A significant weakness of the muscles of lower limbs has been suggested in children with spastic diplegia (SD), which can be associated with difficulties to perform everyday functional activities (Elder et al. 2003). The purpose of this study was to compare voluntary force production and relaxation capacity of the quadriceps femoris (QF) muscle in prepubertal children with and without SD.

Twelve children aged 10-11 yrs (6 girls and 6 boys) with SD and 12 age- and gender-matched children without disabilities participated in this study. Inclusion criteria for children with SD were presence of spasticity with a rating of 2 or 3 on the Modified Ashworth Scale and ability to ambulate at least 10 m without stopping. During testing isometric force–time characteristics of the QF muscle the subject sat in a custom-made chair and was instructed to react to the visual stimuli as quickly and forcefully as possible by extending the leg against a cuff fixed to a strain gauge system, to maintain the maximal effort as long as the signal was on (2 s) and to relax the muscles suddenly after the disappearance of the signal. The following characteristics were calculated: latency of contraction (LATC), rate of isometric force development (RFD50) as dF/dt at the level of 50% of MVC, maximal voluntary contraction (MVC) force, latency of relaxation (LATR) and half-relaxation time (HRT). Voluntary activation (VA) of the QF muscle was estimated by twitch interpolated technique (Knight and Kamen 2001). Children with SD had lower (p<0.05) isometric MVC force, isometric MVC force:body mass ratio and isometric RFD50 of the QF muscle compared to healthy children. In children with SD, HRT was longer (p<0.05) than in healthy children. When compared to healthy children, VA of the QF muscle in children with SD was lower (p<0.05). There were no significant differences in LATC between the measured groups of children. However, children with SD had longer (p<0.05) LATR compared to healthy children.

The present study indicated a markedly reduced isometric MVC force and voluntary activation, impaired capacity for rapid voluntary isometric force production and relaxation of the QF muscle in children with SD. The rate of isometric force development in children with SD was reduced to a greater extent than isometric MVC force, supporting the notion of a reduced ability to adequately recruit higher threshold motor units. The impaired capacity for rapid voluntary relaxation of the QF muscle following a short-time maximal effort is dependent both on delayed reaction and slowing of muscle force-relaxation process. No significant impairment in movement preparation during rapid MVC of the QF muscle was observed in children with SD, assessed by visual reaction time.

REFERENCES

Keywords: Children, Spastic Diplegia, Motor System