SUMMARY

This study describes the use of computer-aided quantified analysis of surface EMG recordings. The measurements are used to calculate the average muscle fiber conduction velocity (MFCV) from two bipolar surface electrodes, placed parallel to the direction of the fibers of the m. biceps brachii between the motor point and the tendon. The time delay between the two signals is estimated with the cross-correlation method. Besides, the energy content (integrated EMG) and the frequency spectrum of the signals are calculated. Applications in the field of exercise physiology (fatigue studies) and diseases of the neuromuscular system are described.

In chapter II a review of the literature concerning the measurement of human muscle fiber conduction is given. Chapter III contains an analysis of the difference between invasive and noninvasive methods to determine MFCV. It is concluded that with needle methods the variability of MFCV can be demonstrated, which can be of advantage in cases of myopathies with only few slow conducting fibers. With surface EMG the average MFCV can be estimated at all forces, which makes this method suitable for fatigue studies and myopathies with a global reduction of MFCV.

Chapters IV and V contain fatigue studies. The importance of the force level is stressed as well as the resulting impediment of the muscle blood flow as an important cause of the surface EMG changes during fatigue. The relation between the average MFCV and the frequency content of the surface EMG signal is studied in chapter IV. By applying ischemia it could be demonstrated that besides MFCV other -probably central- factors also influence the spectrum during fatigue.

Clinical studies are presented in chapters VI - VIII. They are all concerned with myopathies characterised by an abnormal membrane function. In chapter VI the results of our studies of a large family suffering from familial hypokalemic periodic paralysis (HOPP) are presented. The main conclusion is that the reduced interictal MFCV can be used as a tool in the diagnosis of this disease. In chapter VII surface EMG recordings are used to evaluate the effect of acetazolamide in a double blind cross-over study in eight HOPP-patients. Since the reduced MFCV does not improve with acetazolamide, it is suggested that the latter exerts its effects by stabilising the membrane.

In chapter VIII the phase of transient paresis of Myotonia Congenita patients is analysed and compared with the measurements of patients with Dystrophia Myotonia and controls. The MFCV of the Myotonia Congenita patients shows a strong and very fast decline, together with a decrease in integrated EMG activity. This indicates a strong depolarisation of the muscle membrane resulting in a depolarisation block and paresis. These abnormalities are not present in the Dystrophia Myotonia patients.