INTRODUCTION

Functional studies of persons with transradial amputation (TRA) are limited. Studies comparing voluntary opening and voluntary closing body-powered prostheses are also limited. Entry-level prosthetic training material suggests VO systems have decreased grasp force but are preferred over VC systems. Conversely, VC systems reportedly offer higher grip force and enable kinesthetic feedback during manipulation and grasp but may increase the likelihood of fatigue. This study sought to determine if VO systems were functionally different than VC systems and if VO systems are preferred among TRAs.

METHOD

The study was approved by the USF IRB and listed in a federal clinical trial registry. A randomized, 2-period cross-over experimental design was used. A non-amputee control group was also studied. Unilateral TRAs who used body powered prostheses currently for ≥1y were recruited. Subjects were 18-85y and free of medical comorbidities. Non-amputees were also healthy, independently functioning persons of a similar age range. TRAs’ preferred prostheses were evaluated and adapted to accept both a VO and VC terminal device (TD). Assignment to VO or VC were randomized. Subjects were provided a brief training and accommodation period prior to data collection. After data collection, TDs were crossed-over and the process repeated.

CS-PFP10 was administered via standardized procedure (i.e. certified test site, script dialogue, trained rater; all reported elsewhere). CS-PFP10 scores 10 ADLs in time, distance, and mass. Raw data reflects physiologic functional domains. Testing requires ≈30min. Raw data (time, distance, mass) are converted to summary scores with a validated algorithm in licensed software. Scaled from 0-100, summary scores include CS-PFP total score (CS-PFP TOT) and 5 physiologic domain scores: upper body strength (UBS) & flexibility (UBF), balance & coordination (BAL), lower body strength (LBS) & endurance (END). RPE following testing and preference of device were also assessed following testing.

Data were examined for normality. Paired t-tests were used for between-TD comparisons. Independent samples t-tests to compare TRA and controls when data (interval & ratio level) were normally distributed. Otherwise, Wilcoxon’s Signed-Rank test for median differences was used (SPSS). Effect size (ES) was calculated using accepted methods and interpretations for Cohen’s d. The a priori significance level was p≤0.05.

RESULTS

8 TRAs (age: 56.1y±10.4; BMI: 26.7±3.6kg/m²) and 10 controls (age: 23.6y±6.0; BMI: 25.2±2.1kg/m²) completed the study. There was 1 female in each group. Age was greater in TRAs (p<0.01) but BMI was similar between groups (p>0.05). Four TRAs lost their hand to trauma and the remaining 3 were congenitally absent. Mean stump-sound forearm length ratio was 53%. Mean daily prosthetic use was 12.0±4.2hrs/day. Six TRA were employed and 2 were retired. Controls were university students.

Domain and total PFP scores ranged from 2.5-10.1% different between TD conditions but none were significantly different. Differences were on the order of 37-53% greater in TRAs (p<0.05; large effect) for all domains and total PFP regardless of TD. There were no significant differences in perceived exertion or preference between devices among TRA.

DISCUSSION & CONCLUSION

Information suggesting differences in function between VO and VC are not detected using the PFP test across upper and lower body domains or in total function. Further, there were not isolated differences in functional upper body strength, exertion or preference between devices. There were significant differences in function between non-amputee controls and TRA which objectively quantifies a degree of impairment associated with transradial amputation. It is noteworthy that controls were younger and this sample represented TRAs who prefer body-powered devices who are active. Different findings may result depending upon subject age, myoprosthesis use or other factors. Given the large differences between TRA and controls regardless of TD, room for functional improvement and developments for improved devices are emphasized.

REFERENCES & ACKNOWLEDGEMENTS

Cress ME et al. PTJ; 85; 2005. Funding: FHTC and TRS.

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