A Pilot Study In to the Effects of Cervical Manual Therapy Plus Conventional Physical Therapy on Clinical Outcomes and Electrodiagnostic Findings in People With Carpal Tunnel Syndrome

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Background: Carpal tunnel syndrome (CTS) is the most common entrapment neuropathy that has a significant impact on patients' quality of life. Current physical therapy treatment options show limited effects or low-quality evidence, especially in the long term. To date, there has been little research to look at the effects of treating the cervical spine on decreasing symptoms distally to the carpal tunnel. This study aimed to evaluate the effects of cervical manual therapy plus conventional physical therapy on patients with carpal tunnel syndrome.

Methods: This pilot pretest/posttest and six-month follow-up clinical study included 15 adult patients with CTS. For two weeks, each patient received 10 sessions of supervised intervention treatment. The efficacy of the therapies was assessed at baseline (T0), immediately after treatment (T1), and six months after treatment (T2). The visual analog scale (VAS), a symptom severity scale, the functional capacity scale of the Boston Carpal Tunnel Questionnaire (BCTQ), the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire, median nerve motor distal latency (mMDL), and median sensory nerve conduction velocity (mSNCV) were outcome measures.

Results: There were significant improvements in all measures between the baseline values at T0 and those recorded immediately after the treatment at T1 or six months later at T2 (p<.05).

Conclusion: This pilot study indicates that cervical manual therapy plus conventional physical therapy applied for two weeks improves clinical outcomes and electrodiagnostic findings in people with CTS.

KEYWORDS: carpal tunnel syndrome; cervical spine; manual therapy; neck; rehabilitation

INTRODUCTION

Carpal tunnel syndrome (CTS) is the most common compression neuropathy in the upper limb caused by increased pressure on the median nerve at the wrist.[1] Pain, numbness, and tingling in the median nerve distribution characterize the syndrome.[2] The prevalence of this syndrome in the general population is estimated to be 5%, with women being more affected than men.[3,4] Due to the high costs of lost workdays and a marked decline in performance caused by this syndrome, it is

critical to investigate effective methods for treating these patients.[5,6]

Conservative treatments such as splinting, oral medications, corticosteroid injections, and physiotherapy are recommended for patients with mild to moderate symptoms.[7] The best conservative treatment is poorly understood.[8] Physical therapy is a common treatment option for CTS patients who want to avoid or postpone surgery.[9] Alternative physiotherapy interventions such as thermotherapy, electrical stimulation, low-power laser, magnet, ultrasound, manual therapy, and exercise therapy are used in the treatment of these patients.[10] Several physical therapy interventions have been found to provide short-term relief, but no long-term improvement have been reported in recent systematic reviews.[11] Furthermore, evidence on the efficacy of some of these interventions is limited or of poor quality.[12-16] One possible reason may be that the conventional physical therapy interventions focused on localized treatments restricted to the wrist area.

Recent evidence suggests that CTS is a complex pain syndrome, and thus physical therapy should use a comprehensive nociceptive pain rationale to treat this condition.[17] There is evidence that the symptoms of carpal tunnel syndrome, particularly mild-to-moderate carpal tunnel syndrome, are not limited to the wrist.[18] More proximal areas, such as the peripheral nerve at the pronator teres or intervertebral foramen, are involved.[19] Pain in the upper extremities (forearm, elbow, arm, or shoulder) was reported by 45% of people with CTS, and 14% of people with CTS reported neck pain.[18,20] An association between the occurrence of carpal tunnel syndrome and trigger points in the upper trapezius and infraspinatus muscles has been found.[21,22] Rincón et al. demonstrated the cervical range of motion, especially in the opposite direction to the symptomatic side, was significantly reduced in women with CTS.[23] When compared to healthy controls, people with moderate CTS have a more forward head posture and less cervical range of motion.[24] A growing body of literature demonstrates that interventions applied to one anatomical region can influence the outcome and function of other body regions that may be seemingly unrelated.[25,26] The concept of regional interdependence (RI) stemmed from the review of literature that areas of the body appeared to be musculoskeletal linked, so impairments in one region of the body or one system of the body can have a direct or indirect influence upon the musculoskeletal symptoms and function of another area of the body.[27] A systematic review compared manual therapies with surgical decompression in women with CTS and found similar improvements of symptoms severity and functional status of the hand in the manual therapy and surgery groups at one, three, six, and 12 months.[28]

It appears that physical therapy interventions addressing the cervical spine may have superior improvement outcomes when treating carpal tunnel syndrome than localized conventional physical therapy interventions. To our knowledge, no research has examined the effectiveness of combining traditional physical therapy with cervical manual therapy in patients with carpal tunnel syndrome. Therefore, in this pilot study, we attempted to identify the effects of cervical manual therapy plus conventional physical therapy on pain intensity, functional status, and electrodiagnostic findings in patients with carpal tunnel syndrome. We hypothesized that combining cervical manual therapy with traditional physical therapy would result in better clinical and electrodiagnostic outcomes in patients with carpal tunnel syndrome.

METHODS

Study Design

This study was designed as a pretest–posttest and six-week follow up clinical trial. The study was approved by the Research Council, School of Rehabilitation, and the Ethics Committee of the Ahvaz Jundishapur University of Medical Sciences (IR.AJUMS.REC.1399.727). It was registered the Iranian Registry of Clinical Trials (IRCT20201201049565N1). All subjects gave informed consent. All the patients were recruited and referred for treatment at the physiotherapy clinic in the School of Rehabilitation, AJUMS, by a neurologist.

Participants

Participants included those with an age range between 18 to 60, either sex, symptom duration at least 12 weeks, classic or probable CTS in accordance with

the Katz hand diagram criteria,[7] positive Tinel's sign, Phalen's, or carpal compression test, and a 40-mm pain intensity level out of 100 mm on the Visual Analog Scale (VAS). In addition, the diagnosis of mild-to-moderate CTS was confirmed by a neurologist with an electrodiagnosis examination: Mild CTS, sensory nerve conduction velocity in the third digit-wrist segment <44 meters per second (m/s) and distal motor latency ≤4 milliseconds (ms); Moderate CTS, sensory nerve conduction velocity in the third digit-wrist segment <44 m/s and distal motor latency >4 ms.[2,28] Participants were excluded from the study if they had any sensory or motor deficit in either the ulnar or radial nerve, a history of previous surgery or injection in the wrist, presence of systemic diseases such as rheumatoid arthritis, fibromyalgia, diabetes mellitus, thyroid diseases, neck, shoulder, or upper extremity trauma, and pregnancy. Also excluded were participants with concurrent cervical radiculopathy or polyneuropathy.

Interventions

All subjects received a conventional physical therapy program consisting of wrist splints (neoprene wrist splint tebosanat 31190), TENS (Novin, model 733x, Iran) to the wrist region for 20 min, and wrist joint mobilization.[29] Patients also received cervical manual therapies applied to the neck, including manual cervical distraction, lateral glide mobilization, and posteroanterior pressure to the mid-cervical spine.[30] Patients were instructed to self-stretch neck muscles (the upper fibers of the trapezius muscle, upper fibers of the scalene muscles, and levator scapulae muscle) for 45 sec two times[30] (see Appendix A). Exercise regimes were applied by an experienced physiotherapist in manual therapy approaches (see Appendix B). The treatment was applied five times a week for 10 treatment sessions.[28,31] One physiotherapist applied all interventions. Patients were also asked not to use any pain relievers or anti-inflammatory drugs.

Outcome Measures

The primary outcome measure was percent improvement of the electrodiagnostic findings, and clinical outcomes were used as secondary outcome measure. A neurologist measured median nerve motor distal latency (mMDL) and median sensory nerve conduction velocity (mSNCV) as electrodiagnostic outcomes.[28] The Boston Carpal Tunnel Questionnaire[32] (BCTQ; Appendix C), The Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire[33] (Appendix D), and VAS of pain intensity were used as secondary clinical outcomes.[28]

An Electrophysiological Study of the Median Nervex

In a temperature-controlled room (22–24°C), electrodiagnostic study findings were extracted using a Tru-Trace 4 EMG system (Deymed Diagnostic, Hronov, Czech Republic) and a DEEMED electromyography device (Noraxon, Scottsdale, AZ). In this study we used the abductor pollicis brevis muscle as the actively recording electrode (G1) and the palmar surface of the first metacarpophalangeal joint as the reference electrode (G2). A bipolar electrode and supramaximal current were used to stimulate the median nerve in the wrist (between palmaris longus and flexor carpi radialis) and the antecubital fossa (on the pulse of the brachial artery). For mSNCV, this study used a bipolar stimulating electrode to apply supramaximal stimulation to the median nerve at the wrist, with the G1 placed on the metacarpophalangeal and the G2 on the distal interphalangeal joints of the index finger.[34] Both sides were randomly tested.

VAS

The VAS was used to measure the pain intensity This is a straight 100 mm long line anchored by the endpoints "no pain" (score of 0) to "pain as bad as it could be' (score 100).[35] The patients were asked to write down the average level of pain they had experienced in the previous week on a line.

Boston Carpal Tunnel Questionnaire

The symptom severity scale (SSS) and the functional status scale (FSS) are two parts of the BCTQ, which is a patient-reported measurement. A Persian version of this questionnaire was used in this study.[29] The SSS section consists of 11 items about the severity and frequency of symptoms, while the FSS section consists of eight items about the functional status of CTS patients. Each subscale is rated on a Likert scale ranging from 1 (no symptoms) to

5 (severe symptoms), with a lower score indicating better functional status and symptom severity. The average score in each subscale was calculated separately to examine the symptom severity and overall functional ability of patients with carpal tunnel syndrome. The reliability and validity of the Persian version of this questionnaire in CTS patients have been established.[33] Cronbach's alpha was 0.859 for symptom severity scale (SSS) and 0.878 for functional status scale (FSS). Also, intraclass correlation coefficients (ICCs) were calculated as 0.538 for SSS and 0.773 for FSS[33] (see Appendix C).

DASH Questionnaire

The Iranian version of the DASH was used in this study. It's a 30-item questionnaire in which patients rate their ability to perform certain upper-extremity activities. Each item has five options that are rated on a 1 to 5 Likert scale. The final score is the sum of all the items ranging from 0 (no disability) to 100 (most severe disability. For Persian-speaking patients with upper extremity disorders, the test–retest reliability and validity of this instrument where excellent: Cronbach's alpha coefficient for the Persian DASH was 0.96. The Persian DASH showed excellent test-retest reliability with ICC equal to 0.82 (p<0.01)[36] (see Appendix D).

Procedure

Before treatment, all patients were examined by a neurologist to verify the diagnosis of CTS. Outcomes were measured at baseline, after the end of 10 treatment sessions, and six months after the end of therapy. During the study and the follow-up period, no drugs or other physiotherapy interventions were given to the patients and they were asked not to take any medication or participate in any therapeutic intervention.

Statistical Analysis

The data were analyzed using SPSS (version 22; Chicago, IL, USA). Descriptive data were calculated as mean and standard deviation (SD) for demographic and clinical measures. The Kolmogorov-Smirnov test was used to confirm the normal distribution. A repeated-measures ANOVA was used to determine the effects of intervention. A Greenhouse-Geisser correction was used when the Mauchley's test was not homogenous. Post hoc analysis with Bonferroni adjustments was used to determine the differences between time points. Cohen's d was calculated for the effect sizes defined as: negligible (<0.20); small (between ≥ 0.20 and <0.50); moderate (between ≥0.50 and <0.80); and large (≥0.80).[37] P ≤ 0.05 was considered for statistical significance.

RESULTS

Patient Characteristics

A total of 15 patients (female = 13, male = 2) with a mean age of 34 years (SD 7.3; range 20–48) and a mean body mass index (BMI) of 25.42 (SD 2.9; range 22.09–32.88) completed the study protocol. The duration of the CTS onset was 14.73 months (SD 10.22; range 5–36). Bilateral involvement was observed in 11 patients, and unilateral involvement was observed in four patients (2 right and 2 left). Fourteen patients were right-handed.

Right mMDL

Repeated measures ANOVA with a Greenhouse-Geisser correction showed significant decreases in the right mMDL ($F_{(1.20, 13.24)} = 14.40$, $p = .001$). Bonferroni adjustment showed a significant decrease at T1 and T2 compared to T0 ($p < .001$) but not at T2 compared to T1 ($p = .08$). The effect size was large (Cohen's $d = 0.80$) (Table 1).

Left mMDL

Repeated measures ANOVA with a Greenhouse-Geisser correction showed significant decreases in the left mMDL ($F_{(1.15, 12.6)} = 34.33$, $p < .001$). Bonferroni adjustment showed a significant decrease at T1 and T2 compared to T0 ($p < .001$) and at T2 compared to T1 ($p < .001$). The effect size was large (Cohen's $d = 1.37$) (Table 1).

Right SNCV

Repeated measures ANOVA with a Greenhouse-Geisser correction showed a significant increase in the right SNCV ($F_{(1.08, 11.85)} = 42.38$, $p < .001$). Bonferroni adjustment showed a significant increase at

T1 and T2 compared to T0 ($p < .001$) and at T2 compared to T1 ($p < .001$). The effect size was large (Cohen's $d = 1.19$) (Table 1).

Left SNCV

Repeated measures ANOVA with a Greenhouse-Geisser correction showed a significant increase in the left SNCV ($F_{(1.03, 11.29)} = 30.88$, $p < .001$). Bonferroni adjustment showed a significant increase at T1 and T2 compared to T0 ($p < .001$ and at T2 compared to T1 ($p = .001$). The effect size was large (Cohen's $d = 1.16$) (Table 1).

VAS

Repeated-measures ANOVA with sphericity assumed did not reveal a main effect of time on the VAS ($F_{(2, 26)} = 124.09$, $p < .001$). Bonferroni adjustment showed a significant decrease at T1 and T2 compared to T0 ($p < .001$) but not at T2 compared to T1 ($p > .05$). The effect size was large (Cohen's $d = 2.97$) (Table 1).

DASH

Repeated-measures ANOVA with a Greenhouse-Geisser correction showed a main effect of time on the DASH ($F_{(1.11, 14.42)} = 102.81$, $p < .001$). Bonferroni adjustment showed a significant decrease at T1 and T2 compared to T0 ($p < .001$) and at T2 compared to T1 ($p = .029$). The effect size was large (Cohen's $d = 3.31$) (Table 1).

BCTQ Symptom Severity

Repeated measures ANOVA with a Greenhouse-Geisser correction showed significant reductions in the BCTQ Symptom severity ($F_{(1.35, 17.51)} = 139.41$, $p < .001$). Bonferroni adjustment showed a significant decrease at T1 and T2 compared to T0 ($p < .001$) and at T2 compared to T1 ($p = .012$). The effect size was large (Cohen's $d = 2.38$) (Table 1).

BCTQ Functional Status

Repeated-measures ANOVA with sphericity assumed did not show a main effect of time on the BCTQ Functional status ($F_{(2, 26)} = 101.65$, $p < .001$). Bonferroni adjustment showed a significant decrease at T1 and T2 compared to T0 ($p < .001$) and at T2 compared to T1 ($p = .05$). The effect size was large (Cohen's $d = 2.13$) (Table 1).

DISCUSSION

The purpose of the present study was to evaluate the effects of cervical manual therapy plus conventional physical therapy on the pain, functional status, and electrodiagnostic findings in a group of patients with CTS. This study revealed that cervical manual therapy plus conventional physical therapy improved the pain intensity, DASH score, symptom severity scale, the functional status scale of BCTQ, median sensory conduction velocity, and distal latency of the median nerve. Effects sizes for all outcomes were large. To the authors' knowledge, this is the first study to examine the effectiveness of the combination of cervical manual therapy and conventional physical therapy on clinical and electrodiagnostic outcomes in patients with CTS.

Electrophysiological Outcomes

The analyses indicated that the electrophysiological outcomes improved over time. The electrophysiological outcomes at T1 and T2 showed a statistically large improvement over the pretreatment at T0, indicating that the improvements lasted for six months after treatment. The effect size of cervical manual therapy combined with traditional physical therapy on electrodiagnostic outcome improvement was large immediately after the end of treatment. The improvement of electrodiagnostic outcomes six months after treatment was much greater than immediately after treatment, indicating that with the passage of time, electrodiagnostic outcomes further improved. It follows that physiotherapists should expect to see significant improvement in electrodiagnostic outcomes beyond the immediately-after-end of treatment, at least six months later in patients with CTS. This is consistent with the previous case series study that found wrist and cervical manipulation leads to improved electrophysiological outcomes.[38] A randomized, controlled, single-blind trial of 100 women with CTS compared the effectiveness of manual therapy versus surgery, and demonstrated that manual therapy and surgery have similar electrophysiological outcomes after the end of treatment, but manual therapy exhibited significant clinical improvements at one-month follow-up.[30] Also, Valente and Gibson in a case report study reported the improvement of a patient with CTS

who, treated with a multimodal approach including techniques directed at the neck, exhibited improvements in electrophysiological outcomes of the median nerve.[39] A study evaluated the long-term effects of neurodynamic techniques in the treatment of CTS patients and found that, although sensory conduction velocity, motor conduction velocity, and motor latency did not improve within six months after therapy, the electrophysiological outcomes of SNCV and mMDL improved over time.[40,41-43]

It is important to note that the underlying mechanism is currently unclear for improvements in electrophysiological outcomes occurring after cervical manual therapy plus conventional physical therapy. The improvements in electrophysiologic outcomes may be further explained by the improvements in myofascial mobility in the cervical and wrist, increases in blood flow within the vasa nervorum, and alleviation in local ischemia of the median nerve.[41]

VAS

In the present study, the effect of cervical manual therapy plus conventional physical therapy on the pain severity of CTS patients was large. Patients with CTS experienced significant pain reduction. In this study, the changes in pain severity were 39% and 46% immediately after treatment and at six months' follow-up, respectively. Improvements in pain reduction observed in our study are consistent with previous reports that used cervicothoracic thrust manipulations, neural glides, periscapular strengthening, and manipulation of the cervical spine and wrist. Although the treatment protocol is different in the two studies, it was also shown by Prizinski and Brence that distal features decreased with proximally biased treatment.[40]

The CTS is associated with a central sensitization,[42,43] and the desensitization maneuvers applied in the present study may have reduced the sensitization and thus improved the pain.[36]

DASH

The analyses indicated that the DASH scores improved immediately after the end of treatment and persisted six months after treatment. The DASH scores at T1 and T2 showed a statistically large improvement over the pretreatment score at T0, indicating that the improvements lasted for six months after treatment and the effect size was large. This is consistent with a recent pilot study that found that a physical therapy approach focusing on the entire nerve pathway from its origin (cervical) through neural mobilization and cervical segmental stabilization techniques resulted in significant reductions in DASH scores when compared to a control group that received a traditional therapeutic exercise program.[44] Large effect size in DASH scores improvement six months after cervical manual therapy plus conventional physical therapy, that was greater than the minimally clinically important change (MCIC),[45] indicates that, with passage of time, DASH scores of functionality further improved. It follows that physiotherapists should expect significantly greater DASH score improvement beyond the immediately-after-end of treatment, at least six months later, in patients with mild to moderate CTS. Therefore, addressing cervical spine impairments as in the present study resulted in better outcomes in terms of pain and upper-extremity functional abilities.[25]

BCTQ

The BCTQ questionnaire, which examines upper extremity and hand functions, is a standardized, patient-based outcome measure of functional status and symptom severity in individuals with carpal tunnel syndrome.[46] In this study, the BCTQ questionnaire score after the end of treatment significantly improved over time. The BCTQ questionnaire score at T1 and T2 showed a statistically large improvement over the pretreatment score at T0, indicating that the improvements lasted for six months after treatment. In the present study, cervical manual therapy plus conventional physical therapy had a large effect on the BCTQ questionnaire score and was much greater than the minimally clinically important change (MCIC).[47,48] In agreement with the present study, Fernandez de-las-Penas et al., in a randomized control trial, indicated that manual therapy maneuvers targeted at the neck and those areas anatomically related to possible entrapment of the median nerve compared with surgery have similar outcomes in the BCTQ questionnaire score.[30] In the study of Wolny and Linek

that evaluated the long-term (six months) effects of neurodynamic techniques in the conservative treatment of CTS patients, symptom severity improved significantly ($p < .05$). At the same time, the functional status remained unchanged ($p > .05$).[49] In our study, the BCTQ questionnaire score after the end of treatment significantly improved over time ($p > .05$) and had long-term effects.

In addition, the results of this study can track with the results of previous investigations in which the investigators showed a significant improvement of BCTQ scores through multimodal conservative treatment, including concurrent cervical spine and wrist manipulation.[38] The improvements of BCTQ scores could be due to pain relief and enhanced electrophysiological findings.

The current study had some limitations. First, there was a lack of a control group. Second, the sample size was small. Third, the assessor and the patients were not blinded.

CONCLUSION

This study demonstrated the significant large effects of cervical manual therapy combined with conventional physiotherapy in improving outcomes in a group of patients with CTS. The current study was a pilot, single-group clinical trial with no control group. To confirm the findings, more rigorous double-blinded randomized clinical trials with larger sample size are needed.

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CONFLICT OF INTEREST NOTIFICATION

The authors declare that they have no conflicts of interest.

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APPENDICES

Appendix A. Self-stretch cervical spine exercises

1. Self-stretching of the upper trapezius muscle:
   The patient is sitting upright on a table, grasping the edge with an ipsilateral hand to avoid shoulder elevation, and with the contralateral hand, grasps her/his head. Then asked the patient to perform cervical flexion, contralateral lateral flexion, and ipsilateral rotation. This stretching position will be held for 45 seconds twice.

2. Self-stretching of the levator scapulae muscle:
   The position is the same as for upper trapezius muscle stretching. Then they asked the patient to perform cervical flexion, contralateral lateral flexion, and contralateral rotation. This stretching position will be held for 45 seconds. 2 times.

3. Self-stretching of the upper fibers of the scalene muscles:
   The position is the same as for the other stretching exercises. Then ask the patient to perform slight cervical extension, contralateral lateral flexion, and contralateral rotation. This stretching position will be held for 45 seconds twice.

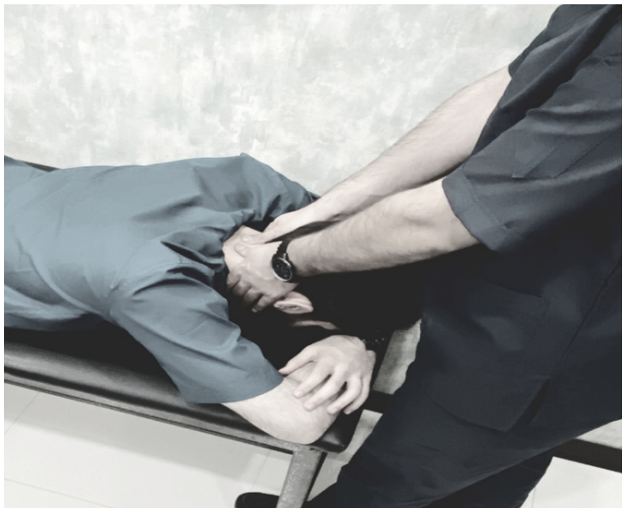
Appendix B. Cervical manual therapy

1. Cervical spine lateral glide applied to the C5/6 segment

The subject is supine, lying with his head in a neutral position. The physiotherapist holds the patient's head with the mobilizer hand at the C5-C6 level while the other hand is placed on the contralateral side of the patient's neck. While in this position, the therapist applies lateral cervical glides at C5/C6 toward the contralateral side of symptoms (Maitland grade III) for 5 minutes in 2 sets of 2 minutes each, with 1 minute of rest between sets.

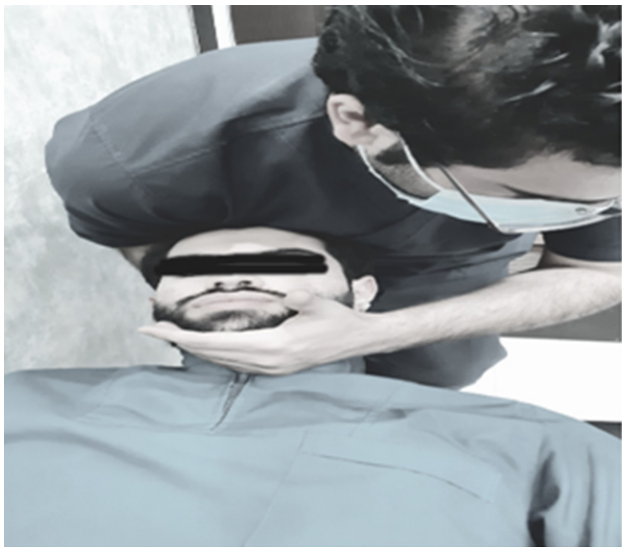
2. Posteroanterior non-thrust mobilization of the mid-cervical spine

The subject lies face downwards. The therapist stands at the head of the patient, the pads of the physiotherapist's thumbs over the zygapophyses of the targeted segment with medically-directed (30°) Central PA mobilization will be applied to C4-C6, 30 sec in each segment (Maitland grade III or IV) for an overall time of approximately 3 minutes.



3. Manual cervical distraction

The subject is in a supine position so that his/her head and neck are beyond the end of the table. The physiotherapist stands at the head of the table and places the patient's neck at 25–30 degrees. Manual traction will be applied to C4-C6 segments with a 10-second pull and a 5-second rest 10 times.



Appendix C. The BCTQ

To calculate score, add together the scores for all 11 questions in part 1, to give a total out of 55.

Part 1 of 2:

	Symptom Severity Scale (11 items)	*1*	*2*	*3*	*4*	*5*
1	How severe is the hand or wrist pain that you have at night?	Normal	Slight	Medium	Severe	Very serious
2	How often did hand or wrist pain wake you up during a typical night in the past two weeks?	Normal	Once	2 to 3 times	4 to 5 times	More than 5 times
3	Do you typically have pain in your hand or wrist during the daytime?	No pain	Slight	Medium	Severe	Very serious
4	How often do you have hand or wrist pain during daytime?	Normal	1-2 times / day	3-5 times / day	More than 5 times	Continued
5	How long on average does an episode of pain last during the daytime?	Normal	< 10 minutes	10 – 60 min continued	> 60 min	Continued
6	Do you have numbness (loss of sensation) in your hand?	Normal	Slight	Medium	Severe	Very serious
7	Do you have weakness in your hand or wrist?	Normal	Slight	Medium	Severe	Very serious
8	Do you have tingling sensations in your hand?	Normal	Slight	Medium	Severe	Very serious
9	How severe is numbness (loss of sensation) or tingling at night?	Normal	Slight	Medium	Severe	Very serious
10	How often did hand numbness or tingling wake you up during a typical night during the past two weeks?	Normal	Once	2 to 3 times	To 5 times	More than 5 times
11	Do you have difficulty with the grasping and use of small objects such as keys or pens?	Without difficulty	Little difficulty	Moderate difficulty	Very difficult	Very difficult

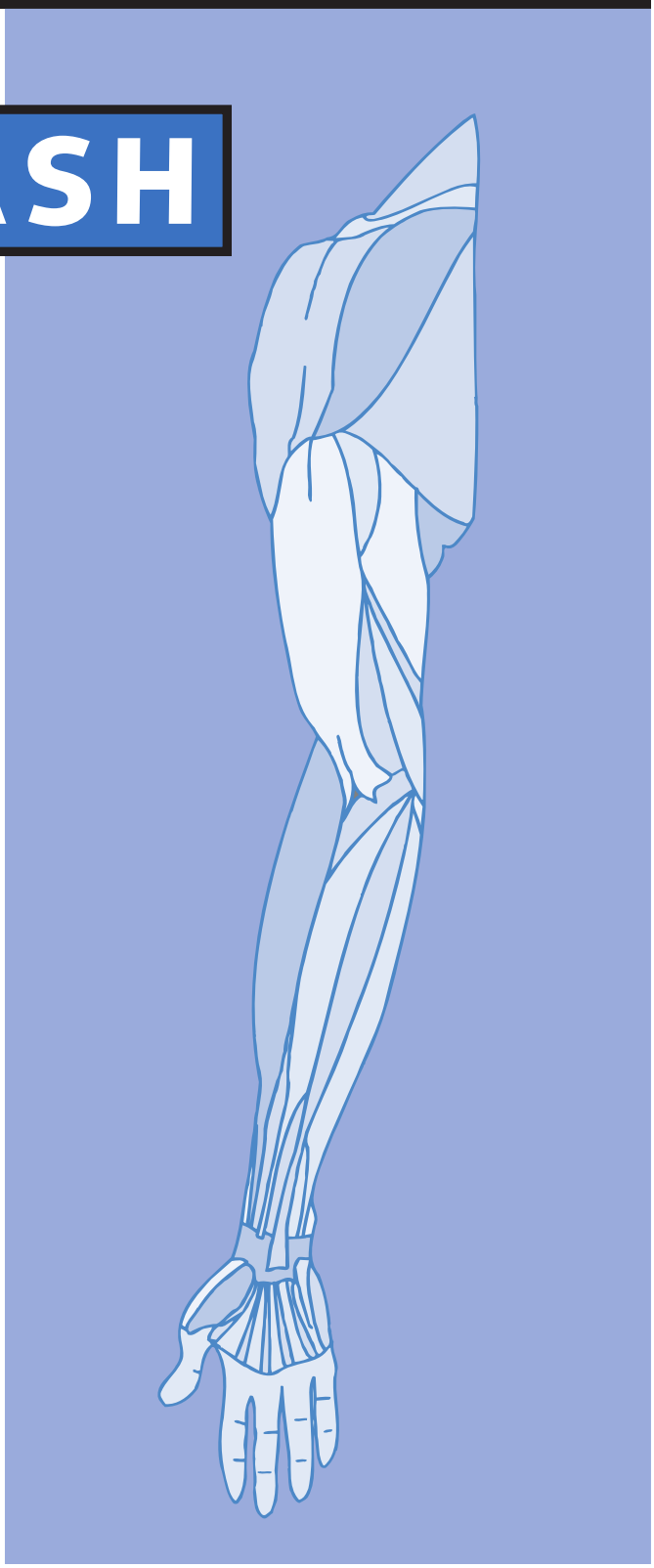
Part 2 of 2:

1	Writing	1	2	3	4	5
2	Buttoning of clothes	1	2	3	4	5
3	Holding a book while reading	1	2	3	4	5
4	Gripping of a telephone handle	1	2	3	4	5
5	Opening of jars	1	2	3	4	5
6	Household chores	1	2	3	4	5
7	Carrying of grocery basket	1	2	3	4	5
8	Bathing and dressing	1	2	3	4	5

Appendix D. The DASH

Disabilities of the Arm, Shoulder and Hand

THE DASH



INSTRUCTIONS

This questionnaire asks about your symptoms as well as your ability to perform certain activities.

Please answer *every question*, based on your condition in the last week, by circling the appropriate number.

If you did not have the opportunity to perform an activity in the past week, please make your *best estimate* on which response would be the most accurate.

It doesn't matter which hand or arm you use to perform the activity; please answer based on your ability regardless of how you perform the task.

Disabilities of the Arm, Shoulder and Hand

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	1	2	3	4	5
2. Write.	1	2	3	4	5
3. Turn a key.	1	2	3	4	5
4. Prepare a meal.	1	2	3	4	5
5. Push open a heavy door.	1	2	3	4	5
6. Place an object on a shelf above your head.	1	2	3	4	5
7. Do heavy household chores (e.g., wash walls, wash floors).	1	2	3	4	5
8. Garden or do yard work.	1	2	3	4	5
9. Make a bed.	1	2	3	4	5
10. Carry a shopping bag or briefcase.	1	2	3	4	5
11. Carry a heavy object (over 10 lbs).	1	2	3	4	5
12. Change a lightbulb overhead.	1	2	3	4	5
13. Wash or blow dry your hair.	1	2	3	4	5
14. Wash your back.	1	2	3	4	5
15. Put on a pullover sweater.	1	2	3	4	5
16. Use a knife to cut food.	1	2	3	4	5
17. Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).	1	2	3	4	5
18. Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	1	2	3	4	5
19. Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).	1	2	3	4	5
20. Manage transportation needs (getting from one place to another).	1	2	3	4	5
21. Sexual activities.	1	2	3	4	5

Disabilities of the Arm, Shoulder and Hand

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
22. During the past week, *to what extent* has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups? *(circle number)*	1	2	3	4	5

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem? *(circle number)*	1	2	3	4	5

Please rate the severity of the following symptoms in the last week. *(circle number)*

	NONE	MILD	MODERATE	SEVERE	EXTREME
24. Arm, shoulder or hand pain.	1	2	3	4	5
25. Arm, shoulder or hand pain when you performed any specific activity.	1	2	3	4	5
26. Tingling (pins and needles) in your arm, shoulder or hand.	1	2	3	4	5
27. Weakness in your arm, shoulder or hand.	1	2	3	4	5
28. Stiffness in your arm, shoulder or hand.	1	2	3	4	5

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	SO MUCH DIFFICULTY THAT I CAN'T SLEEP
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? *(circle number)*	1	2	3	4	5

	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem. *(circle number)*	1	2	3	4	5

DASH DISABILITY/SYMPTOM SCORE = $\left[\left(\frac{\text{sum of n responses}}{n}\right) - 1\right] \times 25$, where n is equal to the number of completed responses.

A DASH score may not be calculated if there are greater than 3 missing items.

DISABILITIES OF THE ARM, SHOULDER AND HAND

WORK MODULE (OPTIONAL)

The following questions ask about the impact of your arm, shoulder or hand problem on your ability to work (including home-making if that is your main work role).

Please indicate what your job/work is:_____

❒ I do not work. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for your work?	1	2	3	4	5
2. doing your usual work because of arm, shoulder or hand pain?	1	2	3	4	5
3. doing your work as well as you would like?	1	2	3	4	5
4. spending your usual amount of time doing your work?	1	2	3	4	5

SPORTS/PERFORMING ARTS MODULE (OPTIONAL)

The following questions relate to the impact of your arm, shoulder or hand problem on playing *your musical instrument or sport or both*. If you play more than one sport or instrument (or play both), please answer with respect to that activity which is most important to you.

Please indicate the sport or instrument which is most important to you:_____

❒ I do not play a sport or an instrument. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for playing your instrument or sport?	1	2	3	4	5
2. playing your musical instrument or sport because of arm, shoulder or hand pain?	1	2	3	4	5
3. playing your musical instrument or sport as well as you would like?	1	2	3	4	5
4. spending your usual amount of time practising or playing your instrument or sport?	1	2	3	4	5

SCORING THE OPTIONAL MODULES: Add up assigned values for each response; divide by 4 (number of items); subtract 1; multiply by 25.
An optional module score may <u>not</u> be calculated if there are any missing items.

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