**Title:** How does the Protonics" knee brace/exercise device affect knee muscle activity during functional tasks?

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**Abstract:**

**Purpose:**
A new knee brace (Protonics) has been advocated as a means of applying variable, programmable resistance to knee flexion during functional activities. This resistance has been suggested to result in alterations of both quadriceps and hamstring activity as well as alterations in the ratio of activity in the medial and lateral portions of the quadriceps. The purpose of this study was to assess the effects of the Protonics brace on knee muscle electromyography (EMG) activity during walking and stepping activities.

**Subjects:**
Twenty-four healthy subjects (11male and 13 female) participated in the study. Methods and Materials: Surface electrodes recorded EMG activity of the vastus medialis oblique (VMO), vastus lateralis (VL), biceps femoris (BF) and semitendinosus (ST) muscles while an electrogoniometer monitored knee angle. Data were obtained during walking and stepping (8" step) with the brace randomly set to one of four different resistance settings or with the resistance apparatus removed from the brace (control condition).

**Analysis:**
Mean amplitude of the root-mean-square EMG was calculated for each resistance condition and normalized in relation to the control condition. One-way repeated measures ANOVA and Tukey multiple comparison tests were used to test for significant differences (a =.05) in mean EMG magnitudes, VMO to VL ratios, and knee angles between resistance and control conditions.

**Results:**
During walking, all four resistance settings resulted in significant reductions in mean angle of knee flexion and three of the four settings resulted in increased hamstring EMG activity, primarily due to an atypical bust of hamstring activity at the initiation of the swing phase of gait. None of the resistance settings significantly changed mean quadriceps EMG amplitude or VMO to VL ratios during walking. During stepping exercises, none of the resistance settings resulted in significant changes in mean EMG activity of the VMO, VL, or BF, and only one setting resulted in ST EMG activity significantly greater than the control condition. Finally, when EMG activities were expressed as a percentage of a maximal voluntary isometric contraction (MVIC), the mean quadriceps activity was less than 7% MVIC during walking and less than 36% MVIC during stepping, while mean hamstring EMG levels were less than 15% MVIC during walking and less than 12% during stepping, regardless of the resistance setting.
**Conclusion:** During walking, the resistance to knee flexion provided by the Protonics results in significantly reduced knee motion and increased hamstring EMG activity as compared to the control (no resistance) condition, though mean hamstring activity remains low in terms of % MVIC. None of the resistance settings caused significant changes in overall quadriceps EMG amplitude or in the ratio of VMO to VL activity during either of the activities tested.