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Manual mobilization of the wrist: A pilot study in rehabilitation of patients with a chronic hemiplegic hand post-stroke

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ABSTRACT

Study design: Prospective pilot cohort study, quasi-experimental design.
Introduction: Restricted hand mobility, limitation in activities and participation, due to relative immobilization of the hemiplegic hand are frequently reported after stroke.
Purpose of the study: To establish whether manual mobilization of the wrist has an additional value in the treatment of the hemiplegic hand.
Methods: Eighteen patients received treatment twice a week for a period of 6 weeks. Both treatment groups received therapy based upon the Dutch guidelines for stroke. In the intervention group, a 10-min manual mobilization of the wrist was integrated. The primary outcomes were active and passive wrist mobility and activity limitation. The secondary outcomes were spasticity, grip strength, and pain. Data were collected at 0, 6 and 10 weeks. Statistical analysis was performed using the Friedman's test, related *t*-test, Wilcoxon test, independent *t*-test, and Mann–Whitney *U*-test.
Results: Statistically significant differences were found in the intervention group; between T0 and T2 measurements in active wrist extension (+18°; $p < 0.001$), in passive wrist extension (+15°; $p < 0.001$), and in the Frenchay Arm Test (+2 points, 18%; $p = 0.038$). This significant improvement was not found in the control group. Statistically significant differences were found between the two groups in active and passive wrist extension ($p < 0.001$; $p = 0.002$), as well as a change in Frenchay Arm Test ($p = 0.01$).
Conclusion: This study suggests that manual mobilization of the wrist has a positive influence on the recovery of the hemiplegic hand. Replication of the results is needed in a large scale randomized controlled trial.
Level of evidence: 4.

Introduction

The World Health Organisation (WHO) describes a stroke as a "clinical syndrome characterized by a rapid development of clinical signs and symptoms of focal (sometimes global) disturbance of cerebral function, lasting more then 24 h or leading to death."[1] In 2007 the prevalence of stroke was 191,000 cases and an incidence of 35,000 new cases per year in the Netherlands.[2] Stroke is the primary cause of disablement in the Netherlands. Upper extremity and hand function are the most limited.[3]

The current view on physiotherapeutic treatment is summarized in the professional guidelines of the Dutch physiotherapy association, KNGF. The KNGF Guideline, "Stroke,"[4] indicates that an eclectic approach toward the patient, with several different treatment methods, concepts, and forms, is the best. There is no evidence for one specific intervention in the rehabilitation of arm and hand function.[4] Within the current view of "neurorehabilitation," task oriented training is strongly advocated.[4] However, the review of French et al[5] showed no significant benefits for "repetitive task" training of the upper extremity in patients with a stroke in comparison to other therapies.

Gracies[6] argued that paresis and/or hypertonia may result in a relative immobilization and "disuse" of the arm and hand. As a result of this "disuse" and relative immobilization, it is very likely that morphologic changes occur in muscle and joint tissue.[6] This

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will lead to loss of mobility based upon capsular adhesions and muscular contractures.[6–9]

Furthermore, pain is considered as a barrier for active movement. Thereby it can contribute to the above-mentioned formation of capsular adhesions and muscular contractures.[8]

Although the primary cause of impaired motor function in stroke originates from cerebral dysfunction,[1] restricted joint mobility (as a result of the above described disuse) of the involved arm, may also require evaluation and treatment. The limited joint mobility is frequently treated with several stretching techniques.[10] Nevertheless, Katalanic et al[10] concluded in their systematic review, that stretching does not have clinically important effects on joint mobility in patients with a neurological condition.

In practice, it appears that hand function can be restored only to a very limited extent in stroke patients. This is an unsatisfactory situation, both for the affected patient, his or her environment, and for the treating therapists. In short, the clinical problem is: *The function of the hemiplegic hand following a stroke is a difficult clinical problem to treat. Current treatments do not have a sufficient effect.*

Capsular impairments are often treated within physical therapy by the usage of manual techniques.[11–13] For most daily tasks, wrist extension of 40–60° is required[14] and this wrist motion is limited in patients following stroke.[3,7,8,15] In the treatment of patients with a hemiplegic condition, manual techniques are used less frequently, though wrist motion was increased after applying manual mobilization in an isolated neurological case.[16]

We assume that manual mobilization of the wrist may provide additional effects in the functional and task-oriented treatment of the hemiplegic hand. This study addressed the following question:

What is the effect of additional manual therapy in the recovery of patients with a hemiplegic hand, with limited wrist extension, activity limitation, spasticity, strength deficits, and pain?

Methods

Patients and study design

In a pilot cohort study with a prospective quasi-experimental design, the therapy and rehabilitation of hand function in stroke patients were compared at two nursing home locations. At one location, the standard treatment was given, according to the KNGF Guideline "Stroke."[4] At the other location, in addition to the standard treatment, a 10 min manual mobilization of the wrist was integrated in the standard treatment. Moreover, both groups received the same amount of treatment time (e.g. 30 min per session). Following contact with the local medical ethical board, "Medisch Ethische ToetsingsCommissie" (METC), it was determined that the study met the ethical requirements, since all patients in both groups would receive regular treatment and were not deprived of treatment

Table 1
Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
The patient: • has an hemiplegic condition due to having suffered a stroke[4] • has a restricted hand function at the affected side (AWE of maximal 60°) • has a limited mobility of the wrist (PWE maximal 75°) • is in physiotherapeutic treatment	• The onset of the stroke is less than 3 months old • The onset of the stroke is longer than 20 months ago • The patient has a subluxation of the gleno-humeral joint • The patient has suffered a trauma to the affected arm • The patient suffers from other joint disease like active rheumatism etc. • The patient can not understand the informed consent

AWE = active wrist extension, PWE = passive wrist extension.

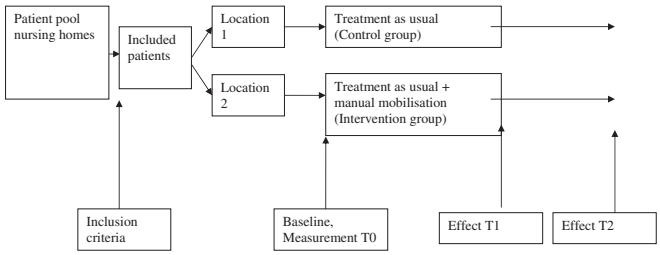

Fig. 1. Flow diagram of the study. The time between T0 and T1 is 6 weeks. The time between T1 and T2 is 4 weeks.

intensity and/or frequency. Patients were recruited at both locations from a population of patients already receiving physical therapy. Patients were included in the study based upon the inclusion and exclusion criteria (see Table 1). After explaining the procedure and having signed the informed consent, patients were admitted into the study. The treating therapists were not involved in taking the measurements. The observer was not involved in the treatments. There were 3 measurement moments; a baseline measurement, T0, and an effect measurement, T1, at the end of a six-week treatment period. After a four-week period of no treatment, a third measurement, T2, was executed (see Fig. 1).

The required amount of patients was calculated using the method described by Altman.[17] The clinically relevant result of increasing the range of motion (ROM) of passive wrist extension (PWE), was set on 15° with a standard deviation of 10°. The significance level was set to 5% and the power to 85%. The calculation showed a needed sample size of 16 participants, 8 in each group.

Measurements

Patient demographics and characteristics, gender, age, time after stroke, and hemiplegic side were recorded. The primary outcome measures were ROM and activity limitation. ROM expressed in active and passive wrist extension (AWE and PWE), was recorded in degrees with the utilization of a standard goniometer. The reliability of a goniometer is shown with an intraclass correlation coefficient (ICC) of 0.95 by Khamwong et al.[18] Activity limitation was measured with the Frenchay Arm Test (FAT) (see Photo 1). This is a test with an ordinal value (range 0–5) with 5 dichotomous items. The inter- and intra-tester reliability of the FAT is shown by Heller et al[19] with correlation coefficients between 0.83 and 0.99. The measurements in this test consist of: 1) Holding a ruler with the affected hand while drawing a line with the other hand; 2) grasping

Photo 1. Frenchay Arm Test material.