Functional Changes Secondary to A 6-Week Hand Training Program Using a Novel Concept Rehabilitation Device

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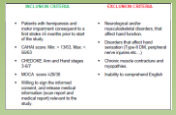
Introduction

- Stroke survivors acquire significant impairment and disability to the hand (Gillen & Burkhardt, 1998).
- Hand and upper limb recovery in the chronic stage of stroke is attributable to changes in plasticity (Nudo 2003)
- Factors such as intensity, variability, task-specificity of practice and motivation modulate experience dependent plasticity (Kliem & Jones 2008)
- In recent years greater focus has been on Robotics to provide hand function rehabilitation, despite the fact that its expensive and complex and are not easily accessible. In lieu of this, a novel, inexpensive, custom-made MSD hand function training device, has been devised to provide targeted hand function training (Patent Pending).
- The objective of this study was to estimate the efficacy of hand sensori-motor rehabilitation in people with chronic post-stroke upper limb hemiparesis using the MSD hand function device, a custom made hand function training device.

Methods

- Eight participants who sustained stroke ≥5 months prior to the start of the study were recruited.
- Participants with stroke were included or excluded as per the following criteria:



Experimental Protocol

- All participants were trained on pincer, tripod, quadripod and spherical grasp finger strengthening/coordination exercises on the MSD hand function device 3 times/week for 6 weeks.
- Participants were assessed using ABILHAND, Box & Block test, and CAHAI-9 prior to start of study, and on completion of six weeks of hand function training (3 times/week).
- Statistics: A paired *t*-test was used to estimate the differences.

MSD Hand Function Device

Fig. 1

Results

- All participants completed the 18-training sessions across 6-weeks, and the pre- and post assessment sessions.
- The participants' CAHAI-9 scores improved from pre-training (Mean 32.11 ± 15.24 SD) to post-training (Mean 37.89 ± 14.29 SD), and these differences were statistically significant (t_7 = -3.37, p = .004). (Fig.2)
- Box & Block Test results revealed no statistically significant results for the affected hand (Fig.3); however, a statistically significant increase in difference was observed for the scores assessed on the unaffected hand (t_8 = -3.27, p = .006).

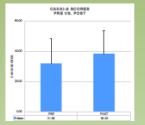


Fig. 2

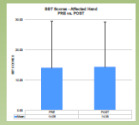


Fig. 3

- ABILHAND scores improved from pre-training (Mean 23 ± 12.33 SD) to post-training (Mean 29.38 ± 9.74 SD), and these differences were statistically significant (t_8 = -2.49, p = .02). (Fig.4)

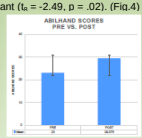


Fig. 4

Discussion

- The most fundamental mechanisms that mediate recovery and/or stimulate plasticity is not well understood. However, there is adequate evidence to indicate improvement in function consequent to a structured hand function training program.
- Results from this study indicate a significant improvement in hand function, assessed using both objective (CAHAI-9) and subjective (ABILHAND) measures. These results are consistent with evidence presented in the literature (Norouzi-Gheidari et al., 2012, Johnson et al., 2013). The difference observed in the CAHAI-9 scores was greater than the MCID value.
- The BBT test was not significant, probably due to the fact that the intervention targeted only the hand, with no particular attention to arm and shoulder.
- The fact that observed gains were found in both objective and subjective measures, indicates that participants probably had gains in function that which they could use when performing activities of daily living.

Conclusion

- Our results indicate that functional benefits as well as hand dexterity can be improved using the MSD hand function training device.
- Incorporation of practice-dependant targeted training program aids in improving hand function post-stroke.
- Further, studies should investigate the benefits of knowledge transfer to clinical practice.
- Future studies could also investigate whether this form of hand function training could be paired with other interventions to enhance rehabilitation outcomes.

References

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