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Keywords: Recurvatum; Knee; Fabrics fibers

Aim.– The main aim of this study is to develop a smart technical fabrics fibers orthosis for knee recurvatum during gait. In the hemiparetic, hyperextension, occurring during the stance phase, may be associated with hyperactivity/weakness of the quadriceps, hyperactivity/contraction of the triceps surae, but also impaired proprioception [1,2]. The proposed solution is based on the implementation of a prototyping platform to simulate all stages of preparation before reaching a model textile performance.

Materials and methods.–:

– Textile modelisation: we developed a platform for modelling and simulation of textile properties to study the behavior of fibers and their interactions in three dimensions. The textile model used in this study is based on three-dimensional curves representing the trajectory of each fibre at the sample. The spatial position of the control points of these curves is defined primarily by the type of binding and the geometrical characteristics of the fibre used. The holding textile structure is guaranteed by the addition of the geometric contact;

– Biomechanical study: the case of hemiparetic patient: a biomechanical analysis of gait 11 chronic hemiplegic patients paired by a conventional orthosis (Knee-Ankle-Foot Orthesis) was able to identify discriminant parameters: net joint moment (double initial contact and support phase) and joint kinematics (hip extension and knee).

Results.– The simulation platform used to characterize the behavior of each fibre by imposing extension work, compression, tension to meet individual needs. The biomechanical joint compensation imposed can compel angular amplitudes while minimizing friction forces to facilitate movement.

Discussion.– The experience and knowledge of technical textile and joint biomechanics permit us to develop and adapt a new prototype via a mechanical simulation platform. The objective of controlling recurvatum hemiparetic subjects design requires a three dimensions fibers specification.

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Effects of wearing safety shoes with convex soles on gait cycle

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Keywords: Gait; Trouble; Workstation

Aim.– Determine effects of wearing different types of safety shoes to industrial environments involving repeated displacements.

Material.– The gait analysis was done using a baropodometric platform (Wintrack, acquisition frequency: 200 Hz) which was already validated.

Participants.– Ten workers, age: 23.3 ± 6.7 years, BMI: 24 ± 2, shoe size: 43–44.

Methods.– The subjects completed six gait cycles on WinTrack, according to the following four conditions:

– barefoot;
– safety shoes respecting conventional standards (λ);
– safety shoes more comfortable than λ (OREGON);
– safety shoes meant to be more ergonomic (MBT).

The four conditions were compared using an ANOVA with a Fisher's post-hoc test ($\alpha = .05$). The measured variables are the gait freqency (WF), stance duration, the ground reaction forces during the heel strike to foot flat (HS), foot flat through midstance (M) and from heel off to toe off (TO).

Results.– There was no significant difference in WF under the different conditions ($P > .05$), gait duration is greater when barefoot than shod [F (3, 116) = 4.7, $P < 05$]. HS peak of force was higher with MBT than the other conditions [F (3, 116) = 4.4, $P < 05$], M peak of force was higher when barefoot than shod [F (3, 116) = 4.2, $P < 05$], MBT was similar to other footwear conditions ($P > .05$).TO peak of force was higher for MBT [F (3, 116) = 11.4, $P < 05$].

Discussion.– The peaks of force observed in this study show that MBT reduces the force required during TO without changing the force, which is necessary to M and stance duration. However, an increase of HS force was reported, which could be offset by the absorption characteristics of the MBT convex sole. So, MBT seems to facilitate TO during walking, without disrupting the temporal parameters of gait cycle.

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Design and optimization of a new kind of manual wheelchair

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Keywords: Wheelchair; Conception; Modelisation; Dynamical analysis

Introduction.– The usage of the manual wheelchair (MW) implies a heavy load of the upper limbs, which eventually can lead to musculoskeletal disorders [1]. The configuration of the wheelchair can have an impact on the usability of the wheelchair such as ergonomics, weight, balance and design [1,2]. The purpose of this study is to develop a new concept of wheelchair focusing on the space and weight.

Methods.– At first, we recorded displacements segmental during MW propulsion in the aim to quantify the dynamical parameters by simulation using a biomechanical model (Vicon, LifeModeler ADAMS). The MW structure was designed by CAD.

In a second step, a finite element simulation was performed. The simulation objective was to quantify the mechanical stress with the von Mises criterion, related to the displacement mass of the user (80 kg) during the MW propulsion on CAD structure.

Results.– The MW conception CAD and the simulation permit to study the behavior of the different element structure of the MW. The results of the simulation with these criteria show little vertical movement of the whole structure (5.4 mm).In addition, we note a stress concentration at the lower area of the backrest and rear seat (16.72 MPa).

Discussion and conclusions.– The finite element simulation of the mechanical stress experienced by the MW in use can identify structural elements at risk. The combination of motion analysis tools and simulation allows the anticipation of the mechanical stress and damage of the element structure during the design. An investigation of other mechanical and/or in other situations use criteria is considered.

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