ISPO 2023 World Congress Guadalajara, Mexico Poster 6.76

Residuum Health of Individuals Suffering from Limb Absence: Opportunities and Challenges to Design the Next-generation Diagnosis Devices

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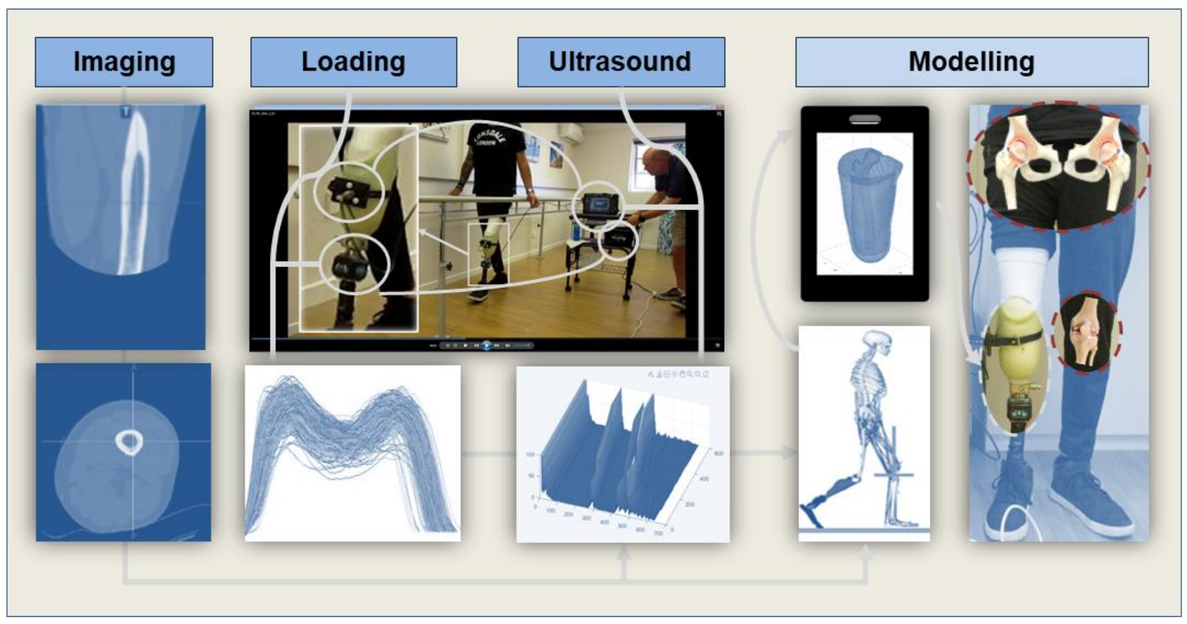
Take home message

Our assessments of current technologies suggest that it will be feasible and worthwhile to develop user-friendly diagnostic devices that could be used safely, efficiently, and routinely by qualified clinicians at critical points of care.

Background

- Individuals suffering from limb absence frequently experience neurological phantom and residuum pain, as well as neuromusculoskeletal disfunctions susceptible to compromise their residuum health [1].
- Care providers have limited means to diagnose these disfunctions, particularly when using the prosthesis during daily living [2].
- There is a need for wearable and non-invasive diagnostic devices that can assist care providers to better assess and maintain residuum health by establishing the pathophysiological cause-and-effect relationship between prosthetic care interventions and residuum neuromusculoskeletal dysfunctions [3].
- This study outlines opportunities and challenges to the development of the next generation of associated diagnostic devices (Figure 1) [2-5].

Figure 1. Overview of the typical next-generation diagnostic devices integrating medical imaging, wireless biosensors and computational modelling to animate a personalized digital twin of the residuum



Methods

- Consider first-hand observations, grey literature, and peer-reviewed publications.
- Review 30+ publications focusing on the assessments of residuum neuromusculoskeletal dysfunctions.
- Evaluate the invasiveness, comprehensiveness, and practicality of each technology deemed appropriate to be integrated into the next-generation diagnostic devices.

Outcomes

- The selection of studies was biased toward systematic reviews and secondary selection of specific articles. We overlooked the strength of the methodology, level of evidence and recommendations of the selected studies.
- Challenges are associated with design, clinical roll-out, and commercialisation.
- Opportunities are related to personalized evidence-based prosthetic care, patient empowerment and development of bionic solutions.
- Future diagnostic devices can positively disrupt the organisation of healthcare by enabling cost-utility analyses required by fee-for-device business models and addressing healthcare gaps due to labour shortages [6].

Conclusions

- The next-generation diagnostic devices will play a key role in bionic innovations that will safely increase mobility and quality of life of the growing population of individuals suffering from limb absence.

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Acknowledgements

- 2019 US DoD RESTORE (W81XWH2110215-DM190659)
- 2021 Bionics Queensland Challenge Major Prize – Mobility
- 2021 ANMS-ISPO Research Grant

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