Myo electricity and 3D printing: a resource for revolutionary hand prosthetics.

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Objective

Upper limb amputations can strongly limit the quality of life of a person. The most advanced dexterous prosthetic hands have remarkable mechanical features. However, in most cases, the costs are often prohibitive for most patients and the control systems are often rudimental. 3D printing and open source software can allow to solve this problem in the future. Publicly available 3D models of hand prostheses are increasingly being released, as well as open source control algorithms, that can strongly improve the state of the art. This paper aims at testing current state of the art in this revolutionary field, by testing in real life settings one of the most advanced 3D printed robotic hand prostheses, which is used in combination with a low cost myoelectric armband.

Methods

Several subjects with transradial amputation wore the Thalmic Labs Myo armband and an adaptive socket that was connected to an HANDi Hand[1]. The control of the hand was multi function and involved four different hand and wrist movements. The subjects tested the system in real time while grasping several objects, performing movements that were selected according the usefulness for activities of daily leaving[2]. The time required to complete the movement and movement performance were evaluated.

Results

The results are encouraging. The 3D printed prosthetic hand was successfully controlled by the classifier provided with the low-cost Myo armband and used for daily life activities by 2 subjects with hand amputation. The gesture recognition approach implemented in the control system used in this study allowed the automatic identification of the desired grasp quickly (average grasping time below 3 seconds for most repetitions). The system allowing the subjects to control up to 3 hand grasps in addition to the gesture used to open the prosthetic hand. Factors like the level of the amputation, neuromuscular fatigue and mechanical limitations of the 3D printed hand prosthesis can influence the performance of the setup. Furthermore, practical aspects still need to be improved to reach performances that can be applied to real life settings.

Conclusions

The results show that multi-function control of dexterous 3D printed hand prostheses can be performed, also using low-cost setups. Future assistive and rehabilitative devices will probably be revolutionized by publicly available software, additive manufacturing and low cost sensors. Scientific research in this innovative field can allow patients to benefit of such change and surgeons to develop surgical procedures that can integrate better with such innovative approaches.

Bibliography

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