

Novel Adjustable Knee Brace Hinge Provides Similar Support while Lowering Thigh Pressure During Walking

Jacob Levin, Conor Sullivan, Kaitlyn Reichl, Alexander Yueh, Kevin Knapp

Background

The knee is one of the most common sources of joint injury within the body¹ and as such, knee braces are widely used to protect the knee and used as a part of a rehabilitation program following knee injury. Mueller Sports Medicine's Tri-Axial hinge is rigid, and has a straight profile that does not conform accurately to the valgus inclination of the leg.

Problem and Existing Products

The current device used by Mueller Sports Medicine utilizes a fabric sleeve around the knee which contains pockets on the lateral and medial portions to allow the insertion of an aluminum hinge. This hinge provides structural support and prevents abduction of the knee joint to help avoid injury. The current hinge has a flat profile which can cause high pressure points and discomfort in the user².

Design

Anthropometric data collection was conducted. It was found that the mean knee-thigh angle was 20 degrees, and the mean knee-calf angle was 8 degrees. This knee-calf angle was assessed to be insignificant and was kept zero degrees from normal for the distal arm of the aluminum support hinge. The proximal arm of the hinge was angled 20 degrees outward.

Prototype Testing

The prototype was tested to make sure that it reduced the pinch force and verified that it functioned the same as the brace Mueller Sports Medicine currently uses as required by the client. The pinch force was tested using Force Sensitive Resistors (Intertek 402 FSRs) to compare the forces associated with not wearing a brace, wearing Mueller's brace, and wearing the Y-arm brace. Further, electromyography (EMG) was used to record activity from major muscles of the leg to monitor the activation during a gait cycle. The prototype successfully reduced the pinch forces associated with Mueller's brace while still maintaining the functionality verified by the EMG test.

Marketability

Knee braces have become a common treatment option for millions of Americans, who suffer from knee pain. They are inexpensive, easy to find, and comfortable to wear. The users of these knee braces included females and males of all sizes and ages. Last year over \$852 million was spent on knee braces in the United States³. This number is expected to grow by 4.9% by 2018³. Specifically, Mueller Sports Medicine receives 20+ complaints per month regarding discomfort of their current model. Therefore, in order to stay a competitor in this market, it is vital to provide a supportive, yet comfortable knee brace for a low cost.

References

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