The influence of EMG-Biofeedback-Therapy on knee extension following anterior cruciate ligament reconstruction

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INTRODUCTION

Loss of knee extension [3,4] and deficits in quadriceps strength [1,2] are frequently found following anterior cruciate ligament (ACL) reconstruction. Many authors described the relation between persistent loss of knee extension and deficits of activation for vastus medialis [7]. Although the underlying mechanisms are still poorly understood, changes in the sensomotoric system caused by protection from the central neuronal system are suspected to play an important role [5,6].

The aim of this study was to investigate, if Biofeedback (BFB)-Therapy for the vastus medialis muscle is able to improve knee extension in the early phase of rehabilitation after ACL- reconstruction.

MATERIALS AND METHODS

Sixteen patients (mean age: 30 years (20-49), 12 male and 4 female) who underwent endoscopic ACL reconstruction using patella tendon autograft were randomly assigned to two groups: Group A (8 patients): standard rehabilitation protocol with full weightbearing post operative, knee brace 0/0/90°, electrical stimulation, aquatics, and proprioceptive training. Group B (8 patients): BFB was added (Myotrainer© - Insight Instruments - Austria) to the standard rehabilitation protocol within the first postoperative week. All patients attended a total of 16 outpatient physiotherapy sessions following surgery which were supervised by the same therapist. High-Heel-Distance (HHD)-Test, range of motion (ROM) and iEMG for vastus medialis (Fig. 1) were measured preoperatively and 1, 2, 4 and 6 weeks follow up. Additionally, knee-function, -swelling and –pain were evaluated using standardized scoring scales.

RESULTS

At 6 weeks passive knee extension (Fig. 2) and HHD-Test (Fig. 3) were significantly ($p<0.01$) better in group B. Also iEMG (vastus medialis) (Fig. 4) of group B showed a significant increase after 2 ($p<0.01$) and 6 ($p<0.01$) weeks.

A significant ($p<0.01$) correlation could be found between HHD-Test, passive knee extension und iEMG.

At 6 weeks follow up no sign. ($p>0.05$) difference was found between the two groups for the assessment of knee function, swelling and pain.

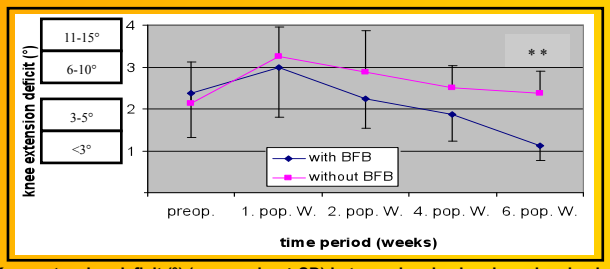

FIG. 2: Knee extension deficit (°) (mean value ± SD) between involved and non involved knee pre- and postoperative 6 weeks follow up (4=11-15°, 3=6-10°, 2=3-5°, 1=<3°)

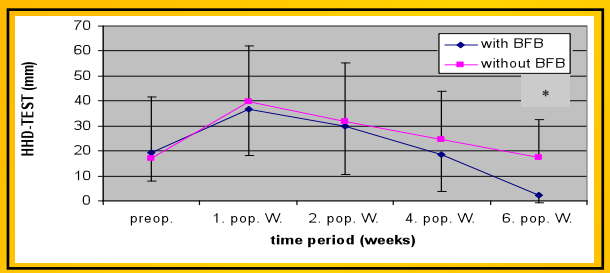

FIG. 3: HHD-Test (mm) (mean value ± SD) between involved and non involved knee pre- and postoperative 6 weeks follow up

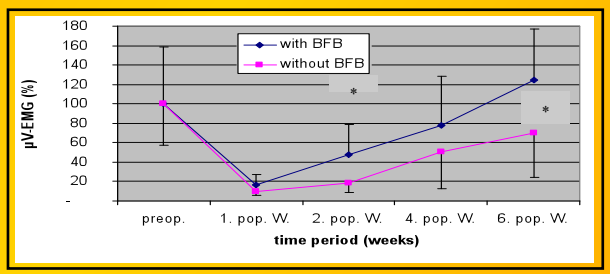

FIG. 4: Comparison of percentage vastus medialis-contraction (% µV-EMG) within two groups (mean value ± SD) pre- and postoperative 6 weeks follow up

FIG. 1: The iEMG-Measuring

DISCUSSION

These results indicate that EMG-BFB-Therapy in the early phase of rehabilitation is useful to enhance knee extension after ACL reconstruction. Improved innervation of the vastus medialis seems to play a key role in the development of post operative knee extension.

Significant correlation between HHD-Test and knee extension measured with long arm goniometer after 6 weeks ($p<0.01$) indicated that both methods are equally useful for evaluation of ACL-rehabilitation.

EMG-BFB is a simple, inexpensive and valuable adjunct to conventional therapeutic modalities.

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