The Role of Active Release Manual Therapy for Upper Extremity Overuse Syndromes – A Preliminary Report

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The study was carried out to evaluate the efficacy of a specific protocol for treatment of overuse syndromes known as Active Release. This treatment protocol was taught to an athletic trainer who had six months experience before initiating a prospective study. Most of the 28 patients who were in the study had failed previous medical treatment for epicondylitis, tendonitis, and carpal tunnel. These patients refused to be randomized as to routine medical care. Results at one month and three months demonstrated a 71% efficacy rate, which when compared to similar studies in literature was superior. As a result of this study, recommendation of further use of this innovative technique is justified.

Key Words: overuse syndrome; manual therapy; epicondylitis; carpal tunnel.

INTRODUCTION

The annual incidence of cumulative trauma in soft tissue of the upper extremity has markedly increased over the past decade. According to the U.S. Bureau of Labor Statistics, cumulative trauma disorders has accounted for more than 60% of all occupational illnesses reported in the United States in 1991 (1). The cause of this phenomenon remains controversial.

These syndromes usually are referred to as tendonitis, epicondylitis, and more etiologically suggestive labels, such as carpal tunnel syndrome. This latter syndrome implies a progressive stenosing phenomenon has occurred while the general tendonitis implication seems to refer to an inflammation (2,3). They all seem to be related to overuse, wherein the physical demands to the local anatomy apparently exceeds the capacity of stressed tissue to tolerate them. In that sense, the phrase "overuse" seems perhaps less pejorative than accumulative trauma, which implies a destructive force. The uniform complaint is pain at specific areas in the upper extremity usually associated with tenderness. The one pathologic phenomenon, which could cause this set of complaints, is local tissue distension. Another clinical observation, however, not common to patients with a defined trauma, is that the area of perceived pain may not always correlate with the area of most significant tenderness.

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What is the cause of the local distension in overuse syndromes? In larger tissues that develop tendonitis, such as the Achilles tendon, the swelling can be defined by ulrasound and, thus, punch biopsies of the symptomatic areas are available (4). These studies show that an extraordinary accumulation of glycos aminoglycans (GAG) is present. In areas where 1% to 2% of the tissue should be of this type, the "injury" sites show up to 40%. This accumulation of GAG is also associated with large amounts of collagenosis disorganization. In these biopsies, as well as with biopsies of other sites of tendonitis and epicondylitis, no inflammatory cells are seen (5). The cause for this collection of GAG is not clear. It isn't necessarily related to obvious overuse. For instance, tennis elbow occurs only 75% of the time in the dominant arm in tennis players (6).

TREATMENT RATIONALE

A unifying concept has been proposed to explain all of the upper extremity overuse syndromes. A Colorado Springs, Colorado chiropractor P. Michael Leahy, has developed the concept identified as the "law of repetitive motion" I=NF/AR (7). In this model, the extent of insult to the tissues is explained by four interrelated factors. These factors are related as the Number of repetitions times the Force or tension of each repetition (as a percent of the maximum muscle strength) divided by the Amplitude of each repetition times the Relaxation time between repetitions. The keyboard operator may experience 10,000 repetitions per day, yet with a tiny force, perhaps only 2% maximum. Because the amplitude is of small amounts, such as 1% of available with a tiny relaxant time, in that the muscles really never do relax, the injury number is very high. Out of this concept, there is justification for injury with apparently minor events. It is assumed that decreased circulation and hypoxia are associated with this injury. Adhesions and fibrosis also develop along with local edema, and these create areas of tenderness and referred pain in the upper extremity. The sites of injury are variable of course, depending upon the particular physical activity the upper extremity is undergoing repetitively and the peculiar anatomy and neuromuscular strategies of each individual. Nonetheless, the injuries are at specific anatomic sites and therefore, if these anatomic sites can be defined, their treatment can be approached on anatomic principles.

To extend this theory into practical terms, Leahy has classified the upper extremity overuse pain patterns into 76 symptom patterns based on the local anatomy. Specific instructions as to the release of the adhesions based on the local anatomy are portrayed in the Instructional Manual (7). Specific techniques for release of adhesions using deep digital tension, usually with the thumb or two fingers, and both active and passive passage of the tissue through this deep tension, are described. It is followed by an active stretching program done by the patients themselves to help avoid recurrences.

The purpose of this study was to determine the clinical utility of these concepts. If the concept has validity it should be teachable, in that the principles of treatment are based on human anatomy and should be transferable to an appropriately oriented therapist. Furthermore, if the injury events are based on the same unifying principle, the same treatment should be applicable to all of the so-called overuse sites of the upper extremity. We proposed to challenge this concept by having a prospective study of consecutive patients treated by one therapist.

METHODS

For this study, the therapist, a certified athletic trainer (ATC) had taken the 4-day course and worked with the innovator, Dr. Leahy, on several occasions before this study. He had 6 months prior clinical experience with the technique at the time the study was started.

Eligible patients for this study were those referred by their primary care physicians to the UCSD Orthopaedic Department (UCSD OrthoMed). They were evaluated either by an orthopaedic surgeon or a primary care physician specializing in sports medicine. All diagnoses of overuse syndromes to the upper extremity were accepted and included consecutively in this study. All participants had the nature of the study explained to them, which included pre and post-treatment testing and their willingness to participate in a clinical research study. For those who wished to participate, the guidelines of the Institutional Review Board (IRB) of UCSD were explained and the patients signed the IRB Approved Informed Conset. Although ideally a comparative study would be more instructive, patients who had previously participated in standard medical care for their syndrome refused to be randomized to the control group of traditional treatment. Also, patients, who had not had previous treatment, had been told by the referring primary care physician that they would be participating in a study using a new type of treatment and again, refused to be randomized to traditional treatment. Excluded from the study were patients who had previous surgery for their current pain complaint or those who had symptoms so severe that they were considered surgical candidates. Patients were also excluded if they had significant neurologic signs, such as loss of reflexes and/or muscle atrophy. During the period of active release treatment, no other type of treatment such as injections, anti-inflammatories, or braces were utilized.

The duration of this study was an 8-month period, which allowed a minimum of a three-month follow-up at conclusion of treatment for this study to be completed within one year as available to the testing physician.

The treatment was carried out by a single therapist according to the standardized ART protocol at start of treatment. Patients selected the pain pattern that best represented their symptom complaint from the series of 76 drawings of the elbow, forearm, and hand, with varied pain distribution depicted. Based on the selection of pain pattern, specific anatomic sites were sited to be the source of symptoms. According to the protocol for that specific pain distribution, specific anatomic sites were treated with deep manual therapy and active release maneuvers. All patients were treated twice a week for 4 weeks. The patients that reported as completely symptom free were discharged. The patients that reported symptoms as partially relieved continued active treatment for an additional 4 weeks. To allow uniform testing status, only the 4-week test results were reported for the whole group. The patients that reported symptoms as worse were referred for evaluation for surgery.

OUTCOME MEASURES

The test battery was introduced to the patients by the assessor, who was not involved in diagnosing or treating the patients. The evaluee throughout the following tests was seated in front of a table having the arms in a comfortable height and fully supported. The same testing area was used for all tests. The battery of tests included the following:

a. *Pain Drawing:* A magnified model of the upper extremities was used. The patients marked the area of pain using symbols illustrating the quality of pain. The area of pain was measured by counting the number of squares on a grid with squares of 0.5 x 0.5 cm. No differentiation was made according to pain-quality in this paper. Visual Analog Scales (VAS), from 0-10 were used describing the worst pain and the usual pain during the last 2 weeks and the actual pin on the day of testing.
b. *Pain Questionnaire:* Patients were asked how often pain, tingling, weakness, or stiffness occurred in the arm or hand area during the last week. Rated on a 7-point scale (1= not at all, 2 = very rarely, 3 = a few times, 4 = abut _ time, 5 = usually, 6 = almost always, 7 = always), patients were asked the severity of the pain, tingling, weakness, or stiffness. Patients were asked to rate the influence of pain on daily activities (at work, among friends, in the family), sleep and use of medication.
c. *SF 12:* General health. The scale described both physical and mental health according to the Standard Scoring. Permission to use the scale was given prior to the study. The results were related to normative data.
d. *Job Demand Questionnaire:* Describes demands at the work area. Patients were asked to quantify the amount of time they were supposed to sit, stand, walk, and carry. They were asked to quantify length of time during a day they were exposed to repetitive or forceful handling task, awkward postures, vibrations, and work overhead, on a 5-point scale (1 = not at all, 2 = rarely, 3 = occasionally, 4 = frequently, or 5 = constantly). The answers were used to describe the work function in more detail than the job title. The answer was related to the Hand Function Sort test (described in the following).
e. *Hand Function Sort:* Describes the patient's perception of work capacity. The patients went through a booklet with drawings depicting 62 different activities related to the upper extremities. They were asked to rate their ability to perform the shown activity on a 5-point scale (1 = able, 2 = slightly restricted, 3 = moderately restricted, 4 = very restricted or, 5 = unable to perform the activity shown on the picture). The score was related to the PDC-scoring (United States Department of Labor) and the subjective perceived function of the individual patient at the time of testing was described using the 4 groups: sedentary, light, medium, heavy.
f. *Phalen's Test:* Performed with the evaluee seated, with both shoulders abducted to 90°. Both hands were flexed and the dorsal surfaces of each hand are gently pressed against one another. The hands were maintained at the level of the sternum for one minute. A positive test was indicated by sensory numbness, tingling, or paresis with or without pain.
g. *Tinel's Sign:* Performed with the evaluee seated in front of a table. The dorsum of the hand and forearm rests on the table at a comfortable height with the forearm supinated. The evaluator taps gently over the carpal tunnel with the index finger. A positive test is indicated by pain or dysesthesia along the distribution of the thumb, index, and middle fingers.

h. *Semmens-Weinsteins Discrimination Test:* Performed through the use of Semmens-Weinstein Anesthesiometer Monofilament Testing Set. The evaluee was asked to relax and close their eyes. The monofilaments were applied one at a time perpendicular to the palmar skin until the filament bows. The size of the filament was changed from above normal until the patient could not discriminate the touch any more. The lightest touch that was discriminated at the index and the little finger were registered. The results were dichotomized according to a normal value.
i. *Static 2-Point Discrimination Test:* Performed after the Semmens-Weinsteins Discrimination Test. The patient was asked to tell whether they felt a two-point or a single touch.
j. *Range of Motion:* Measured using a goniometer. The test was performed three times in each direction (flexion and extension) and the mean of the three trials was used for the analysis.
k. *Isometric Finger Pinch:* Performed using the B & L Pinch Gauge with results related to the American Society of Hand Therapists Normative Data. The test was performed three times with each hand. Mean of the three trials was used for comparison.
l. *Isometric Power Grip:* Performed using the JAMAR Hand Dynamometer and the results were related to the American Society of Hand Therapists Normative Data. The test was performed three times with each hand. Mean of the three trials was used for comparison.

The patients did all the tests (a – i) in the same order, before treatment and after 4 weeks of treatment. Some of the test results could be relatively lower than maximal effort performance resulting from fatigue because of the order of tests and number of trials. In the following analyses we compared the results intra-individually. The bias according to fatigue was kept as minimal as possible in a clinical setting.

STATISTICS

Parametric statistics was used describing data, which was recorded at specific intervals. In the questionnaires, we have used mostly oridinal scales, therefore nonparametric methods are used analyzing data between visits. The Wilcoxon matched pairs test was used for comparison. SPSS 7.0 was used as the software package.

RESULTS

Twenty-eight patients agreed to participate. All were referred and treated by the same therapist during the study treatment period of 8 months. Only one patient did not complete the second set of tests after 4 weeks of treatment.

Table 1 shows the diagnoses, which were made by the patient's referring physician on the basis of usual history and physical examination.

Table 1 - Diagnosis

	n	%
Epicondylitis	15	54
Carpal Tunnel Syndrome	8	29
DeQuervain	3	10
Tendonitis	2	7

The median age was 45.5 years (Percentiles: 36.5 – 49); 46% were men and 64% were women. The mean height was 69 inches (SD: 12.5); mean weight 164 pound (SD: 45.65). Eighty-six percent of the patients (86%) were White, 7% Asian, and 7% Hispanic. Of the patients, 61% were married, 18% single, 4% widowed, and 18% separated or divorced. Education (highest level); 36% had a graduate degree, 21% a college degree, and 43% a high school degree. Eighty-six percent (86%) of the patients were right-handed, 7% left-handed, and 7% ambidextrous. Only one of the patients smoked.

The patients employment status was as follows: 89% of the patients were employed at inclusion, only two were on sick leave, two were homemakers, and one was a student at the time of entry. After 4 weeks of treatment, all the patients having a job were back working, two with permanent modifications at the workstation; 32% were at their usual job, the rest had some type of work restrictions. All of the employed patients were on workers' compensation medical care. There were no workers doing heavy or moderate physical demanding work. All were sedentary, performing office work.

Twenty-one percent (21%) of the patients were seen in the clinic with pain onset within 3 months, 68% of the patients have had their first episode of pain within a year, 43% were still in their first episode of pain. Fifty-five percent (55%) of the patients had been treated previous to the inclusion-consultation, most often by medication (80%) prescribed by their GP, splints (66%), and/or injections (25%). Two patients had five different types of previous treatment in the past, two patients had four types of treatment, three patients had three types of patients, four patients had two types of treatment, and five patients had one type of previous treatment.

Sixty-four percent (64%) of the patients had pain related to the neck area, but not as their primary pain problem. One patient with a cervical fusion years before the current pain complaint.

TREATMENT

During 4 weeks, the patients were treated a median of seven times (min-max: 4-9). After 4 weeks, 50% were discharged by the physician. No difference was found between patients diagnosed as carpal tunnel and epicondylitis (OR = 0.44, CI 0.092-2.15).

ACTUAL PAIN-STATUS

Twenty-six (26) patients had pain in their dominant arm. Only two patients had pain in both arms. All patients tested in the most pain-full arm.

Table 2. Pain Drawing

	Min/Max	Inclusion	4 Weeks	Change
VAS-Max	Median	7 (2-10)	4 (0-9)	0.002
VAS-Usual	Median	45 (1-8)	3 (0-8)	0.002
Number of squares	_ cm 2	13 (5-171)	7 (0-123)	0.00

[a]Wilcoxon Signed Ranks Test

a. *Pain-Drawing* (Table 2): 75% of the patients got better according to VAS-max, five got worse (3 two "cm", 2 three "cm"), three of the patients that were diagnosed as having carpal tunnel syndrome got worse, and two of the patients diagnosed with epicondylitis got worse.

   No statistically significant difference was found in rate of improvement between the two diagnostic groups according to test results and in the following the patients are analyzed as one group.

b. *Pain-Questionnaire*: At inclusion, 71% of the patients complained about pain as "about half time" during the last week, most often when they performed specific activities, such as data-entry work (22%), lifting or carrying heavy load (25%), grip function (14%), and 61% stated that, normally, relaxation relieved their pain.

   About half of the patients did not have tingling; 17% had tingling usually or always, 75% experienced weakness, of those, 32% usually or always, and 25% experienced stiffness.

   Asked on a 7-point scale how the pain was rated, 64% stated mild or somewhat severe pain, 22% severe to extremely severe pain.

   After 4 weeks of treatment the patients had less pain and tingling while at rest or when performing activities. The severity of pain, tingling, and weakness was also less during activity (Table 3). Throughout the night, 54% were awake because of pain and they also experienced pain in the morning (Table 4).

c. *SF12*: Results are shown in Table 5: The mental score was above normal at both visits. The physical score was under normal for the women, normal for males. Both groups changed significantly during treatment.

d. *Job Demands at Work*: Most of our patients had sedentary work (55%) or light work (31%). They were sitting down for about 7 hours a day, performing repetitive movements without lifting, or performing carrying duties.

   Most of the patients had good social relations at work, 79% said that they can turn to a fellow co-worker if something troubles them and share problems most of the time, 80% accepted new ideas and enjoyed the tasks they were involved in, and 93% got along with their closest or intermediate supervisor.

e. *Hand Function Sort Test (HFS)* (Table 6): At inclusion, only four patients could not perform what they were supposed to do according to the job demand questionnaire. After 4 weeks, only two patients still had problems. If the HFS test score is used as a nominal-scale, the test results showed that four patients were worse than at inclusion, 22 patients were better ($p = 0.00$).

OBJECTIVE TEST BATTERY

f. *Phalen's Test*: Ten (36%) of the patients had a positive test; aggravation of pain in their painful hand during Phalen's Test. After treatment, four patients had a positive test. One of the post-treatment positive tests was negative at the first test. The difference was not statistically significant ($p = 0.059$), Wilcoxon).

g. *Tinel's Test*: None of the patients had a positive test at inclusion or at 4-week follow-up.

h. *Semmens-Weinsteins Test*: At inclusion, 7 (25%) of the patients had less sensibility of the painful side related to the nonpainful side and at the index finger, and five (18%) at the little finger. After 4 weeks of treatment 6,7 respectively, had abnormal sensibility. No significant difference was found related to this test.

i. *Two Point Discrimination Test* (2-PD): At inclusion, mean 2-PD at the index finger was 3.85 mm. At 4 weeks, 3.0 mm. The change was statistically significant (p = 0.008). 2-PD at the little finger was changed from 4.04 to 3.15 (p = 0.027). No difference was found between visits at the painfree side.
j. *Range of Motion*: No difference was found between hands or between visits, which means that ROM did not change according to treatment.
k. *Isometric Palmar Pinch Strength*: Small differences were found between palmar pinch strength on the painful side and the nonpainful side. At start, there was a mean of 20% loss compared to normal, and at 4 weeks there was a mean of 10% loss compared to normal (0.30).
l. *Isometric Power Grip Strength*: The strength at the pain side was better than the nonpain side at both test sessions, but no significant difference was found between visits.

When directly asked about satisfaction according to treatment, 71% of the patients felt better after treatment, but only 7% found that their pain was abolished, most experienced intermittent loss of pain.

The patients were asked about pain related to prior treatment at 3 months after conclusion of treatment, specifically how the ART-treatment was compared to any previous treatment. Of the 15 patients having treatment prior to ART who could be contacted, 12 of 15 stated that the result after ART-treatment was better, 2 of 15 the same, 1 of 15 worse. The one patient who was worse had a cyst on the thumb extensor tendon and was improved after surgery.

Table 3. Symptoms at Inclusion and After Four Weeks

	Inclusion		4 Weeks		Change [b] P
	Median	Percentile	Median	Percentile	
How Often In the Last Week [a]					
In Rest	4	2-5	2	2-4	0.004[d]
Performing anything	5	3-6	3	3-4	0.002[d]
Tingling	2	0-2	0	0-3	0.012[d]
Weakness	3	0-6	2	0-4	0.148
Stiffness	1	0-3	2	0-3	0.618
How Severe In the Last Week [c]					
In Rest	3	1-3	2	1-3	0.082
Performing anything	4	1-5	2	1-4	0.001[d]
Tingling	1	0-2	0	0-2	0.027[d]
Weakness	3	1-4	2	1-2	0.030[d]
Stiffness	1	0-3	1	0-2	0.377

[a] 1= not at all; 2 = a few times; 3 = about _ the time; 4 = usually; 5 = almost always; 6 = always.
[b] Wilcoxon Rank Rest.
[c] 0 = none; 1 = very mild; 2 = mild; 3 = moderate; 4 = somewhat severe; 5 = severe; 6 = extremely severe.
[d] Statistically significant.

DISCUSSION

This study demonstrated that a specific manual therapy treatment program based on the release of tissue adhesions was successful in most of the patients. Success was measured both by objective and subjective measures ranging from function questionnaires through objective testing with standardized current clinical tests. Most improved, many only in a subtle manner. In the 3-month follow-up, the treatment was as good or better than previous medical treatment for most of the patients.

The limitations of this study were that it was not randomized and there was no control group. This was not feasible in the reality of a private practice setting. The testing was not randomized either and thus, there might have been an order effect in the results. It was felt, however, that the subtle variation in performance could more easily be discerned by a constant of order of tests at the start and conclusion of treatment. Another limitation of this study was the limited number of patients; therefore, that the wide variation in tests, both objective and subjective, could seldom reach statistical significance.

This is a difficult problem. The cause and treatment for overuse syndrome of the upper extremity certainly remains undefined. In a recent extensively referenced review article on this subject by Millender and Conlon (8), the authors indicated the etiology remains controversial. Little clear-cut histologic evidence exists. One of the few articles that reports on the presumed pathology based on the biopsy of the pertinent lesion in patients, Nirschl notes what is called angiofibroblastic tendinosis (9). He notes that this is edematous tissue. He also notes the absence of inflammatory cells and disorganized collagenous tissue. In the recent review of the whole subject based on a 1994 symposium, no other histologic evidence is reported from biopsies of clinical tendinosis and epicondylitis sites (10).

In the case of the carpal tunnel syndrome, no better clarity as to the specific pathophysiology exists. One would assume if it was a chronic stenosis phenomenon, aberrations in the electrical conduction of the traversing median nerve would be consistent. Nonetheless, when this question is put to the test, it is evident that the electrical studies are not a predictor of success in the case of surgical relief for the carpal tunnel stenosis. The results in patients with typical carpal tunnel clinical picture were similar in 75 of 151 workers with normal conduction studies to those with abnormal studies who had carpal tunnel release (11), and normal o abnormal electrical studies were not a predictor as to return to work. Only about half of the patients returned to their regular work even at 6 months.

In fact, it is also clear that objective findings such as grip strength and preoperative pain complaints and physical findings are also not predictors of return-to-work (12). If the pure stenosis wee the pathologic factor one would expect a higher success rate and more relevance of objective testing. The reduction of reactive inflammation and edema by steroid injection should be quite successful. Again, in the recent study, only half of the patients had any relief whatsoever, and only about a quarter of them had lasting relief (13).

Added to the lack of consensus as to etiology and treatment is the problem of evaluation of subjective complaints. Because the clinical syndrome is based largely on subjective complaints of pain and tenderness, results are difficult to measure. In fact, some clinicians feel that these disorders occur largely because of psychosocial behavior should not be a significant factor. Most of the patients were working at the time of initiation of treatment, and indeed, all were back to work at conclusion of treatment. In an attempt to document the positive state of mental health, as well as physical function, we used the SF12. The SF12 has been documented to directly correlate with the results of the longer SF36, which has been extensively validated (15). The SF12 has a mental component summary scale score (MCS) as well as a physical component summary scale score (PCS). Our study demonstrated no change in the mental score, which was above normal, before and after the 4-week treatment. The physical component score did significantly improve at 4 weeks to normal and above.

In an attempt to document change we chose several objective testing instruments to evaluate function. These included grip and pinch test, as well as range of motion. Only the pinch test showed some improvement. The other functional tests did not demonstrate significant changes. Other studies have demonstrated lack of correlation between functional test, such as grip test, and the subjective results (16). The most definitive documentation of change on the basis of subjective complaints was in the form of pain at night diminishing and tingling and constancy of pain. These complaints did demonstrate statistically significantly areas of improvement.

The conceptual framework of a consistent pathologic process proposed by Leahy (7) does lend itself for evaluation. As noted, pain patterns defined by the particular anatomic relationships associated with evaluation of tenderness and the physical consistency of the soft tissue are the determinate findings on which the treatment is based. If this is an anatomic reality, the concepts should be transferable to other clinicians with a knowledge of the anatomic principles, but lacking the charisma and experience of the innovator. This indeed was demonstrated in the case of this study.

The specific objective and subjective measurements might have been improved if we had carried the study out further, but because all patients did not have an 8-week follow-up evaluation (half of them had sufficiently improved at 4 weeks that no additional treatment was necessary), it seemed inappropriate t discuss longer term follow-up studies with such a small number. In the follow-up telephone interview at 3 months, most did feel that this was a more successful treatment than their previous experience with standard medical care.

On this basis, we feel it is appropriate to recommend continued use of this specific modality, Active Release Therapy. The rationale for care seems justified. The number of treatments is not excessive and no additional expenses, such as the cost of injection, braces, and medications, are necessary. As in the case of all manual therapies, there is increasing efficacy of the therapist to be expected because of the development of the art with increased experience. The achievement of this level of modes success reported here by a relatively inexperienced therapist is worthy of further serious consideration of both the concept and the therapy. A true randomized prospective study is needed to clarify these issues.

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Table 4. Pain Pattern During the Last Two Weeks

Pain Pattern	Inclusion N-28	4 Weeks N = 26	Change [a] P
During the night (yes)	15	4	0.007[b]
Times during the night (median)	2 (1-3)	2 (1-2)	0.015[b]
When waking up (yes)	14	5	0.021[b]
# of mornings (median)	14 (14-14)	14 (8, 5-14)	0.022[b]
Constantly during day (yes)	7	4	

[a] Wilcoxon Rank Test.
[b] Statistically significant.

Table 5. SF12

		All		Male		Female		Diff. Acc To normal
		Median	Percentile	Median	Percentile	Median	Percentile	
Physical score	1st visit	41.56	35-27	42.95	37-51	37.55	33-45	Normal/Under
	4 Weeks	47.19	39-54	51.70	46-57	43.25	38-53	Above/Normal
Difference		0.001		0.015		0.031		
Mental Score	1st visit	58.42	52-61	58.04	53-61	58.81	59-61	Above/Above
	4 Weeks	57.89	53-60	58.73	57-83	57.83	58-59	Above/Above
Difference		.0548		0.937		0.394		

Table 6. Demands on the Job Related to Functional Status According to Hand Function Sort Test

	Job Demands	Hfs at inclusion	Hfs at 4 weeks
Sedentary	55	29	11
Light	31	32	32
Medium	7	36	43
Heavy	0	4	11