

The Role of Functional Strength Training in the Post-Operative Treatment of Children with Cerebral Palsy

K. Mund, P. Armbrust, D. Patikas, A. Schmidt, W. Schuster, S. Wolf, L. Döderlein
University of Heidelberg, Department of Orthopedic Surgery, Germany

Introduction

The commonly prescribed post-operative physical therapy for children with cerebral palsy (CP) does not currently include functional strength conditioning. However, several recent studies have been formulated and published, which examine the effects of short-term strength training on functional ability, walking efficiency and crouch gait in non-operated spastic diplegics [1-3]. The use of functional strength training as an additional post-operative rehabilitation tool has not been investigated so far. The purpose of this study is to compare the effects of an additional functional strength training on post-operative functional outcomes. The strength gains as a result of this training are measured in order to determine whether there is a relationship between strength gains and functional improvements.

Statement of Clinical Significance

Functional strength training in addition to regular physiotherapy does not affect spasticity [4]. However it is still unknown whether it shortens the rehabilitation process and helps the patient to gain muscle strength, which is diminished by surgery.

Methodology

In the study, 40 ambulant CP patients with spastic diplegia (assisted or unassisted walkers) are examined in the age group of 6 to 16 years. Prior to surgery, the patients undergo clinical examination, 3D gait analysis, oxygen consumption testing, Biodex strength testing and Gross Motor Function Measurement (GMFM). Half of the patients (randomized) receives functional strength training of the flexor and extensor muscles of the lower limb in addition to regular physiotherapy, whereas the other half receives physiotherapy only. The patients and their parents are instructed during the hospital stay to perform the strength training independently at home, at least 4 times a week. Six months after surgery the patients are reexamined for clinical examination and muscle strength (Biodex). Twelve months after surgery a complete set of measurements is taken again. The assessment of functional outcome is examined using several measurement methods (kinematic, kinetic, subjective and clinical outcomes, gait efficiency and GMFM). Strength gains are assessed by measuring maximal force production. These two sets of goals (strength and functional outcomes) and their associated measures are used to compare two matched groups of surgically treated spastic diplegics.

Results

At the time of call for abstracts, 34 patients underwent multilevel soft-tissue and bony surgery, 12 of which were seen for the 1-year follow-up examination. At this stage, we do not yet have statistical evidence for any effects of functional strength training. The experience is that the extra strength training is well tolerated and intensifies the patients compliance. The rehabilitation phase after soft-tissue and bony surgery is longer than originally estimated, especially when looking at the patients muscle strength. This circumstance becomes manifest

in the strength data for the knee flexors and extensors, which are illustrated in figure 1. Disregarding extra strength training, the knee extensors and flexors were still weak 6 months after surgery by one third on average, with respect to the pre-surgery data. This weakening was overcome 6 months later to reach the pre-surgery level.

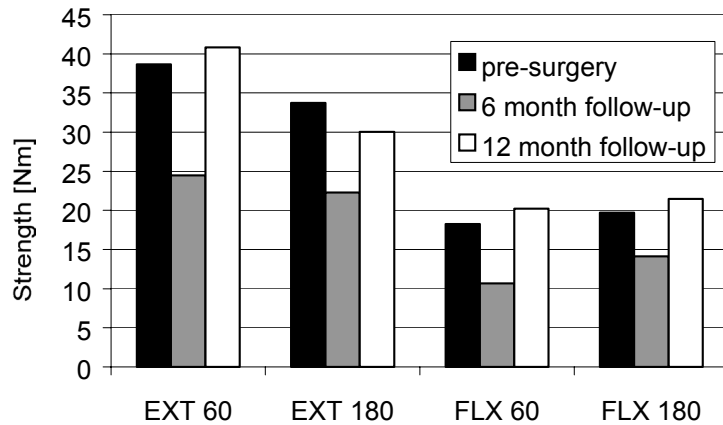


Figure 1: Mean knee extensor and flexor moments measured at the angular velocities 60 and 180°/s.

Discussion

The presented study is to our knowledge the first long-term study of the effects of strength training in the post-surgical rehabilitation process of CP patients. As other authors [4], we could not find any signs for increased spasticity due to strength training, whereas the strength condition seems to be of major importance for the progress of rehabilitation. Our preliminary results suggest that the rehabilitation process after multilevel surgery takes longer than generally estimated, i.e. longer than one year. Following the concept of the study, the strength training was kept as uniform as possible for all patients to guarantee comparability. Nevertheless, it seems that an individually oriented strength training is more favorable. Such individual training plans are currently in preparation to be applied in a follow-up study with the same patients. With this contribution, the authors hope to draw attention to the process of rehabilitation after surgery, which has to be taken into account in the management of patients with CP.

References

- [1] Damiano DL, et al., *Dev Med and Child Neur*, 37: 731-739, 1995
- [2] MacPhail HEA, Kramer JF., *Dev Med and Child Neur*, 37: 763-775, 1995
- [3] Damiano DL, et al., *Phys Ther*, 8: 658-671, 1995
- [4] Fowler E.G., et al. *AACPDM, Abstract*, 1998