SUMMARY

This study describes the application of a hand-held dynamometer that was designed to measure muscle strength in normal individuals and neurological patients in a simple way, comparable to manual muscle testing.

In the introduction general aspects of muscle strength are discussed. After mentioning some important physiologic factors, the diverse methods of measuring strength are reviewed, as well as other parameters of strength and muscle volume.

Chapter 2 gives a description of the dynamometer. A test was designed in order to establish to what extent differences in results can be attributed to the observer, the subject and replication. Observers learned the technique quickly and their results agreed wich each other to a considerable extent. The subjects showed a small learning effect in three of the four muscles tested. Normal muscle strength was measured in one hundred 18-year-old men.

In chapter 3 the results are presented of measurements of maximum voluntary contraction in 13 major muscle groups of 50 healthy females and 50 males, aged 20 to 60 years. The intrasession variation, the left-right variation, and the 5th and 50th centile values were calculated. The ratio of two observations within one session ranges from 0.85 to 1.18 and the ratio of left to right ranges from 0.82 to 1.22 (95% reference limits). In 20 volunteers the repeatability was tested after one week. The ratio of averages of three measurements in two successive weeks ranges from 0.82 to 1.23 (95% reference limits). There were only small differences between muscle groups concerning these ratios. A significant relation with age and weight/Quetelet index could be demonstrated in some muscle groups. The mean strength of females is approximately 2/3 of the strength of males. These data are useful as reference values in the application of hand-held dynamometry.

Chapter 4 describes a method of testing which makes it possible to evaluate cooperation during the contractions. Strength was measured in four major muscle groups with different test techniques: the tests were carried out with the "make" technique, the "break" technique, with and without encouragement, and the fatiguability was tested. Healthy volunteers, patients with organic weakness and patients with functional weakness were investigated. Patients with a functional weakness could be distinguished from the other two groups by an increase in strength >20% with the break technique, compared to the results with the make technique. Additionally they tend to show larger increases in strength with encouragement and their fatiguability is less.

Chapter 5 contains the results of strength measurements in two groups of patients with the Guillain-Barré Syndrome (GBS), comparing the MRC-scale and dynamometry. Ten muscle groups were tested in 25 GBS patients during a single session and four muscle groups of 10 GBS patients were tested approximately 10 times during

their disease. Sumscores were applied. During a single investigation a dynamometer seems to be more sensitive to reveal slight subnormality, but in routine practice manual muscle testing will suffice to determine abnormality. Dynamometry appeared superior to manual muscle testing in reflecting the course of weakness in patients with GBS. The reason that the MRC sumscore seems to give a correct presentation of the course of strength, is caused by adding up differing values of strength needed for each muscle to overcome gravity and different values at which each muscle is judged normal.

Finally the appendices present a description of the technique and a more elaborate description of the test position in the individual muscle groups.