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BASIC ASPECTS OF KNEE-PAD DESIGN TECHNOLOGY FOR SPORTSWEAR

ОСНОВНЫЕ АСПЕКТЫ ТЕХНОЛОГИИ ПРОЕКТИРОВАНИЯ НАКОЛЕННИКОВ ДЛЯ СПОРТИВНОЙ ОДЕЖДЫ

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ABSTRACT

CONSTRUCTIVE MODELING, SPORTS KNEE PADS, SPORTSWEAR, KNEE JOINTS, DESIGNING CLOTHES FOR SPORTS

The article presents the results of the study and systematization of information about the knee pads according to their purpose, degree of rigidity, type of fixation and materials, studied the features of the structure of the knee joint, considered the variety of the structure of the knee joints, the range of problems is set to be solved to update the process of design and manufacture of knee pads on an industrial scale.

The increasing interest in sports actualizes the problem of producing high-quality sportswear [1]. In Russia extreme sports gain great popularity, so one of the main quality indicators of clothing for these hobbies is to ensure a high degree of the athlete protection from possible injuries [2]. Traditional protective equipment includes knee pads, elbow pads, the helmet.

Knee pads, along with other elements of protection, are an important component of sports equipment for various kinds of sports. Information about the methods of designing knee pads is very limited and often of an advertising nature. The different purpose of using

АННОТАЦИЯ

МОДЕЛИРОВАНИЕ, СПОРТИВНЫЕ НАКОЛЕННИКИ, СПОРТИВНАЯ ОДЕЖДА, КОЛЕННЫЕ СУСТАВЫ, КОНСТРУИРОВАНИЕ ОДЕЖДЫ ДЛЯ СПОРТА

В статье приведены результаты изучения и систематизации информации о наколенниках по назначению, степени жесткости, типу фиксации и материалам, изучены особенности строения коленного сустава, рассмотрено разнообразие строения коленных суставов, определен круг задач, которые необходимо решить для актуализации процесса проектирования и изготовления наколенников в промышленных масштабах.

knee pads, the variety of their constructive and technological solutions, the variety of materials types used in their manufacture, as well as the newest innovative developments and technologies [3] represent a huge information field requiring careful research and systematization, on the basis of which a scientifically grounded designing method [4] of knee pads for sportswear is being developed.

In a modern sportswear, the knee pad can be either an independent piece of clothing or part of the product (for example, the knee pad can be connected with trousers by any technological method: stanching, glued, soldered, etc.). The first listed type of knee pads is the most common. Designing and manufacturing of such knee pads is carried out in a separate way, apart from the complete set of sports clothes of a certain type. In this case, the knee pad is considered as a universal element, which can be more often attributed to shortcomings, since the employment of various sports presupposes the need to protection from injuries of various kinds.

In addition to sportswear, knee pads are very popular in medicine, this aspect should also be taken into account when studying information about knee pads. The question of the connection between the shape and design of the knee pad and the features of the knee joint structure is of great interest. The functional purposes of knee pads are varied. Based on the studied material [3], the following directions of using knee pads for medicinal purposes are highlighted: for the prevention of various diseases, for orthopedic and corrective purposes, as protection against large knee loads. In clothes for sports training, the key function of knee pads is to protect knee joints from external influences.

Every year, a large number of knee pads of various compression level [5], materials [6], degree of construction rigidity [7], and method of fixation appear on the market of sporting goods. To implement the knee design process, all the information describing the feature of this element of protection is systematized. For athletic knee pads, the following are the most typical applications, depending on the variety:

- the rigidity degree. The most relevant for such sports as running, tennis, football are soft knee pads, since they fix the position of the knee sufficiently, reducing the risk of sprain, but are not protective from bruises and falls, since these sports do not involve a large number of injuries of this kind. Semi-rigid knee pads are used in those sports where falls are frequent enough, and protection of ligaments from stretching is still needed (hockey, snowboarding, etc.) Rigid knee pads are used to rigidly fix the knee joint in many ways restricting movement, so these knee pads are used for therapeutic and preventive purposes.

- by fixation degree. The knee pads of light fixation are made of elastic materials and correspond to soft knee pads. Reinforced knee braces are used to stabilize the knee joint, supporting it on the sides. Tutors and reinforced frame structures rigidly fix the position of the knee joint, excluding its movement (for rehabilitation after complex injuries and

operations on the knees).

An important question is which materials are most suitable for the manufacture of sports knee pads. Currently, knee pads are made of cotton, neoprene, nylon, spandex, lycra. Along with woven materials for knee pads, reinforcing parts made of plastic and light metal alloys, silicone inserts, foam, various innovative materials of various properties and purposes are used.

Another important aspect in the design of knee pads is information about the knee joint itself, it is necessary to know how the knee itself is constructed and what it should be protected from. The knee joint is the largest and most complex joint. It does not only withstands body weight, but also allows a variety of movements [8].

The knee consists of bones, muscles, ligaments, meniscuses (external and internal), nerve endings and blood vessels.

The most interesting information basis, from the point of the design of knee pads (part of the product), is the patella (the bone that forms part of the knee joint). The movement of the patella in the article «Anatomy of the knee joint of a person and caring about it» [8] is described as follows: «The trouser is attached to the main bones by ligaments, located in front of the kneecap. Its movements are ensured by sliding along special grooves in the tibial femoral condyle - a pallofemoral fossa. All three surfaces are covered with a thick layer of cartilaginous tissue, its thickness reaches 5-6 mm, which provides amortization and reduction of thistle during movement».

With the help of the articulated structure, the knee joint enables to perform such movements as flexion and extension of the tibia, pronation (rotation inward) and supination (movement outside), turning the tibia, and rotational and circular movements.

With the appearance of deformity of the knee joint, the shape of legs, the position of the internal parts of the knee joint, and even the character of the motor activity changes. Most often deformations of this type take place in childhood, and then with age, the knees assume a permanent incorrect position[9].

With valgus pathology, the knee joints are curved to the side, the so-called X-shaped form of the lower limbs appears. In the knee joint, the position of all bones is shifted, the pathological development of the muscles of the knee joint occurs, while the patella is displaced outward when bending.

With valgus pathology, the knee joints deflect from the normal axis to the outside, which causes the O-shaped development of the lower limbs. When squatting people with this knee structure have patella often turned inside.

Because of such differences in the structure of the knee joint of different people in dynamics, it is often difficult to choose a semi-rigid protective knee that would not constrain movement of the knee cap when squatting and would not slip off it.

When designing knee pads on an industrial scale, it is important to take into account

differences in the structure of the knee joint. To do this you need:

1. To study the statistics of the occurrence of different structure of the knee joint among the population. At the same time, the age and sex characteristics of consumers and the appointment of knee pads should be taken into account.

2. Develop a system of parameters that objectively describe the structure of the knee joint and the construction of the knee.

3. Develop a method for designing the knee pad construction, which will take into account the differences in the structure of the knee.

The development of a universal knee pad design as an element of sportswear will allow to satisfy the needs of a wide range of consumers and provide protection to the athlete, which is one of the most important functions of clothing for sports.

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