STUDY ON COMPRESSION PROPERTIES OF KNITTED ORTHOPAEDIC SUPPORTS

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Introduction
The aim of this study was to investigate the influence of elastomeric inlay-yarn linear density and insertion density on compression properties of weft-knitted orthopaedic supports. In area of low extensions, pressure linear depends on inlay-yarn PU core linear density, while dependence of elastomeric inlay-yarn insertion density on pressure values has an exponential character. Moreover, the raw material and linear density of covering yarns do not have any significant influence on pressure generated by the support in area of low extensions. It is necessary to find an optimal ratio between the elastomeric inlay-yarn linear density and insertion into the structure density, thereby achieving the best compressive, wear comfort and economical result.

Experimental
3 types of elastomeric yarns were used as inlay-yarns considering to their linear density: 340 tex (233 tex PU core); 203 tex (132 tex PU core); 70 tex (47 tex PU core). The linear density of elastomeric covered yarns was estimated according to the standard D 2591–01 (average linear density with 1tex accuracy was calculated from 5 elementary tests). Samples were made on the flat double needle-bed knitting machine in laid-in rib 1×1 base structure and differ by inlay-yarn linear density and density of the insertion into the knitted structure. 5 variants of knitted structures have been made for this work: KS0 - without elastomeric inlay-yarn, KS4/1 - with 1 inlay-yarn inserted in every fourth course, KS2/1 - with 1 inlay-yarn inserted in every second course, KS2/2 - with 2 inlay-yarns inserted in every second course, KS1/1 - with 1 inlay-yarn inserted in each course. Compression was calculated by the Laplace formula [Ališauskiene et al. 2012; Ališauskiene et al. 2013]. All experiments were carried out in a standard atmosphere for testing according to the standard ISO 139:2002. Structure parameters of knitted samples were analysed according to the British Standard BS 5441:1998.

Results and discussion
In area of low elongations, only elastomeric core of inlay-yarn is affected by tensile strength.

Figure 1. Dependence of pressure P of knits on linear density of PU core yarn T
As demonstrate results presented in Figure 1, by increasing of linear density of inlaid-yarn PU core pressure values increase also - till 48% for 47 tex linear density core yarn; till 79% for 132 tex linear density core yarn; till 90% for 233 tex linear density core yarn (depending on inlaid-yarn insertion density). The highest influence of elastomeric core linear density alteration was obtained for knits with highest density of inlaid-yarn insertion. Thus, in case of low insertion density of inlaid-yarn KS_{4/1} it can be used inlaid-yarns with lower linear density.

![Figure 2. Influence of elastic inlay-yarn insertion density on pressure $P$, according to inlay-yarn linear density](image)

The influence of elastomeric inlaid-yarn insertion density on pressure according to inlaid-yarn linear density (presented in Figure 2) has an exponential character. It demonstrates that with increasing of linear density of inlaid-yarn elastomeric core, insertion density of inlaid-yarn into the knit has higher impact on compression generated.

**Conclusion**

During designing of knitted compressive support it is necessary to find an optimal ratio between the elastic inlay-yarn linear density and insertion density, thereby achieving the best compressive, wear comfort and economical result. Knitted structure with lower linear density inlaid-yarn is more flexible and softer to the touch, hence more comfortable to wear.

**Keywords:** compression, orthopaedic support, knit, inlaid-yarn.

**References:**


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