Rehabilitation following nerve transfers in the upper extremity

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Objective

Successful motor function recovery following nerve transfers depends on the re-innervation of the new target muscle by regenerating axons as well as adequate motor learning. As this learning process is cognitively demanding for the patient, a structured rehabilitation program is needed. Our objective was to present such a protocol and to evaluate it in a pilot study.

Methods

Five patients after severe injuries of their brachial plexus were included. On all patients nerve transfers were performed to restore biological upper extremity function. Muscle strength was assessed with the British Medical Research Council (BMRC) muscle scale before surgery and after completion of rehabilitation. Explorative statistics were applied. All patients did undergo a structured rehabilitation regime in three phases.

Rehabilitation protocol

In the first months after neurotization no active movements are possible and therapy therefore focused on enhancing cortical representation of upper extremity motor areas. This included motor imagery as well as mirror therapy. As soon as the patients could activate the re-innervated muscles, the second phase started. Here, otherwise undetectable motor activity was visualized using surface EMG biofeedback. Patients were educated on what activation patterns to use as, after motor nerve transfers, muscular activation requires thinking about the movements the nerve was initially responsible for. Subsequently, they were educated to also think about the intended movements. The third phase started when patients could initiate movements that were easily detectable with naked eye. Here the focus lied on relearning the original movement pattern. This was done by asking the patient to execute the intended motor task without the nerve was initially responsible for. Subsequently, they were educated to also think about the intended movements. The third phase started when patients could initiate movements that were easily detectable with naked eye. Here the focus lied on relearning the original movement pattern. This was done by asking the patient to execute the intended motor task without the new target muscle by regenerating axons as well as adequate motor learning. As this learning process is cognitively demanding for the patient, a structured rehabilitation program is needed. Our objective was to present such a protocol and to evaluate it in a pilot study.

Results

All patients completed rehabilitation and had an improved muscle strength. As presented in the table, all patients had a severely impaired elbow flexion with BMRC grade 0 (n=4) or grade 1 (n=1) before surgery. Function clearly improved to BMRC grade 3 (n=3), grade 3+ (n=1) and grade 5 (n=2). In the 4 patients with impaired deltoid function, a similar improvement was seen. Additionally, all patients regained a better triceps function.

Relearning the original movement pattern was supported. It can help in the cognitively demanding process of establishing new motor patterns.

Conclusion

As all patients completed the rehabilitation program, it can be considered feasible. The functional outcomes were better than or equal to those described in literature. Although many factors influence the outcome after neurotization, the structured rehabilitation program can be considered as supportive. It can help in the cognitively demanding process of establishing new motor patterns.

References