Effects of hand amputation surgery procedures on sEMG activity to control robotic hand prostheses.

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Objective
Amputation is both an ablative and reconstructive surgical procedure. It consists in the partial or complete removal of the limb. Currently amputations are aimed at creating stable stumps for prosthetic sockets, but they are quickly evolving to functional procedures that can allow amputees to better control robotic dexterous prosthetic hands with electromyography[1]. This technique promises a high capacity for movement but require high patient compliance. At the moment there are no appropriate studies that have tried to identify the relationship between surgical techniques used in the amputation surgery, control of prosthetic movements and phantom phenomena. The purpose of the study is thus to analyze the effects that different surgical procedures have on the control of myoelectric prostheses.

Methods
11 patients who had undergone a transradial amputation of the hand between 1999 and 2017 were included in the study. Muscular activity is measured using 12 double differential sEMG electrodes (Delsys Trigno Wireless System). The subjects were asked to imitate hand movement movies with the missing limb as naturally as possible[2–5]. Machine Learning and Artificial Intelligence techniques were used to understand the muscular movements performed by patients through recorded data. The surgical procedures performed on the patients (such as cutaneous flaps, nerve treatment and amputation packing techniques) were assessed from the surgical reports. The statistical techniques used for data analysis are the Mann-Whitney test for the comparison between two groups of independent samples and the descriptive analysis of the graphs (box plots).

Results
The techniques for packing the amputation abutment appear to have a similar weight on prosthetic control and phantom limb sensations.

Conclusions
Despite the limits of the retrospective study and the low number of population, the study is certainly innovative and useful to define optimal amputation strategies. All the different surgical procedures taken into consideration can have a determining role for the control of myoelectric prosthesis. Currently, the surgeon goal should include patient's future need to use functional prostheses. This must be done taking into consideration even the most innovative and recent surgical techniques.

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