

Should you restrict the hand of able-bodied participants?

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Introduction

A considerable amount of studies uses able-bodied participants with the assumption that results translates to participants with limb loss. However able-bodied participants normally perform isotonic muscle contractions which differ from the isometric muscle contractions of participants with limb loss. If unaffected arms are restricted so they perform isometric contractions the EMG might become more similar to that of affected arms. The aim of this study is two-fold; first we wanted to assess if the EMG of the unaffected arm is comparable to that of the affected arm. Secondly we want to investigate if the EMG of the unaffected arm becomes more similar to the affected arm if the hand is restrained.

Methods

Five participants with an acquired unilateral transradial limb deficiency participated (table 1). Participants were asked to perform 7 different movements bilaterally 3 times at 3 different arm positions in 2 conditions. In the restricted condition the unaffected hand of the participant was restricted (fig. 1). In the unrestricted condition the unaffected hand of the participant was not restricted. Feature values and the Mahalanobis distance between the centre of the clusters of features was calculated. Participants also filled in a questionnaire after each condition.

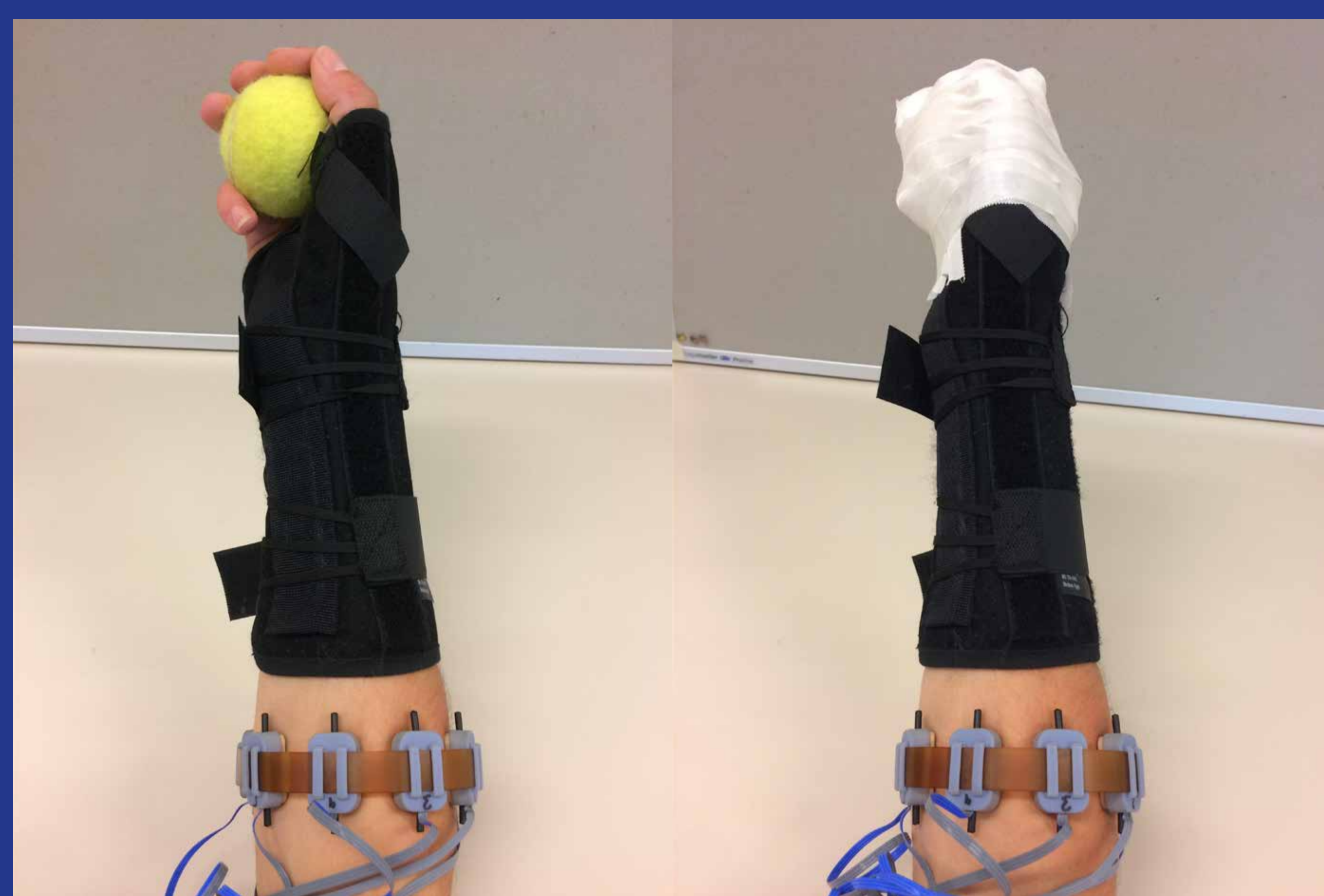


Figure 1. The restricted condition of the experiment for the unaffected arm. Participants wore 8 equally spaced electrodes around the forearm and a brace that restricted wrist and thumb movement. Participants were then asked to hold a standard tennis ball (left) which was taped in place using surgical tape to restrict movement of the fingers (right).

Gender	Age	Affected side	Dominant hand	Years since limb loss	Prosthesis used	Prosthesis wear
Female	43	Left	Unaffected	2.5	Passive	Daily, 5-12 hours
Male	74	Right	Affected	53	Myoelectric	Daily, +12 hours
Female	50	Left	Unaffected	21	Myoelectric	Daily, +12 hours
Male	26	Right	Affected	0.5	None	N/A
Male	59	Right	Affected	25	Myoelectric	Daily, +12 hours

Table 1

Results

No significant difference ($p=.344$) was found between the 2 conditions in terms of distance between cluster of features. However for features slope-changes and zero-crossings there is a significant effect of arm*restriction ($p=.035$ and $.009$ respectively). Post-hoc tests reveal that for slope-changes the restricted condition is more similar than the unrestricted condition ($p=.007$). No clear trend was found in the questionnaire data, but 2 participants reported that it was easier to perform bilateral movements when the unaffected hand was restricted.



Figure 2

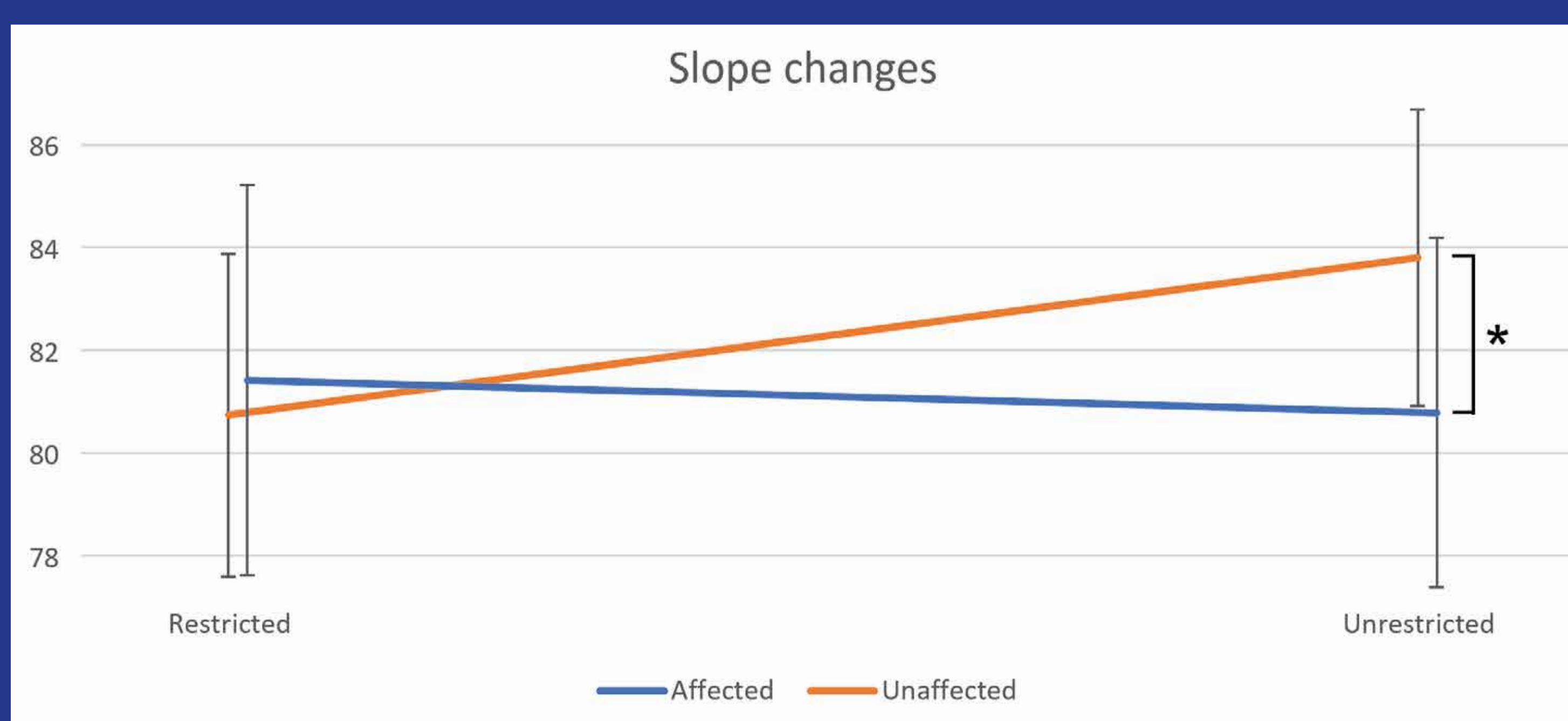


Figure 3

Discussion

Additional participants and further analysis is required to reach any definite conclusions, but preliminary data suggest that the EMG of the unaffected arm is significantly different from the affected arm. However, restricting the hand of the unaffected arm significantly changes some qualities of the myosignal as to make it more similar to the EMG of the affected arm.

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