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Adaptation of bone-anchored limb prosthesis for locomotor behaviors

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Bone-anchored limb prostheses have been utilized in Europe for over 20 years. Although this technology has many advantages over traditional socket prosthesis attachments, it has not been approved for use in US due to high risk of skin infection at the skin-implant interface. The recently developed porous titanium pylon for skin and bone integration (SBIP, Poly-Orth International, USA; Pitkin, Raykhtsaum, 2012) has demonstrated the potential for skin-bone ingrowth into the pylon thus reducing or preventing infections. Our laboratory has utilized animal models (rodents, felines) to investigate integration of SBIP pylons with residual limb after the implant is loaded during every-day prosthetic walking and standing. The animals wear a trans-tibial J-shape prosthesis over several months. Level and slope prosthetic walking is recorded using 3D motion capture and force plates. Biomechanical analysis is used to determine contributions of the prosthetic and contralateral hindlimb to joint movement, power and work production. At the end of study, animals are euthanized using deep anesthesia and limb with implant is harvested for histological analysis. Our current results have demonstrated that animals adopt bone-anchored prostheses for standing and locomotion over several months. Although load on prostheses is reduced by approximately 30-40%, it appears caused by loss of the ankle joint, important source of mechanical energy for locomotion. Histology shows substantial skin-bone ingrowth into implant. The results strongly suggest that the SBIP can successfully be used in bone-anchored prosthesis and has the potential for reducing skin infection.

Biography

Boris I Prilutsky has received his PhD from Latvian Research Institute of Traumatology and Orthopedics, Riga, former USSR. He is the director of Biomechanics & Motor Control laboratory in the School of Applied Physiology at Georgia Tech, Atlanta, USA. He has published 2 books and over 60 scientific papers, has been serving as a review panel member of National Institutes of Health & National Science Foundation, USA and Natural Sciences and Engineering Research Council, Canada, and has been an editorial board member of Scientific Reports, UK.

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