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Pattern Making for Individual Sport Athletes to their Physiology for High Performance Sports.

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ABSTRACT:

Sports like weight lifting, wrestling, athletics, and swimming can cause muscular injury, which results in delayed onset of discomfort and abnormal blood flow, making compression garments a useful treatment. Elastic fabric is used to make compression garments. Mostly, the fabric selected is polyester and spandex for the better stretchability of the compression garments. The tensile characteristics of materials with different orientations to stretch, and the pressure produced by the compression garments helps in reducing muscle fatigue and enhance performance in sports athletes. A technique for the construction method can be done by the pattern reduction method. In order to contain their muscle vibration during athletic action, the athletes needs body mapped compression garments to keep the muscles intact. In order to design and develop that, this work shall study the anatomy of Male and Female Athletes muscular formation and find the appropriate areas where higher compression is required. Accordingly the Apparel needs to be designed and create patterns accordingly for them. This study examined the fabric size, fabric type, stretch characteristics, and clothing pressure for various knit structures in order to establish an effective design and development of diverse high stretch compression garments[1-3].

Keywords : compression garments, pressure, elastic fabric, stretchability

INTRODUCTION:

One of the solutions for muscle recovery in sports persons is compression garments which have been used by athletes for a while as an ergogenic, performance-improving, and recovery aid in sports. Compression clothing is an essential component that aids in the process of external therapy because it applies a unit pressure to the portions of the covered body. The range of values for this component is established from a medical perspective depending on the type of therapy[4-9]. Compression garments have most crucial qualities that are extensibility and elastic recovery, allowing it to exert pressure on the human body Power Fit describes either the entire garment or certain regions where the force of the stretch grips and compresses the flesh, altering the shape of the human form[10]. Applications include a variety of sportswear, form-fitting bodywear, and medical applications. For the majority of the commercially branded clothing currently on the market for sport applications, benefits like improved blood flow, better muscle oxygenation, reduced fatigue, faster recovery, reduced muscle oscillation, and reduced muscle injury have been reported[11].The objectives are designing and developing body mapped compression garments in order to keep the muscles intact, creating patterns accordingly by locating the appropriate areas where higher compression is required, enhancing the sports performance by these applications[12-15]. Studying the muscle movements based on their activities. In order to construct the garment we have to work on the pattern in order to obtain the tight fitting of garment.Only a few studies have shown how these types of clothing affect performance and the physiological processes that underlie those effects. Stretch characteristics are calculated as a percentage of fabric stretch, growth, and recovery. In order for the pattern pieces to provide the necessary stretch and fit in the product, they must be properly engineered.

METHODOLOGY:

The current problems faced by the sports person during their performance is taken into consideration. The current trends of the compression garment is to focus on the fit, assessing the performance, possible placebo effect. Stretch garment evaluation is interpretative; the excellence of the body contouring fit is closely related with fabric stretch capacity. The designer must utilize a mathematical approach to measure the degree of fabric stretch that will be used in the pattern reduction procedure. Making this tacit information explicit will increase communication between industry, research, technology, and practitioners, allowing developing digital technologies in compressive stretch garment design to be developed further. After analysing the muscle movements, design for compression garments based on the aspects such as human anatomy, ergonomics, material selection, final application, service life. Any movement of the body must be handled by using the fabric's available stretch, which often needs to be more than free body expansion. Therefore, the fabric will need to be lowered by a different proportion than the body's circumference, which is not susceptible to the same movement excesses, in order for the length of the body to accept maximal elongation. It is possible to handle various fit level categories.

MUSCLES THAT AFFECT THE GAME PERFORMANCE:

Sports like weight lifting, wrestling, athletics, and swimming can cause muscle damage while high performance. Muscles that causes discomfort are of the following:

Swimming:

Swimming breaststroke muscles: The latissimus dorsi (back muscles), pectoralis major (chest muscles), biceps and triceps (arm muscles), brachialis, brachioradialis, and deltoids are all used during breaststroke (shoulder muscles). The glutes (butt muscle), quads (thigh muscles), gastroc, and soleus are some of the leg muscles involved during breaststroke (calf muscles)

Swimming freestyle muscles: The freestyle swimming stroke, often known as the front crawl, makes extensive use of arm motion to propel swimmers through the water. Some leg muscles are also engaged when the flutter kick is employed. As a result, triceps, biceps, quadriceps, and hamstrings will be largely engaged.

Swimming backstroke muscles: The backstroke offsets some of the movements made in the freestyle while still using many of the same muscles. More of the latissimus dorsi and deltoids (shoulders) are engaged during the reverse arm movement (the large muscles that extend across your back). Swimmers will use their glutes, quads, hamstrings, and anterior tibialis (shin muscles) in the flutter kick, which is nearly comparable to freestyle.

Swimming butterfly muscles: abdominals, quads, pecs, hamstrings, glutes, deltoids, and lats.

These are the muscles involved in swimming[16].

Atheletics:

Core muscles: Strong abdominal muscles help the body remain upright and lessen the impact of shock on the back. They might use other muscles to make up for a weak core, which causes injury.

Hip flexors: Right above the thighs, in front of the hips, are the hip flexor muscles. They join the thigh bone to your hips, groin, and low back. The stabilization of the pelvis and spine is aided by the hip flexors.

Glutes: Running depends heavily on the strength of these muscles since they propulsion athletes forward and allow them to run quicker. The torso's stability is supported by the glutes, allowing it to maintain good posture.

Quadriceps: On the front of the leg, there are four lengthy muscles collectively known as the quadriceps. They assist in running by extending your knee . The hamstrings receive the energy that is first produced in the quadriceps.

Hamstrings: On the back of the thigh, between the hips and the knees, are the hamstrings. They are in charge of knee flexion and hip extension. As the body moves your upper leg backward, the hamstrings also aid in thigh extension.

Calf muscles: On the rear of the lower leg are the calf muscles. Each time when the body pushes off and lifts the leg to move ahead activates calf muscles.

These are the muscles involved in atheletics[17].

Weight lifting:

The muscles used in the squat are listed in detail below, along with a ranking system from 1 to 5 that indicates how much each one contributes to the lift (1 is minimal involvement; 5 is super heavily involved).

MUSCLES	**CONTRIBUTION**
Gluteus Maximus	5
Glute Med/Min(Abductors)	3
Quads	5
Hamstrings	4
Adductors (Magnus)	4
Erectors and Multifidus	3
Core (Abs, Obliques)	2

Hip Flexor	1
Gastroc	1

These are the muscles involved in weight lifting[18].

Wrestling :

Core muscles: the abdominals, hip flexors, and glutes.

Erector Spinae Muscles: The human body's erector spinae muscles, which run along the spine, are in charge of bending and twisting motions.

Abdominals: The trunk and hips are crucially supported by the abdominals.

Hip, leg and calf muscles: The development of the hip, leg, and calf muscles is crucial for every wrestler. They support movement, flexibility, and balance.

Gluteal muscles: An individual's spine and pelvis are supported and moved by the glutes, a muscular group. These muscles are crucial for core stability as well.

Hamstrings: An individual's spine and pelvis are supported and moved by the glutes, a muscular group. These muscles are crucial for core stability as well.

Arm and shoulder muscles: Wrestling requires strong arm and shoulder muscles. They are employed for blocking, lifting, tossing, and holding an adversary.

Trapezius: The neck and upper back are covered by the broad, triangular muscle known as the trapezius. Additionally, it rotates the scapula and is a component of the shoulder blade.

These are the muscles involved in wrestling[19].

New 'Quad load' stretch extension test:

The ideal outcome would be a split of the fabric extension into course, wale, and bias (45° and 135°), from which the relative stretch reduction factor could be calculated. The author applied a modified hanger load test known as the "quad load test method," which was created expressly to digitally measure fabric extension for use as part of Watkins' stretch block pattern reduction procedure.

The course and wale have 45° and 135° bias fabric samples were placed on the hanger and the 250 g weight was applied as part of the quad load test procedure. The prolonged measurement between the benchmarks was taken after one minute to allow the fabric to stabilise.

The benchmark relaxed length of 10 cm was selected because it makes it easier to calculate the degree of stretch. By subtracting the relaxed length from the stretched length and dividing the result by the original length, or by simply deducting 10 cm (100 mm), from the expanded length, the degree of stretch is given as a percentage. Degree of stretch= [Extended length (mm) – 100] %

After analysing the degree of stretch of the fabric along the course and wale direction by quad load stretch extension test,we can start working on the pattern by pattern reduction method[20].

Pattern Reduction Method:

The possible fabric stretch (FS%) in the course, wale, and bias directions is provided by the quad load test. It will refer to the impact that bias stretch has on the x and y axis values as the course-bias and wale-bias, respectively, for 2D pattern construction[21-23]. For instance, the following table provides observations of fabric stretch values in the course (FSc), wales (FSw), and bias (FSb) orientations:

Fabric bias vector %:

An average of the coarse & bias and wale & bias extension measurements has been calculated, the course-bias (cb) and weight-bias (wb) vectors can be calculated by,

Course-bias vector (cb), % = (c% + b%)/2

Wale-bias vector (wb), % = (w% + b%)/2

Axis ratio %:

The way in which the garment pattern profile is reduced depends on the axis ratio (AR).

Tension release factor %:

For adults, the tension release factor (TRF) is given as a per unit value of 1, which drops to 0.5 for young children.

Taking TRF into consideration,

ART % = Tension release factor × Axis ratio %

By taking these factors into consideration, the stretch reduction factor could be calculated[24-25].

Stretch reduction method:

The proportion by which the pattern is to be decreased is specified by the stretch reduction (SR%). The reduction factor uses a portion of the stretch that is available for the ideal fit level. The axis ratio, which is the allocation of the available stretch by different proportions to the vertical and horizontal pattern profile, is then used to calculate how much of the available stretch will be applied as a result of this fit factor.

The following relationship can be used to determine it for both course and bias directions:

$$SR\% = \frac{\text{Fabric stretch}(\%) * \text{Axis stretch}(\%)}{100}$$

Stretch distribution factor:

A multiplier value per unit is used to indicate the stretch reduction factor (SRF). The following equation can be used to determine it for both course and bias directions:

$$\text{Stretch Reduction Factor} = \frac{100}{100 + \text{Stretch reduction}}$$

The stretch reduction factor is analysed based on the above methods [25-26].

Findings of the study:

In the past few years, there has been a lot of research on the impact of compression clothing on physical performance, most of which has found no benefits. The effects of knee-high socks with various levels of compression on the performance of 15 athletes were examined who found no correlation between the compression and heart rate, stroke volume, arterial oxygen saturation, or arterial lactate concentration. When analyzing 23 studies, some researchers discovered that compression clothing worn on the lower limbs had no detectable positive impact on performance. Five trials revealed a favorable benefit of compression clothing worn during recovering, therefore there was a trend in that direction. Both low and high pressures produced positive results, hence the pressure used did not correspond to the effects that were seen[27-28].

CONCLUSION:

Athletes now frequently wear compression clothing. The compression zones might range from entire limbs to individual limb segments (socks, shorts, and sleeves). Such garments are frequently composed of fibre blends that contain a significant amount of elastane (Spandex). The garment's fabric, size, and design, the body location (due to various underlying tissues), body position, and movement all affect how much pressure is delivered to human tissue. Compression is achieved by applying an elongation force to the fibres and yarns in compression garments, which are typically smaller than the body location to be covered. The mechanics of compression are still not entirely understood because it is unclear how human tissues would react to pressure from the outside.So the work on the pattern based on the stretchability of the fabric in order to obtain the close fitting of the garment[29-30] some of the studies showed that the compression garments have no effects. Now the work on the pattern making of the compression garments in order to bring out effective benefits. By analyzing the stretchability of the fabric and performing the pattern reduction method and applying it on the two dimensional pattern for the expectation of accurate results.

REFERENCES:

1) Millet G (2006) The role of engineering in fatigue reduction during

human locomotion -A review. Sports Engineering 9: 209-220.

1) Millet G (2006) The role of engineering in fatigue reduction during

human locomotion -A review. Sports Engineering 9: 209-220.

1) Millet G (2006) The role of engineering in fatigue reduction during human locomotion -A review. Sports Engineering 9: 209-220.

2) Estivalet M, Brisson P (2008) Compression garments: evidence for their physiological effects in The Engineering of Sport 7(2).

3) Chatard ic, Atlaoui D, farjanel J, lousy E, rastel D, et al. (2004) Elastic stokings, performance and leg pain recovery in the 63-year old sportsmen. European Journal of Applied Physiology 93(3): 347-352.

4) Nyka W, Tomczak H (2003) Rehabilitacja chorch z oparzeniami termicznymi. Rehabilitacia Medyczna 7(4).

5) Garrison SJ (1997) Podstawy rehabilitacji i medycyny fizykalnej.Warszawa Wyd Lek PZWL.

6) Adamczyk W, Magierski M (1996) Healing hypertrophic scars by the pressing method (in Polish). Roczniki Oparzen 7(8): 219-222.

7) Mikolajczyk A, Sosniak K, Fry D, Mis K (1999) Strategia postepowania w leczeniu blizn przerostowych u dzieci oparzonych. Dermatologia Kliniczna i Zabiegowa 1 (2): 74-76.

8) Fritz K, Gahlen I, Itschert G (1997) Gesunde Venen-Gesunde Beine.Rowohlt Taschenbuch Verlag GmbH 1996, Reinbek bei Hamburg.

9) Dias I, Cooke W, Fernando A, Jayawarna D, Chaudhury NH (2006)Pressure garment. US Patent.

10) Salleh, M. N. B., Lazim, H. B. M., Othman, S. N. B., & Merican, A. F. M. B. A. (2013). Development of a flexible customised compression garment pattern design system. *International Journal of Advanced Mechatronic Systems*, *5*(3), 202-208.

11) Gokarneshan, N. (2017). Design of compression/pressure garments for diversified medical applications. *Biomedical Journal of Scientific & Technical*, *1*(3), 1-8.

12) Brown, F., Gissane, C., Howatson, G., Van Someren, K., Pedlar, C., & Hill, J. (2017). Compression garments and recovery from exercise: a meta-analysis. *Sports medicine*, *47*(11), 2245-2267.

13) MacRae, B. A., Cotter, J. D., & Laing, R. M. (2011). Compression garments and exercise. *Sports medicine*, *41*(10), 815-843.

14) Davies, V., Thompson, K. G., & Cooper, S. M. (2009). The effects of compression garments on recovery. *The Journal of Strength & Conditioning Research*, *23*(6), 1786-1794.

15) Marques-Jimenez, D., Calleja-Gonzalez, J., Arratibel, I., Delextrat, A., & Terrados, N. (2016). Are compression garments effective for the recovery of exercise-induced muscle damage? A systematic review with meta-analysis. *Physiology & behavior*, *153*, 133-148.

16)Muscles involved in swimming: https://eliteclubs.com/what-muscles-are-used-in-swimming/

17)Muscles involved in atheletics: https://www.healthline.com/health/what-muscles-get-used-when-you-run

18)Muscles involved in weight lifting: http://allaboutpowerlifting.com/muscles-involved-in-the-squat/

19)Muscles involved in wrestling: https://www.inspireusafoundation.org/most-important-muscles-for-wrestling/

20) Methods of Test for Elastic Fabrics, BS 4952 (British Standards Institute, UK), 1992, 1-12.

21)Aldrich, W (1997) Metric Pattern Cutting. 3rd Ed Oxford: Blackwell Science Ltd

22)Armstrong, H (1995) Patternmaking for Fashion Design. 2rd Ed. USA: Harper Collins Publishers

23) Aldrich, W (1996) Fabric, Form and Flat Pattern Cutting. Oxford: Blackwell Science Ltd

24) Rossi, R. M. (2018). High-performance sportswear. *High-Performance Apparel*, 341-356.

25) Watkins, P. (2011). Designing with stretch fabrics.

26) American Standard (1996) ASTM Designation: D 4964-96 Standard Test Methods for Stretch Properties of Knitted Fabrics Having Low Power. USA: ASTM Standards, pp. 641-645.

27) Sperlich, B., Haegele, M., Krüger, M., Schiffer, T., Holmberg, H. -C., & Mester, J. (2011). Car-dio-respiratory and metabolic responses to different levels of compression during sub-maximal exercise. Phlebology, 26, 102-106.

28) LaBat, K.L. and DeLong, M.R. (1990) Body Cathexis and Satisfaction with Fit of Apparel, Clothing and Textiles Research Journal, vol.8 (pt.2), Winter, pp.43-48.

29) Dubuis, L., Avril, S., Debayle, J., & Badel, P. (2012). Identification of the material parameters of soft tissues in the compressed leg. *Computer Methods in Biomechanics and Biomedical Engineering*, *15*(1), 3-11.

30) Partsch, H., & Mosti, G. (2014). Sport socks do not enhance calf muscle pump function but inclastic wraps do. International Angiology: A Journal of the International Union of Angiology, 33,511-517.