Analysis of the biomechanics of the musculoskeletal system of young children for the manufacture of clothing

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Abstract: The article discusses the features of biomechanics of the musculoskeletal system of young children in the manufacture of special clothing for the rehabilitation and effective treatment of hip dysplasia.

Keywords: biomechanics, musculoskeletal system, dysplasia, joint, lead, hip dysplastic joint

From the point of view of biomechanics, the human musculoskeletal system is a controlled system of movably connected bodies with certain sizes, masses, moments of inertia and equipped with muscle motors. From the standpoint of the theory of machines and mechanisms, the human musculoskeletal system can be considered as a complex biomechanism consisting of rigid links (bones) and kinematic pairs of certain classes (joints) [1].

The well-known pediatric orthopedic surgeon Bob Selter [2], in his research, showed that the hip joint of a child develops best in conditions as close as possible to those created in the womb and are natural for its formation. He introduced the term "natural position" into practice - that is, the position of the fetus in the womb, when its legs are strongly bent and slightly apart. However, there are also deviations, then the child has dysplasia (developmental disorders).

Hip dysplasia is common in almost all countries (2-3%), but there are significant racial and ethnic features of its spread [3].

A prerequisite for the successful treatment of hip dysplasia in children of the first year of life is to maintain the following position of the legs (Fig.1):

• flexion in the hip joints at an angle exceeding 90 °

• controlled moderate deflection at an angle from 30° to 45°

Early detection of the problem and the beginning of treatment immediately after the birth of a child is the best prerequisite for the rapid development and maturation of the hip joint.

Knowing the peculiarities of the development of the hip joint, it is easy to understand why it is so important to reproduce the position that best corresponds to

the natural position of the fetus in the womb. It is impossible to create such a position with the help of previously used devices for hip retraction, since in most cases they do not allow achieving the required hip flexion angle of more than 90 ° and are even less effective for maintaining it.

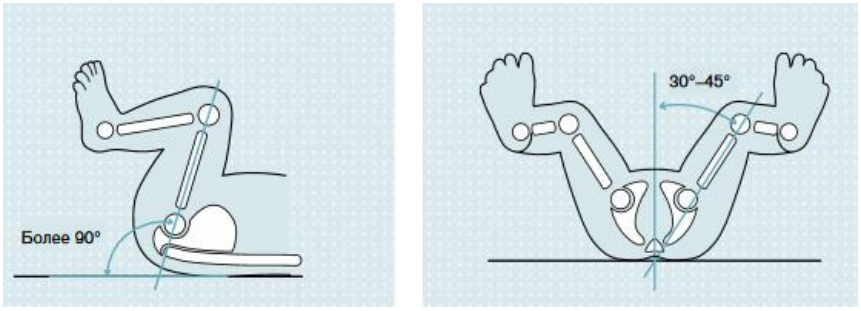

Fig.1. The positions of the legs of children of the first year of life: a - flexion, b - retraction

A characteristic feature of the dysplastic hip joint is the discrepancy between the shape of the femoral head and the shape of the acetabulum. The femoral head is usually smaller than normal, while the radius of the acetabulum, on the contrary, increases. Such a feature of biomechanics inevitably leads to early “wear” of the joint and to the development of the most frequent and most severe complication, which is called “dysplastic arthrosis of the hip joint”.

If dysplasia was detected in the first 3 months of the baby’s life, then after a course of treatment, the joint’s performance is fully restored (as a rule, by 6-8 months), and there are no long-term consequences.

The younger the child, the easier it is to treat dysplasia. For example, in babies up to 3 months old, the joint can recover on its own, provided that the baby’s legs will be in the right position all the time. That is why the main method of treatment in the early stages of the disease is free swaddling, in which the baby’s legs are in a divorced state. At the age of 3 months, the divorced position of the legs is achieved by using a Frake pillow, selected according to the size of the child. The later treatment is started, the more serious orthopedic devices are used, Mirzoeva’s splint or Pavlik’s stirrups are already used at 6 months [4]. (Figure 2, 3, 4).

It is known [5] that orthopedic diseases in young children in the Republic of Uzbekistan tend to increase, therefore, the issue of the development and production of clothing for children of this category becomes relevant.

Despite the availability of such documentation as GOST 32119-2013 "Products for newborns and children of the nursery group. General technical conditions", GOST R 54408-2011 "Special clothing for the disabled. General technical conditions", GOST R 51079-2006 (ISO 9999:2002) "Technical means of rehabilitation of people with disabilities. Classification" for children with orthopedic diseases, there are no special clothes made taking into account the functional capabilities of the child.

Fig.2. Frake's pillow

Fig. 3. Mirzoeva's Tire

Fig. 4. Pavlik's Stirrups

Taking into account the above analysis results, it can be concluded that in Uzbekistan there are newborns and children of the first months of life with hip dysplastic changes who need special clothes for rehabilitation and their effective treatment. To do this, it is necessary to study and take into account the features of the biomechanics of the musculoskeletal system of young children in the manufacture of special clothing for them.

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