

INFLUENCE OF KNEE BANDAGES ON EMG – QUADRICEPS MUSCLE PATTERNS DURING "DROP JUMPS"

Lothar Thorwesten, Katharina Engels, Jörg Jerosch,
Westfälische Wilhelms-Universität, Münster, Germany

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INTRODUCTION: Therapeutic management of knee injuries is still a central topic in the field of sports traumatology. Different therapeutic concepts and functional training, as well as proprioceptive stimulation with external devices, have been discussed for optimized active muscular stabilization (2, 8, 10, 11). The mechanical stabilization of external devices is discussed secondarily and is even ignored by some authors (12). The purpose of this study was to evaluate the influence of knee bandages on EMG patterns of quadriceps muscles performing "drop jumps" from various heights.

MATERIALS AND METHODS: 12 healthy male volunteers (mean age: 24.7 ± 2.8 years; mean weight: 78.3 ± 4.0 kg; mean height: 184.5 ± 6.2 cm) with a regular training frequency of at least 5.7 hours a week were tested, performing four "drop jumps" from each height (16cm, 32cm, 48cm, 64cm; 80 cm) using 2 types of knee bandages ("Kasseler-patellar-tendon bandage"; "Genu-plus" bandage), as well as none, in a randomized order. Muscular activation of the knee-stabilizing muscles was recorded by an 8-channel EMG-System with surface electrodes. For the assignment of ground reaction forces we used a Kistler platform (Fig. 1). Using a template the positions of electrodes were marked on the skin. After shaving and drying the skin the electrodes (blue sensor, Fa. Medicotest) were fixed on m. rectus femoris, m. vastus lateralis, and m. vastus medialis. The raw EMG-signal was transformed and calculated using the MYO-DAT-5.0 software (Orthodata/Lüdenscheid Germany). The time between first ground contact and first EMG-peak was taken for calculating the muscular activation latency for each muscle group. The patellar tendon bandage consists of an inelastic circular ribbon with a small cone-shaped cushion pad in front. In addition to this device, the "super-genuplus" bandage has an elastic bandage with an integrated silicon-friction ring which encircled the patella. Mean values of all data regarding bandage type and drop height were calculated; statistical evaluation for significant differences was performed at the 95% confidence level using SPSS (6.1.3.d) statistical software.

RESULTS: Regarding the activation latency of the different muscle groups after first ground contact, a steady decrease in activation latency depending on drop height could be measured for the *m. rectus femoris* using the patellar tendon bandage, unlike the drop jumps without a bandage device. A similar tendency could be demonstrated using the "super genuplus" bandage, excepting the drop height of 48 cm. (Fig. 2) At a drop height of 16 cm the *m. vastus lateralis* showed nearly the same activation latency either using a bandage or without a bandage.

With an increasing drop height the muscular activation time decreases using both bandages as shown in Figure 3.

According to the tendency the activation of the m. vastus medialis showed similar development regarding different drop heights.

Our results showed a significantly shorter activation latency of the different parts of the quadriceps muscle (m. rectus femoris; m. vastus lateralis; m. vastus medialis) with increasing jumping height using a knee bandage compared to those drop jumps without a knee bandage.

DISCUSSION: In 1978 Levine gathered initial experiences with the mechanism of patellar tendon bandages (9). Patients with chondropathia patellae were treated with slight pressure on the ligamentum patellae using a special bandage. Most of the patients showed an increasing tonic reaction of the quadriceps muscle with contemporaneous pain reduction. The attempted explanation was based on neurophysiologic reflex inhibition. In different examinations Hildebrandt et al. could demonstrate increasing standing stability as well as pain reduction, using knee bandages (5, 6, 7). The mechanical stabilization of knee bandages was evaluated by Schmickal et al. (12). Testing a knee model they could not demonstrate stabilization effects using elastic bandages. Also, the influence of knee bandages on proprioceptive capabilities was evaluated by different authors using an angle reproduction test (1, 8, 10).

Schaff et al. in 1995 and Gutenbrunner et al. in 1997 (4) could demonstrate the influence on muscle innervation using infrapatellar taping or patellar tendon bandages. Their corresponding results showed a higher EMG-Signal during a "one-leg-square-hop" after application of a bandage, as well as shorter activation latency of the m. quadriceps during drop jumps from a height of 10 cm.

As distinguished from these examinations, in this study only healthy volunteers were evaluated and in addition to this the drop height was varied in a randomized order. The faster response of the knee stabilizing muscle seems to be influenced by infrapatellar pressure, as well as the drop height. The additional stimulation to the skin receptors using the super genuplus bandage with the integrated patellar tendon bandage seems to have no benefit. To what extent sports specific capabilities as well as gonarthrotic or ACL-deficient patients are influenced by knee bandages remains unanswered. Therefore further investigation is necessary.

CONCLUSION: With regard to the influence of knee bandages on sensomotoric functions it seems to be profitable to use such a proprioceptive stimulation for optimizing active muscular stabilisation.

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