Summary

In the present thesis the activation of the quadriceps muscle was investigated during isometric and dynamic exercise. Changes in recruitment of type I and II fibres were studied during a cycling exercise at ~40 % of the maximal muscle force using the phosphocreatine-to-creatine (PCr/Cr) ratio method and the glycogen depletion method. During the cycling exercise, a greater proportion of type II fibres was recruited than previously reported for isometric contractions at the same relative muscle force, probably due to the dynamic character of the cycling exercise. Since during cycling only shortening contractions were exerted by the quadriceps muscle, whereas in daily life lengthening contractions are also performed, single motor unit and surface electromyography (EMG) were subsequently studied during shortening and isometric contractions as well as during lengthening contractions. When shortening, lengthening and isometric contractions were compared at the same relative torque (i.e. at the same percentage of their respective maximal capacity), muscle activation was similar between lengthening and isometric contractions. However, surface EMG was ~30 % higher and single motor unit discharge rate was ~20 % higher during shortening than during isometric contractions, indicating that motor units were activated at higher rates and probably additional motor units are recruited during shortening. In addition, muscle activation remained higher during the isometric contraction phase 1 – 5 s following shortening compared to the isometric reference contraction (i.e. at the same torque and knee angle). This higher muscle activation during and following shortening may be a consequence of shortening induced force depression. In contrast, 1 – 5 s following lengthening motor unit discharge rates were similar to isometric reference contractions, whereas surface EMG was lower, indicating that motor units were derecruited during isometric contractions following lengthening to compensate for the enhanced force capacity following lengthening. Since during dynamic contractions force is produced over a range of knee angles (i.e. muscle lengths), muscle activation was also studied during isometric contractions at different knee angles. At knee angles above the optimum angle for torque production more motor units were activated compared to the optimum angle when the same absolute torque had to be produced, to compensate for the lower torque capacity. However, although maximal torque was ~40 % lower and surface EMG ~20 % higher at knee angles below the optimal angle, there was no evidence for additional recruitment of motor units. In addition, motor unit discharge rate was unaffected by the change in knee angle.