ALGORITHMIC TWO-SITE SELECTION FOR UPPER-LIMB MYOELECTRIC PROSTHETIC CONTROL

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INTRODUCTION

Reliably controlling upper limb prostheses continues to be a limiting factor in clinical deployment. This unreliability can lead to fatigue causing considerable reductions in function, which is found to be a main cause of prosthesis abandonment [Biddiss]. Ultimately, preventing the issue of unreliable prosthesis control can lead to a substantial increase in the quality of life of people living with limb absence.

The OptiMyo system was designed to address this problem by finding the optimal 2-site electrode locations and control strategy algorithmically.

METHOD

The OptiMyo system consists of 128 monopolar electromyographic (EMG) channels that were filtered and converted to differential channels representing conventional electrode spacing. An algorithm was developed to identify the optimal site locations and incorporates accidental co-contraction, natural movement, the weight of a socket, and arm position during both intended and unintended actuation of the prosthesis (Figure 1).

Each subject was consented to an IRB-approved protocol and had sites located by the OptiMyo system and by traditional methods using the technique taught to student prosthetists at the University of Salford. The sites were evaluated by measuring the “EMG Skill” through the use of static and dynamic tracking exercises similar to those proposed by Chadwell et al.

Subjects: 4 people: 2 male, 2 female. Age: 33 ± 9 yrs
Apparatus: OT Bioelettronica EMG-USB

RESULTS

EMG Skill testing showed better results for the OptiMyo System in 12 out of 20 static testing conditions (Figure 2). Additionally, 3 out of 4 subjects scored better with the OptiMyo system during dynamic testing.

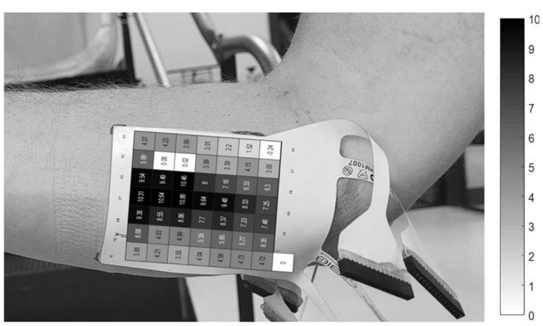

Figure 1: A visualization of the output from the OptiMyo system on a subject’s extensor muscles. Darker sections reflect a higher (better) score.

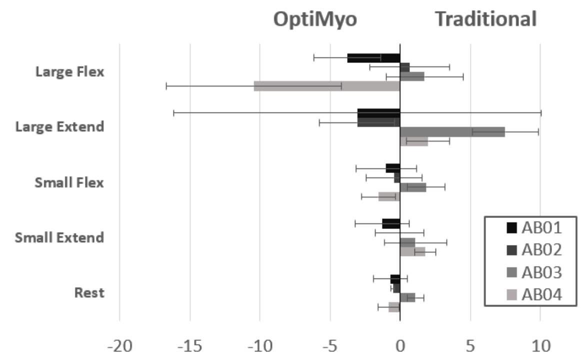

Figure 2: Difference in EMG skill between the two methods (error bars show 95% confidence interval). Negative values represent that tests with the OptiMyo sites had better scores.

DISCUSSION

The EMG Skill results were similar between subjects using sites selected from the first iteration of the OptiMyo system and sites selected following traditional site finding methods.

CONCLUSION

The first iteration of the OptiMyo system demonstrated equivalence to the current standard of care for myoelectric site finding. There are clear and obvious improvements to be made to the algorithm, and these changes will be implanted with additional testing on limb absent subjects to be completed in the summer of 2022.

CLINICAL APPLICATIONS

With further improvements the OptiMyo system has the ability to improve the myoelectric site finding process and control strategy selection for upper-limb prosthetics. The OptiMyo system can simplify and streamline the fitting process for clinicians while also providing data on the entire arm during simulated real life-scenarios (different arm movements, weight of socket, etc.).

Future iterations of the OptiMyo system will aim to select the best control strategy, gain, and dead band level for each patient.

REFERENCES

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