INTRODUCTION

In locomotion of animals - including humans - the body segments are periodically subjected to impact forces, as in running or jumping, or because some external force such as gravity lengthens the muscle. In these phases the skeletal muscles are acting eccentrically, and concentric action follows. By definition of eccentric action, the muscles must be active during the stretching phase. The combination of eccentric and concentric actions forms a natural type of muscle function called a stretch-shortening cycle or SSC (Norman & Komi, 1979; Komi, 1984).

FORCE AND POWER POTENTIATION IN SSC

Since Cavagna et al. (1965) introduced the basic mechanisms of work enhancement when an isolated muscle was subjected to active stretch (eccentric action) prior to its shortening (concentric action), considerable work has been devoted to offer explanations for force and power potentiation in SSC (see Huijing, 1992; Komi, 1992). When compared to isolated SSC studies with constant electrical stimulation (see also Edman, 1996) the normal SSC has always variable muscle activation, which is under central and reflex control. For this reason the instantaneous force-length and force-velocity curves of normal SSC are not only very different from those of isolated preparations, but may demonstrate even more pronounced force and power potentiation. These phenomena can be demonstrated well with the technique of direct in-vivo measurements of tendon force in humans (Komi, 1990).

When the mechanical outputs of the muscle are enhanced in SSC action, the logical consequence should be that the work efficiency is enhanced as well. This is indeed the case, as demonstrated by several studies (e.g. Aura & Komi, 1986, Kyröläinen and Komi, 1995).

NEUROMUSCULAR FATIGUE IN SSC EXERCISES

In fatiguing SSC exercises the long-lasting reduction in force is associated with a gradually developing, but reversible muscle damage and soreness as well as reductions in stretch reflex sensitivity (Nicol et al. 1996). When measured immediately after the long lasting SSC exercise (marathon run) the short-latency stretch reflex has been observed to disappear dramatically (Avela and Komi, in preparation). This emphasizes the nature of the SSC exercise: the loading is not only metabolic but very importantly also mechanical (repeated impacts) and the exercise requires specific performance from the reflex control.
of muscle. In addition to disfacilitation of la afferent input to the α MN pool, exhaustive SSC exercise may also stimulate group III and IV muscle afferents with resulting reflex inhibition. Because reflexes are very important in stiffness regulation of muscle function, SSC exercise is consequently an excellent model for the study of the adaptation of this phenomenon (e.g. Horita et al. 1996).

REFERENCES


HORITA, T.; KOMI, P.V.; NICOL, C.;


