acetabular remodelling after reduction in DDH, it is imperative to review the normal development of the hip joint. In the embryo, the femoral head and acetabulum are 2 of the hip joint components that develop from the same primitive mesenchymal cells. By the 7th week of gestation, a cleft appears in the precartilage cells defining the femoral head and the acetabulum. The differentiation of the primitive chondroblasts leads to the formation of the femur, which is in the shape of a club. The anlagen of the ilium, ischium, and pubis develops into a disc-shaped mass. At the age of 11 weeks, the femoral head is fully formed with a spherical configuration, a short neck, and a primitive greater trochanter. With continuous development of the labrum, the femoral head becomes deeply seated in the acetabulum and is held by the surface tension of the synovial fluid. The postnatal acetabular cartilage complex is a unit that is triradiate medially and cup-shaped laterally, interposing between the ilium, ischium, and pubis. This complex is composed of the epiphyseal growth plate cartilage adjacent to these bones, the articular cartilage around the acetabular cavity and, for the most part, hyaline cartilage. The interstitial growth within the triradiate part of the cartilage complex causes the hip socket to expand during growth, and the concavity of the acetabulum develops in response to the presence of the spherical femoral head. At puberty, the depth of the acetabulum is further increased by the development of 3 secondary centres of ossification in the hyaline cartilage surrounding the acetabular cartilage. These centres are homologous with other epiphysis in the skeleton. As the acetabulum enlarges, a balance between the growth of the acetabular and triradiate cartilage and that of the adjacent bone induces normal depth of acetabulum.

In DDH, this balance may be at risk. In these patients, the degree of acetabular malformation at birth ranges from mild to severe. A ridge in the ischial and
iliac portion of the acetabular cartilage, which divides the surface of the socket into 2 sections, is a common abnormal anatomical component that causes the positive Ortolani sign. Without treatment, the ridge may become more prominent, and the femoral head stays dislocated in the secondary acetabulum for a few weeks or months after birth. The acetabular growth plate adjoining the ilium is more oblique, and the periosteal bone at the superoposterior margin of the acetabulum appears underdeveloped. These abnormalities can be corrected by subsequent growth when the femoral head has been reduced concentrically in the primary acetabulum during infancy. On the other hand, when dislocation is not reduced during this period, the obliquity of the acetabular roof and distortion of the hip joint will increase, making the reduction more difficult and traumatic. It can be easily estimated that recovery of the dysplastic acetabulum is more uncertain if the dislocation has not been reduced after the child starts to walk. Many efforts to decide on the upper age limit of open reduction were made to achieve a good result such as the restoration of a balanced relationship between the acetabulum and the femoral head. Salter recommended this age limit to be 1.5 years, while Harris and many other authors placed this limit at 8 years.

Unfortunately, we do not know the age limit beyond which a dysplastic hip joint cannot return to normality. Patients with long-standing untreated dislocated hips can actually live good and productive lives, especially in complete dislocation without false acetabulum. Surgeons are afraid of ruining the patients older than 10 years because reducing the dislocated femoral head may have poor outcomes. This belief makes the surgeons underestimate the remodelling potential of the bone and cartilage around the joint. In the oriental society, abnormality and disability of one’s body may affect the individual’s attitude towards society and total life quality. To relieve this stress from the patients, we have conducted a trial by treating 12 patients above 10 years old with DDH with open reduction, femoral shortening, and varus derotational osteotomy. All the hips were in a state of complete dislocation and the age of the patients varied from 10 to 23 years. During the follow-up period, we observed the remodelling of the acetabulum into a component of the functional hip joint. Even though the socket failed to develop in terms of both the area and depth in the dislocated hip, an adequate depth of acetabulum, which keeps the reduced femoral head stable, can be maintained, because the growth plates of the triradiate cartilage remain histologically normal along with the normal length of the innominate bone. From our experience, the deep and stable reduction of the femoral head in the acetabulum seems the most important factor for the acetabular development. The age of the patient at the time of reduction is generally believed to be a correlation factor in predicting the outcome of the acetabular development in DDH, but we are not sure if it is an absolute factor. The remodelling potential of the bone and cartilage around the hip joint may persist beyond the age limit set in the past.

REFERENCES