

Running Compression Garments Design Using Biomass Graphene Modified Fiber^{*}

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Abstract

This Paper elaborates the performance of biomass graphene modified fibers and the importance of muscle protection during running. Then, it analyzes the muscle contraction and relaxation during the running process and the human thermal-wet comfort. According to the needs, we conduct the human body partition and enter the design of the compression garments. During the design process, the functionalities of graphene modified fibers and the advantages of seamless knitting are explained. The function and technique are integrated to ensure the scientific and rationality of compression garments design. Finally, the detailed design concept are illustrated.

Keywords: Biomass Graphene Modified Fibers; Compression Garments; Running Protection; Thermal-wet Comfort; Seamless Knitting

1 Introduction

Graphene is a revolutionary material. It has excellent optical, electrical, and mechanical properties. Graphene has important application prospects in materials science, micro-nano processing, etc. [1]. Biomass graphene manufacturing from biological raw materials adopts “group coordination and assembly” method. This new biomass graphene materials has the functions of far-infrared, long-term antibacterial, anti-static, anti-ultraviolet radiation, constant temperature heat storage and conductive. We modify the fiber to take advantage of the excellent properties of biomass graphene. This smart fiber can effectively enhance the body’s comfort experience, and is currently widely introduced to sports, outdoor, underwear, protective gear, home textiles.

The high-performance sport garments design is carried out in this paper. It is based on running compression garments, using biomass graphene-modified fibers as material, and ergonomics as the background.

^{*}Project supported by Beijing Key Laboratory of Clothing Ergonomics and Innovation Functional Design program (KYTG02170202).

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2 Muscle Movement Law and Compression Area Division During Running

In running sports, muscle damage seems to be a topic that can never be avoided. Overtraining and unfamiliar training movements can cause uncomfortable symptoms such as muscle aches, muscle spasms or strains. Most of these symptoms are related to the way of running and the muscle groups that produce running movements [2]. When the muscles are severely damaged, unbearable pain occurs. Therefore, it is particularly important to scientifically and rationally develop and design such compression garments. It helps to relieve lactic acid accumulation, strengthen muscle recovery, and increase muscle strength.

2.1 Active Muscle Groups During Running Movements

Dividing the cycle of the upper and lower body movements during running. The movement of the upper limbs is smaller than that of the lower limbs, the cycle of the upper limbs during running is divided into two parts of the front and rear arms swing. The relative amplitude of the lower extremities is relatively large. According to the simple running cycle division, it is divided into three stages: stretching, vacant and landing cushioning [3].

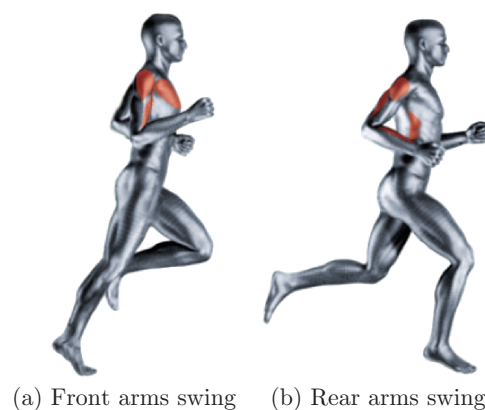


Fig. 1: Two stages division of upper limbs running cycle

The table below is the analysis of muscles participating into movements based on the characteristics of running at each stage. The muscles in each stage of the cycle are shown in Fig. 3.

2.2 Muscle Block Division of Running Movement Function

The division of blocks is based on the force of muscle groups [8] involved during running (Fig. 3). In addition to the necessary compression protection of the human body, the concept of “gradient compression” is widely proposed and applied. The Australian brand SKINS, 2XU, and the Japanese sports brand CW-X are pioneers of this concept. Drawing on the research results of the above branded products [9-11]. Proceeding from the perspective of human ergonomics and biomechanics, Compression garments place high pressure on the extremities far from the heart to accelerate blood circulation and increase the amount of sports groups oxygen supplied.