

Design of clothing for better comfort and design – static and dynamic comfort assessment using a network of sensors

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ABSTRACT

Pattern making is crucial for optimal garment fit and wearer comfort. Traditional multi-panel garment construction introduces structural seams that generate localized stress concentrations and interface pressure, limiting mobility. Kinetic garment construction (one-piece pattern making) reduces structural segmentation by aligning fabric orientation with body movement. However, its mechanical performance has not been experimentally quantified.

This study presents the first quantitative experimental comparison of static and dynamic interface pressure between a traditional multi-pattern shirt and a one-piece pattern shirt. Static pressure was measured under ten standardized postures using AMI air bag sensors, while dynamic pressure was recorded during ten corresponding movements using Pliance X capacitive sensors.

Quantitative results indicate that the one-piece pattern shirt demonstrated consistently lower interface pressure. In a representative static posture (Bilateral forward flexion 90°), scapular pressure was reduced by 38% (1.78 vs. 2.88 kPa). During dynamic movements, the average pressure decreased by 0.58 kPa (1.95 vs. 2.53 kPa), and peak pressure was reduced from 11.1 kPa to 6.6 kPa, remaining below the comfort threshold specified in ISO 13688:2013 (8 kPa).

These results provide experimental validation of the mechanical advantages of kinetic garment construction, demonstrating reduced garment–body interface pressure and improved motion adaptability. The findings support its application in performance and functional apparel and establish a quantitative basis for further engineering developments, including surface flattening algorithms and automated generation of one-piece patterns.

Keywords: Biomechanical evaluation, Kinetic garment construction, One-piece garment pattern, Interface pressure measurement, Dynamic pressure comfort, Wearable sensors