A Study on the Dynamic Pressure Comfort of Tight Seamless Sportswear

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Abstract: The clothing pressure of tight seamless sportswear restricts wearer's movement and causes discomfort. In this paper, a research on the dynamic pressure comfort of tight seamless sportswear is conducted. The study samples are four men's sportswear of an ordinary style. They are made of same material with same style and cylinder diameter but with different organization structure and knitting methods. The dynamic pressure and pressure sense of different positions in tight seamless sportswear are tested by young men of similar body sizes. In combination with fuzzy mathematics and box control graph, the methods of objective and subjective evaluation are used to describe the pressure of positions and garments, and to summarize the relationship between pressure and comfort. The study will provide some useful guidance for design and production of tight seamless sportswear.

Keywords: seamless sportswear, tight, pressure comfort, dynamic

1. Introduction

Seamless garment is a kind of one-time forming clothes produced by seamless knitting machine. High seamless technology makes it possible that yarn is directly made into apparel without any cutting and sewing. Because of the seamless in the neck, waist, hip and other parts, customers can enjoy much more the advantages such as comfort, fitness, fashion and change of shape. Although the yield of sportswear is ranked No.3 in seamless garment market at present, with pursuit of health lifestyle by more and more people, it will have a bigger share of the market and generate much more profits. At the start of production and research of seamless sportswear in China, lots of customers found wearing seamless sportswear uncomfortable due to the clothing pressure. This phenomenon still exists.

This paper focuses on studying the dynamic pressure comfort of tight seamless sportswear in order to develop some scientific basis for the design and production of seamless garment.

2. Experiment

2.1 Tight Seamless Samples

Four samples of seamless sportswear are made of Santoni SM8-TOP2 seamless knitting machine's 15"cylinder diameters and yarns are 4.6 tex cotton, 5.56 tex nylon and 3.33 tex spandex; organization structures are plain weave and rib 1×1 stitch and weave methods are road four and road eight, all of which are conventional factors to make seamless underwear. The details of the sample seamless sportswear are shown in Table 1

Table 1 Details of tight seamless sportswear samples

Samples	S1	S2	S3	S4
Weave methods	Road eight	Road eight	Road four	Road four
Organization structures	Plain	1×1 Rib	Plain	1×1 Rib
Fibers	78%cotton、17%nylon、5%spandex		60%cotton、35%nylon、5%spandex	

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2.2 Human Subjects

Aged from twenty to twenty eight, one hundred adults with universal body size to the requirement of GB/T1335-97 are invited to act as human subjects. The specific size of upper body is 170/88A and under body 170/72A.

2.3 Measurement Instrument

The measurement of clothing pressure is taken by use of AMI3037-10 - a balloon type sensor. Through adjusting the output of voltage, the measurement accuracy can be limited to ± 0.03 kPa. The balloon is 3cm in diameter and 0.8 mL air can be pumped into it. It suits clothing pressure measurement.

2.4 Measurement Conditions

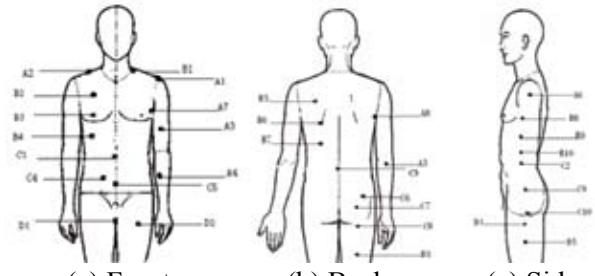
The experiments are conducted under the temperature of 23 ± 2°C, humidity of 68 ± 5% and wind speed below 1 m/s.

2.5 Clothing Pressure Experiment

Clothing pressure experiment consists of objective pressure test and subjective assessment. One hundred testing subjects are explained about the experimental procedure and asked to wear four sportswear samples in order. Upper body postures are flexing upper limbs to 180 degree, flexing upper limbs back extent to limitation, pectoral fly and flexing upper limbs surrounded; Under body postures are bend over, squat(thighs parallel floor), flexing under limbs to 90 degree and flexing under limbs back extent to limitation [1].

Subjective assessment in this experiment is to assess pressure comfort sensation of ten parts in four sportswear samples. In this study, a five-point semantic differential method is used. The five points corresponding to the sensation of pressure comfort are rated in 1 to 5 scale (i.e.1=least comfortable, 2=less comfortable, 3=uncomfortable but acceptable, 4=comfortable, 5= most comfortable). Subjects are asked to give the rating of the pressure comfort sensation of each part while wearing each sportswear sample [2].

Objective experiment tested four body parts respectively because of the quantity restriction of balloon sensor. They are upper limbs, trunk 1 (from shoulder to waist), trunk 2 (from waist to hip) and under limbs, All over the 4 body parts there are 33 test points which are selected by many pre-experiments according to characteristics of body structure and ergonomics principle [3]. These points can reflect the pressure comfort. The positions of test points are shown in Figure1. In order to get the average experimental data, the test is repeated two times and one time for the left side and the other for the right side. The details of parts and their relevant test points are shown in Table 2.



(a) Front (b) Back (c) Side

Figure1 Measurement positio

Table 2 Details of sportswear parts and their relevant test points

Parts	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
Position	Arm	Shoulder	Breast	Back	Upper side	Waist	Abdomen	Hip	Thigh	Under outside
Relevant test points	A3 A4 A5 A6	A1 A2 B1	A7 B2 B3 B4	A8 B5 B6 B7	B8 B9 B10	C1 C2 C3	C4 C5	C6 C7 C8	D1 D2 D3	D4 D5
Points No.	4	3	4	4	3	3	2	3	3	4

3 Discussion and Results

3.1 Data Processing

Among many test points of one position, the test point that produces the maximum objective garment pressure will make determinant effect to the pressure comfort of this position [4-7]. So the maximum test value of the pressure is chosen as the pressure of this position. The names of each test point of positions in different postures are shown in Table 3.