Interface Loads Dependent on Amputation Height in Normal Gait, Falling

Link to publication record in USC Research Bank:
http://research.usc.edu.au/vital/access/manager/Repository/usc:18799

Document Version:
Author accepted manuscript (postprint)

Citation for published version:

Copyright Statement:
Copyright © 2014 The Author. The accepted version is reproduced here in accordance with the publisher’s copyright policy.

General Rights:
Copyright for the publications made accessible via the USC Research Bank is retained by the author(s) and / or the copyright owners and it is a condition of accessing these publications that users recognize and abide by the legal requirements associated with these rights.

Take down policy
The University of the Sunshine Coast has made every reasonable effort to ensure that USC Research Bank content complies with copyright legislation. If you believe that the public display of this file breaches copyright please contact research-repository@usc.edu.au providing details, and we will remove the work immediately and investigate your claim.
One step closer into the design of fall protective device for individuals fitted with a bone-anchored prosthesis

Laurent Frossard, PhD \(^{(1,2)}\)
Professor of Biomechanics

\(^{(1)}\) University of Quebec in Montreal (UQAM), Montréal, Canada
\(^{(2)}\) Marie Enfant Rehabilitation Centre, CHU Sainte-Justine, Montréal, Canada


DISCLOSURE
Any relevant financial disclosures: None

ARTICLE TO COMMENT

PERSPECTIVE
The consequences of falls are often dreadful for individuals with lower limb amputation using bone-anchored prosthesis.\(^{[1-5]}\) Typically, the impact on the fixation is responsible for bending the intercutaneous piece that could lead to a complete breakage over time.\(^{[3,5-8]}\) The surgical replacement of this piece is possible but complex and expensive. Clearly, there is a need for solid data enabling an evidence-based design of protective devices limiting impact forces and torsion applied during a fall.

The impact on the fixation during an actual fall is obviously difficult to record during a scientific experiment.\(^{[6,8-13]}\) Consequently, Schwartz and colleagues opted for one of the next best options science has to offer: simulation with an able-bodied participant. They recorded body movements and knee impacts on the floor while mimicking several plausible falling scenarios. Then, they calculated the forces and moments that would be applied at four levels along the femur corresponding to amputation heights.\(^{[6,8-11,14-25]}\)

The overall forces applied during the falls were similar regardless of the amputation height indicating that the impact forces were simply translated along the femur. As expected, they showed that overall moments generally increased with amputation height due to changes in lever arm. This work demonstrates that devices preventing only against force overload do not require considering amputation height while those protecting against bending moments should. Another significant contribution is to provide, for the time, the magnitude of the impact load during different falls. This loading range is crucial to the overall design and, more precisely, the triggering threshold of protective devices.

Unfortunately, the analysis of only a single able-bodied participant replicating falls limits greatly the generalisation of the findings. Nonetheless, this case study is an important milestone contributing to a better understanding of load impact during a fall. This new knowledge will improve the treatment, the safe ambulation and, ultimately, the quality of life of individuals fitted with bone-anchored prosthesis.

REFERENCES


