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Applications of Compression Garments

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Compression Garments were first introduced around 60 years ago where they were mainly used as a medical stocking to create pressure around muscles, bones and connective tissues. Compression Garments were originally used to help treat patients with poor venous blood flow in the lower leg and foot. This is the flow of deoxygenated blood returning to heart from the peripheral limbs. The purpose of these garments has developed over the years and is now becoming an increasingly popular training aid amongst athletes and sports teams.

Compression garments are the clothing that fit tightly around the body. Compression garments provide support to people who have to stand for long periods or have poor circulation. They have a gradient compressive force measured in millimetres of mercury (mmHg).

Gradient compressive force:

- 15-20 mmHg (Mild compressive force)
- 20-30 mmHg (medical grade 1, moderate compressive force)
- 30-40 mmHg (medical grade 2, a medical prescription is required, moderate compressive force)
- 40-50 mmHg (medical grade 3, a medical prescription is required, very strong compressive force).

How Compression Garments Work

- Compression is a technique used to increase blood circulation in the body-specifically the blood flowing from your extremities back to your heart to be oxygenized.
- Compression wear improves blood circulation meaning more oxygen delivery to muscles resulting in increased performance.

Types of the Fiber Used

- Polyamide (nylon) and elastane (Spandex) are the most frequently used fibers for making Compression Garments, because they are stretchable, strong, durable and soft.

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- Elastane is always used as a small percentage of the fabric composition to ensure that the Compression Garment is comfortable.
- Commercial synthetic elastic fibers used in compression garments normally have an extension break over 200% and exhibit rapid recovery when tension is released.
- Core-spun yarn is achieved on a ring spinning machine where short staple fibers like cotton are around an elastomeric core yarn.
- The textured yarn consists of elastomeric yarn and false-twisted covering yarn. It is made by a combined process of false-twist texturing and air-jet mingling.
- Among the three kinds of yarns, the covered and core-spun elastomeric yarns are for high extension applications and textured yarns are for low to medium stretch requirements.

Construction Technique

Circular (round) knitting

- Circular knitting is a form of knitting that creates a seamless tube.
- Circular knit garments are knitted on a circular knit machine in a tubular fashion and are generally produced to a standard size called ready to wear (RTW).
- Circular knitted garments generally have a finer finish and are more cosmetically pleasing.
- In general, they are recommended for those who have an early/mild oedema (Stage l) with an excess fluid volume of less than 20% when compared to the unaffected limb.
- They can also be used for those who have moderate lymph oedema (Stage ll) as long as the swollen limb is an even/uniform shape.

Flat bed Knitting

- In flat bed knitting, the garments are made as a flat piece, to specific measurements, which are then joined together with a flat seam.
- Flat knit garments are knitted on a flatbed machine comprised of rows of hundreds of needles in a linear configuration.

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- The needles are larger gauge and able to knit thicker yarns than circular knit machines.
- Flat knit textiles are coarser than circular knit because of the thicker yarns.
- These garments tend to be slightly more expensive and require accurate, specific measurements for an optimum, precise fit.
- They are recommended for those who have moderate to severe oedema (Stages ll/lll) with an excess fluid volume of more than 20%.

Garments Manufacturing Process

There are six steps in the manufacturing process:

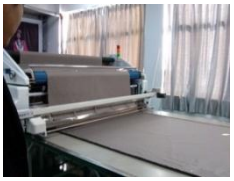
Marker→ Making→ Fabric→ Spreading→ Cutting → Sewing→ Dyeing→ Packaging

Marker Making

- Firstly, compression garments' maker is making.
- The maker making is one of the most important tasks in the garment manufacturing industry.
- Accurate maker making helps to reduce fabric wastage which ultimately reduced the cost of making the garments.

Fabric Spreading

- To cut the fabric properly, the fabric is spread in the play form.
- Fabric spreading is done manually or by using the computerized method.



Cutting

- In this stage, the fabric is layered on a table, layer by layer up to a certain level.
- Then by means of cutting machine fabric are cut into garment shapes or pattern and separated from the layer.
- This cutting can be done by manually operated blade cutting machines or by computerized laser beam cutting.

Sewing

Several sewing operations are realized to put the article together:

- Hem sewing, Assembly, Elastic sewing etc.

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- These tasks are very precise. Comfort and solidity of the product will depend on the quality of those operations.
- Normal compression garments are produced in a regular cut-and-sew method. Electronic and Fully automated machines are used for this purpose.
- First, flat knitted elastic fabrics are knitted to the correct size and shape (fully fashioned) and, in a subsequent step, to sew them together.
- Most of sportswear with low compression is produced with this method. Although it has the advantages of lower cost and production flexibility.
- The disadvantages are more obvious since the seams always cause skin irritation and easy to make breaks on the garments.

Dyeing

Acid dyes are used to dyeing the compression garments. A dyeing cycle lasts about 5 hours and counts steps:

- Washing
- Dyeing
- Compression garments put in a high tech dyeing machine. For 1h machines wash the garments and next 5hrs it dyes them.
- Each dyeing process is carefully controlled. The colour is verified with samples under a normalized light.

Packaging

- After the dyeing, the articles are put in pairs and are all carefully controlled.
- Labels are sewed in. Then, the garments are folded up, placed in a plastic protection and put in a box.
- Boxes are labelled and put in stock.

Microscopic Structure of Compression Fabric

- Observation with a microscope revealed that all the fabrics have a knitted structure and Spandex is only present in the wale direction.
- All fabrics have the same construction pattern.
- Generally, the face side of the fabric has raised wales while the back side is smooth.
- A flat fabric back surface would reduce stress concentration upon compression and also provide a comfortable smooth surface to contact with the skin.

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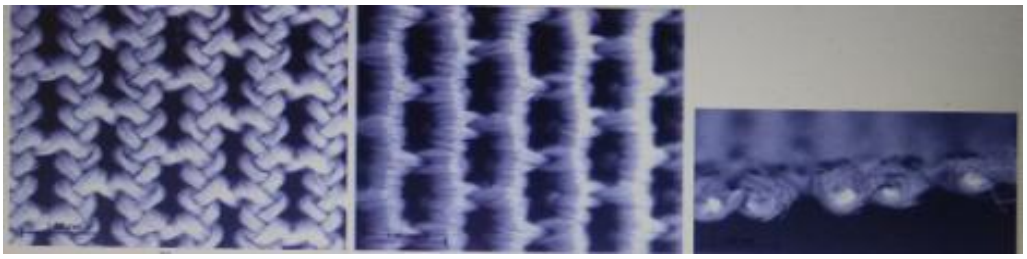

Face **Back** **Cross-section**

- The compression force is usually produced through one dimensional fabric stretching, which means that the wale direction with spandex is normally used for producing effective pressure in compression garment design.

Properties of compression garments

- Strong and have excellent stretch ability.
- Good elastic recovery.
- High bursting strength and extension.
- Wind and water proof.
- Able to wick moisture away from the skin.
- Keeps the wearer warm in cold conditions and cool in warm condition.

Benefits of compression wear in rugby:

- Reduce muscle soreness and swelling
- Reducing muscle oscillation during a vertical jump or fall
- Increase VO2 max [maximum oxygen consumption/uptake,a physiological index of sports performance]
- Reduce collection of blood lactate levels in the tissue
- Reduce muscle injury or cramps.

Limitations of Compression Garments

1. **They can be too tight**

   Sometimes compression, for all its good muscle-oxygenation intentions, can leave breathless. Some people who are not used to wearing tight garments can feel restricted and uncomfortable.

2. **They are uncomfortable to wear in certain conditions.**

   Wearing an additional layer of clothing can be too much for some, especially during summer days.

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Even if most compression gear is designed to wick sweat, there is still less air flow.

3. **They cause itchiness and dry skin**

Some people may just have extra sensitive skin while others' epidermis reacts when it cannot be aired or dried right away after breaking a sweat.

If you feel itchy or have dry skin due to compression garments, it is recommended to apply a moisturizing lotion before and after wearing them.

Conclusion

Compression garments are the clothing that fit tightly around the skin. These garments provide support to people who have to stand for long periods or have poor circulation. These come in varying level of compression, and higher degree compression garments, such as garments that provide compression of 20–30 mmHg or higher, typically require a doctor's prescription. Compression Garments promote blood flow, as they work to pump blood to and from the areas of focus by applying subtle pressure. Compression garments mainly have elastomeric fibers and yarns for maintaining substantial mechanical pressure on the specific surface of body zones for stabilizing, compressing and supporting underlying tissues. There are two construction techniques used for Compression Garments. One is circular knitting for seamless garments and other is flat bed knitting for garments with seams. The face side of the compression fabric has raised wales while the back side is smooth. Compression fabrics are strong and have excellent stretch ability. Have high bursting strength and extension. Compression garment keeps the wearer warm in cold conditions and cool in warm condition.

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