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PTB prosthesis inspired by Euplectella aspergillum sponge to improve load distribution and prevent limb complications

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Abstract

Transtibial prostheses are important devices for the replacement of a body part that has undergone amputation below the knee. However, their use can lead to complications such as ulcers, osteopenia, and muscle atrophy, due to inadequate load distribution, so a structural redesign of the transtibial prosthesis in Fusion 360 inspired by the skeletal organization of the marine sponge Euplectella Aspergillum is proposed, which would help to improve the distribution and dissipation of loads during walking and thus improve the quality of life of users. For the proposal, a bibliographic analysis of the structure of the marine sponge and the existing transtibial prostheses was carried out, considering their consequences for long and short-term use. On the other hand, Fusion 360, a 3D design program, was considered for the simulation and virtual fabrication of a bar that simulates the tibia and fibula, together with a suspension system in the ankle to increase cushioning. This redesign is expected to prevent complications and significantly improve the functionality and comfort of transtibial prostheses, presenting an innovative, nature-based solution to address the mobility challenges of transtibial amputees. © 2022 RAD Association. All rights reserved.

Author keywords

bioengineering; biomechanics; PTB; sustainable innovation; Transtibial prostheses

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