Is simultaneous hamstring lengthening necessary when performing distal femoral extension osteotomy and patella tendon advancement?

MT HEALY MD\textsuperscript{1,2}, MH SCHWARTZ PHD\textsuperscript{1,2}, JL STOUT PT MS\textsuperscript{1}, JR GAGE MD\textsuperscript{1,2}, TF NOVACHEK MD\textsuperscript{1,2}.

\textsuperscript{1}Center for Gait and Motion Analysis, Gillette Children’s Specialty Healthcare, ST Paul, MN .
\textsuperscript{2}Department of orthopaedic surgery, University of Minnesota, Minneapolis, MN, USA.

\textbf{Background/objectives:} Crouch gait is common in individuals with cerebral palsy. Recently published data has shown that distal femoral extension osteotomy with patellar tendon advancement (DFEO/PTA) is an effective procedure to correct crouch gait in the presence of a knee flexion contracture and quadriceps insufficiency [1]; Short length and show lengthening rate (velocity) of the hamstrings surgery would not be necessary to improve hamstring function when DFEO/PTA are performed. This hypothesis was examined in a retrospective review of hamstrings length and velocity before and after DFEO/PTA.

\textbf{Design:} Retrospective, non-randomized, repeated measures.

\textbf{Participants and setting:} Fifty-one limbs in 32 individuals with a diagnosis of CP who underwent DFEO/PTA without concomitant hamstring surgery.

\textbf{Materials/Methods:} Pre and post-operative peak medial hamstring length and velocity z-scores were calculated using a musculoskeletal model [3]. To form the control group, the same model was applied to 83 typically developing children previously analyzed in laboratory. A subset of limbs with pre-operative values above or below two SD from the control mean emerged and were called long or short respectively. Members of this subset would often be considered candidates for hamstrings surgery. Categorical length outcome were derived as follows [Table 1], with analogous categories for velocity.

\textbf{Results:} The mean peak hamstring length z-score improved pre-to post-operatively from -2.2 to -0.76 (p<0.001). The mean peak velocity z-score improved from -3.1 to -1.5 (p<0.001) [Figure 1]. Pre-operatively, 29 of the 51 hamstrings were longer, 38 were faster, (35 longer and faster), resulting in 10 hamstrings that were short, and 24 that were slow (10 short and slow). For hamstrings length there were 39 good outcomes, 9 neutral outcomes, and poor outcomes, for velocity there were 22 good outcomes, 19 neutral outcomes, and 10 poor outcomes.

\textbf{Conclusions/Significance:} DFEO/PTA surgery alone led to significantly longer or faster hamstrings. Specifically, we saw 94% good or neutral results for length correction and 80% good or neutral results for velocity correction. An important limitation of this study is the use of an un-deformed musculoskeletal model to estimate the hamstring length is unknown, and possibly of a magnitude similar to the length changes observed in this study. Hamstring velocity would not be significantly affected by these geometric changes. Because crouch improved without posterior pelvic tilting, and because both hamstring length and velocity increased substantially, we conclude that concomitant hamstring surgery is rarely needed when performing DFEO/PTA.