Neural Mobilization and Carpal Bones Mobilization in Carpal Tunnel Syndrome.

Amal F. Ahmed, PT. D.* and Mohamed H. El Gendy, PT. D.*
* Department of Basic Sciences, Faculty of Physical Therapy, Cairo University.

ABSTRACT

Carpal tunnel syndrome (CTS) is a common disease involves compression of median nerve at the carpal canal. This study was conducted to investigate the effect of two manipulative techniques, neural mobilization and carpal bones mobilization on motor distal latency of median nerve in patients with CTS and to compare the potential effectiveness of each technique. A total of sixty females with age 40:60 years and mean age 52±4.07 years with clinical and electrophysiologic evidence of mild to moderate CTS participated in the study. The subjects were divided into three equal groups: group (1) received neural mobilization, group (2) received carpal bone mobilization, and group (3) received no intervention and served as control group. The treatment was delivered at a schedule of three times /week for one month. Measurement of median nerve motor distal latency was performed before and after the treatment duration. Analysis of the data using paired t-test revealed that both treated groups (neural mobilization and carpal bone mobilization) produced significant reduction of motor distal latency of the posttest results as compared to pretest ($P<0.0001$, $P< 0.001$), while the control group there was non significant increase ($P=0.13$) of motor distal latency control untreated group. ANOVA test revealed significant differences between the three groups ($P<0.0001$). When comparing each treated group to control there was significant reduction of the latency of both treated groups than control group ($P=0.0001$, $P< 0.02$). In addition when comparing both treated groups, there was significant reduction of distal latency in group 1 receiving neural mobilization than group 2 receiving carpal bone mobilization ($P<0.01$). In conclusion, in cases of carpal tunnel syndrome both neural mobilization and carpal bone mobilization are effective in improving median nerve motor distal latency, with the neural mobilization technique more effective than carpal bone mobilization.

Key Words: *CTS Carpal tunnel syndrome, NM Neural mobilization, and CBM Carpal bone mobilization.*

INTRODUCTION

Carpal tunnel syndrome (CTS) is a relatively common entrapment neuropathy that involves compression of the median nerve at the wrist within the narrow carpal canal[1,20]. The disease characterized by burning pain, numbness, and parathesthesia in the distribution of the median nerve which aggravated by repeated wrist and fingers flexion and extention[2,34].

Dahlin and mclean 1986, stated that compression of the nerve lead to alterations in

intraneural blood flow and forms a mechanical barrier to impulse traffic and axonal transport which clearly alter the conduction properties of the median nerve[9]. In addition, it was established that due to compression, inflammatory changes occurring in the connective tissues within nerves lead to intraneural fibrosis with consequent alteration in conduction[32].

There were many methods reported for diagnosing and evaluating the effect of different physical therapy modalities in cases of carpal tunnel syndrome including physical examination and tension tests, different pain scales, range of motion of wrist and forearm, hand function and activities of daily living (ADL), grip and pinch strength[17,21,35]. Recently electrodignostic studies and sonography have been used as objective methods for diagnosis of carpal tunnel syndrome[8,24,30]. Electrodiagnostic studies are considered the diagnostic tool of choice. It provides evidence to support the diagnosis, quantify the severity of the diagnosis, exclude other diagnosis, and provide baseline for prognosis[15].

There were many treatment approaches for the management of carpal tunnel syndrome including either conservative treatment or surgical approach[14], non-operative treatment is most effective in the early stages, prior to irreparable damage to the nerve. Early intervention combined with a comprehensive treatment plan can help improve effectiveness of treatment during this phase.[17]

The conservative treatment includes nonsteroidal anti-inflammatory drugs[10], rest and splinting[18], heating, underwater exercises[25,28], ultrasonic[12], and manual therapy[3,10,31].

Neural mobilization or neurodynamic approach for the examination and treatment of pain and dysfunction has been widely accepted and integrated into clinical physical therapy practice[5-7]. Mobilization of nervous tissues leads to normalizing the pressure gradient around the nerve, decreases neural fibrosis, and improves the mechanical features of the nerve and connective tissues[29]. As the nervous system mechanical and physiological function are dramatically inter dependent, the physiological function of the nerves improves evidenced by improving blood supply to the hypoxic nerve tissues with subsequent improvement in axonal transport and conduction through the nerve[16,22].

Carpal bone mobilization in the other hand was reported to decrease pressure of the carpal tunnel, breakdown adhesion in addition the gliding motion of the carpal bone improve nutrition and provide sensory input which inhibit the transmission of pain[26,27,33]. It was reported that excessive pressure in the carpal tunnel causes the median neuropathy associated with carpal tunnel syndrome[28].

The current study was designed to investigate and compare the effect of median nerve mobilization and carpal bone mobilization in the treatment of carpal tunnel syndrome through measuring changes in neural function of median nerve using electrodiagnostic studies.

MATERIALS AND METHODS

Subjects

A total of sixty females with age 40:60 years and mean age 52 ± 4.07 year with clinical and electrophysiologic evidence of mild to moderate CTS participated in the study. The subjects were selected from the outpatient clinic of the faculty of physical therapy and outpatient clinic of Kaser El-Aini Hospital. Patients had been complaining for at least 6 months to two years. Electro-physiologic evidence for CTS included prolonged median distal motor latency (>4.2

msec)[11]. The following cases were excluded: (1) Any patient with electrophysiologic evidence of neuropathy, radiculopathy, and pronator teres syndrome. (2) Patients with other predisposing etiology such as diabetes mellitus, and pregnancy.

The subjects were divided into three equal groups, each included 20 patients. Group (1) received neural mobilization, group (2) received carpal bone mobilization, and group (3) received no intervention and served as control group. The treatment was delivered at a schedule of three times/week for two months. Subjects in all groups were allowed to receive a dose of ibuprofen (800 mg twice a day for the duration of treatment[10].

Testing Procedure

Measurement of median nerve distal motor latency was performed for each subject at two occasions before the beginning and after completion of the treatment duration.

Measurement of median nerve distal motor latency:

Each patient was informed about the steps of the test procedures. The areas under the recording and stimulating electrodes were swept with alcohol to decrease skin resistance, and conducting gel was put under the recording electrodes.

- The recording electrodes were positioned as the following: the active electrode on the motor point of abductor pollicis brevis and the reference electrode on the tip of the thumb. The earth electrode was fastened on the dorsum of the hand at the wrist joint.
- Bipolar stimulating electrode was placed on the volar aspect of the wrist between tendons of the flexor capi radialis and palmaris longus muscles.
- For stimulation of the median nerve at the wrist. for testing the sweep speed was set at 30 msec, the sensitivity was 4000.0 uv/div and the duration of the stimulus was 0.1 msec the intensity was increased until action potentials reached maximal amplitude then the latency were recorded[4].

Treatment Procedures

Neural mobilization. Subjects participated in group 1, received neural mobilization of the median nerve in the form of upper limb tension test 1 (ULTT1). The specific sequences of the technique used as described and modified by lewis, et al., (1998) were ipsilateral shoulder depression, glenohumeral abduction to 90 degree with forearm fully supinated, glenohumeral external rotation, elbow extension, with the application of wrist and finger extension being the final component, followed by contrlateral cervical side flexion. The technique was done with emphasizing on elbow and wrist extension and contralateral cervical side flexion. At the end of the procedures the position was sustained and the whole technique was repeated 3 times/session with period of rest in-between[19].

Carpal bone mobilization. Subjects participated in group 2, received carpal bone mobilization by applying anteroposterior pressure to induce gliding and sliding movement of carpal bone in the following steps: (1) First apply distraction to increase joint play in the mid carpal joint (2) With one hand of the therapist grasping the patient forearm just above the wrist the other hand move pisiform bone cephalic, caudally, medially and laterally. (3) While the fingers of each hand of the therapist separate the pisiform and the hook of the hamate away from the trapezium and scaphoid, the thumb

tips on the posterior surface of the carpus form a fulcrum for the movement. (4) Gliding movements in all directions were performed for each of the carpal bones through the following technique, the stabilizing hand holds the proximal carpal bone in position and the manipulating hand glides the desired bone in volar and dorsal direction[2].

- The procedures were performed from supine lying position in a rhythmic and repeated manner for ten minutes for three times/session with period of rest in-between.

DATA ANALYSIS

Scores of the median nerve motor distal latency were recorded pre and post treatment for the three groups. The scores were expressed as mean standard deviation (SD), difference and percentage of difference (% Dif.) from pretest scores.

Paired t-test comparing pre and post scores was performed for individual group to determine the effect of each modality alone. ANOVA test was performed for each recorded variable comparing the three groups to determine differences among them either pre or post application of the program. The pre test was to determine whether differences existed between the groups to avoid the disparity in initial performance and post the application of the program to test difference among the three groups compare the effect of the modalities.

If there was difference among the three groups in the ANOVA test, further post hoc pair-wise comparisons was used to examine difference between each pair of the three groups to determine differences between treated and untreated control group and differences between the two treated groups. Level of significance level was set at ($P < 0.05$).

RESULTS

Table (1) and fig. (1), represented mean value of pre and post test of motor distal latency of group I, II, and III. The scores were (5.37±0.69, 4.3 ± 0.75msec), (5.51±0.68, 4.83±0.64 msec) and (5.29±0.65, 5.38±0.61 msec) respectively.

Paired t-test comparing pre and post results for each group revealed, significant decrease in motor distal latency of both neural mobilization group ($P < 0.0001$) and carpal bone mobilization ($P<0.001$) while the control group showed non-significant increase of motor distal latency ($P=0.13$), table (1).

Table (1): Motor distal latency (msec) pre and post test of the three groups.

	Group I (Neural mobilization) n=20		Group II (Carpal bone mobilization) n=20		Group III (Control untreated) n=20	
	Pretest	**Posttest**	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Mean ± SD	5.37±0.69	4.3± 0.75	5.51±0.68	4.83±0.64	5.29±0.65	5.38±0.61
Difference	- 1.07		- 0.68		0.09	
% Dif	- 19.92 %		- 12.34 %		1.7 %	
T	5.18		3.1		1.56	
P	0.0001*		0.001*		0.13	

* Significant

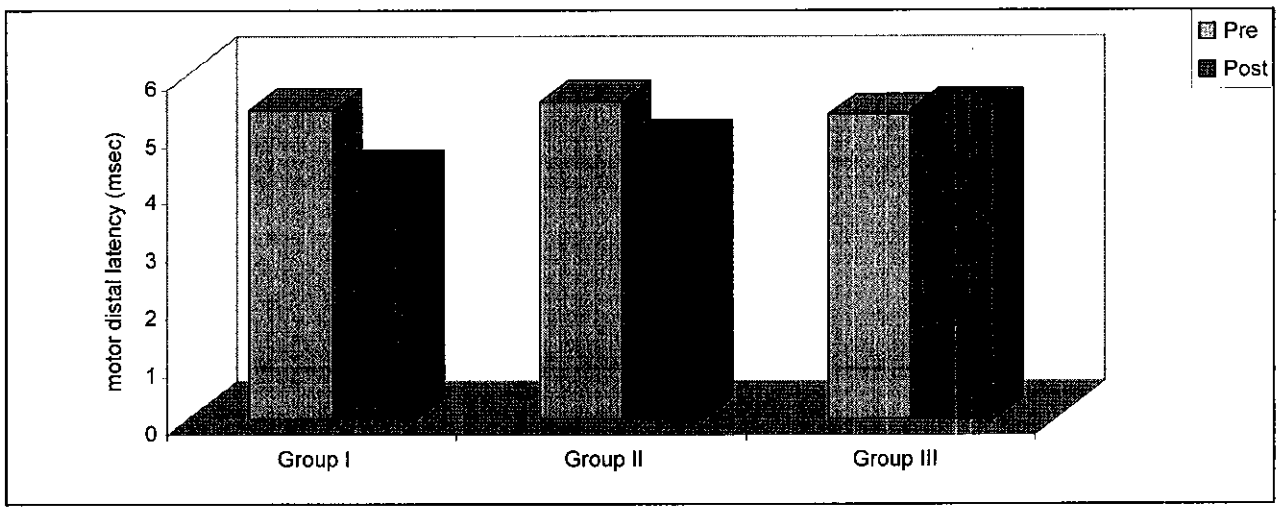

Fig. (1): Motor distal latency pre and posttest of the studied groups.

When calculating the percentage difference of the recorded scores of the motor distal latency as compared to the pre test scores, the neural mobilization group showed a decrease in distal latency by 19.92 % and the decrease in carpal bone mobilization group was 12.43 % of the pretest scores, while the control untreated group showed increase than pretest scores by 1.7 %, table (1) and fig. (2).

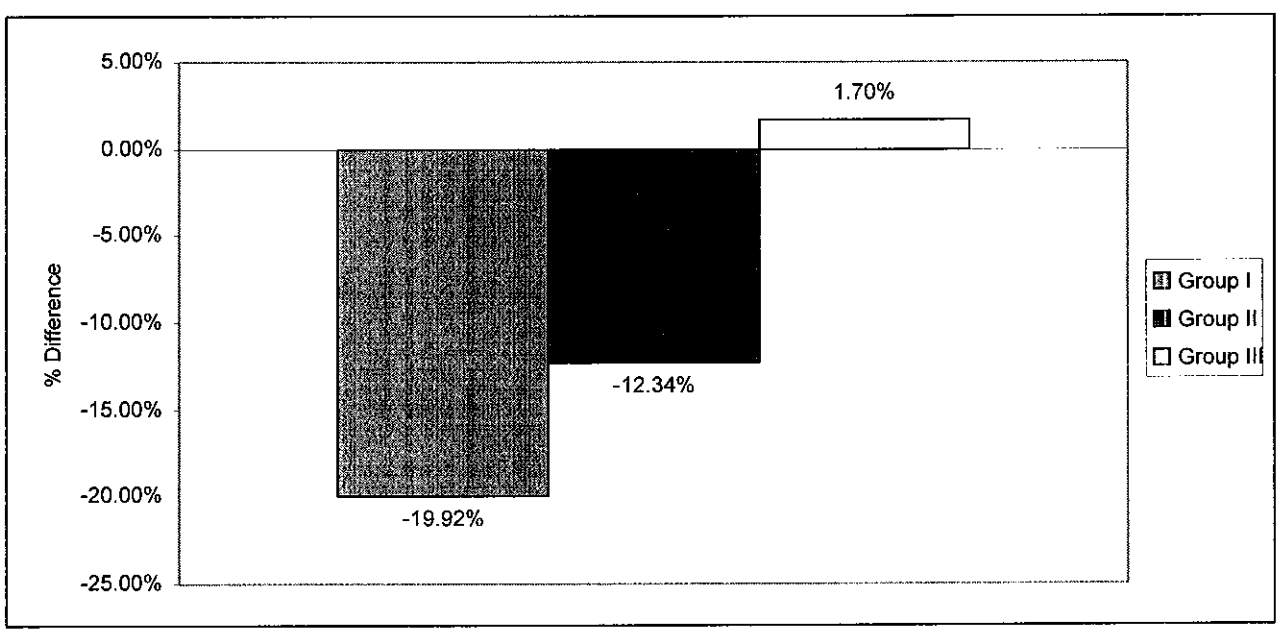

Fig. (2): The percentage of difference of posttest as compared to pretest distal latency.

The results of the ANOVA test presented in table (2) showed that there was no significant difference in the recorded pretest motor distal latency among the three groups (P = 0.2). There was significant difference in the posttest motor distal latency among the three groups (P < 0.0001) table (3).

Table (2): ANOVA table for the pretest motor distal latency for differences among groups.

Source of Variation	SS	df	MS	F	P-value
Between Groups	1.2853	2	0.64266	1.397	0.2
Within Groups	26.2165	57	0.45993		
Total	27.5018	59			

Table (3): ANOVA table for the posttest motor distal latency for differences among groups.

Source of Variation	SS	df	MS	F	P-value
Between Groups	11.667	2	5.8335	12.9	<0.0001*
Within Groups	25.757	57	0.45187		
Total	37.424	59			

*Significant

The results of post hoc test showed that compared to the control non-treated group there was significant decrease in distal latency of group I (Neural Mobilization) (P=0.0001) and group II (Carpal Bone Mobilization) (P<0.02). When comparing neural mobilization group to the carpal bone mobilization group, there was significant decrease of motor distal latency of neural mobilization than those of carpal bone mobilization (P< 0.01).

DISCUSSION

CTS is a common upper extremity musculoskeletal disorder which occurs most commonly in adults older than 30 years, particularly women and people with jobs involving prolonged static gripping or forceful and repetitive hand movement[1,23].

The current study was designed to investigate the potential effectiveness of two manipulative techniques neural mobilization and carpal bone mobilization in improving neural function of median nerve in patients with carpal tunnel syndrome, and to determine the differences between treated and untreated groups, between neural mobilization and carpal bone mobilization.

The results of the study demonstrated that both neural mobilization and carpal bone mobilization caused improvement of neural transport and conduction across median nerve as evidenced by the significant decrease in motor distal latency of the treatment groups. On the other hand there was no significant increase in motor distal latency of the control untreated group.

Neural mobilization has been used in assessment and treatment of pain syndrome with the purpose to improve the mechanical and physiological function of neural tissues, via mechanical treatment of neural tissues and the non neural structure surrounding the nervous system. An important approach of neural mobilization is that normal mechanics of the nervous system enable pain free movement to be achieved[6,7]. As nervous

system mechanical and physiological function are interrelated, so improving the mechanical function would improve physiological function of the nervous tissues[29].

It was reported that neural mobilization increase intraneural microcirculation, axonal transport, and impulse traffic[16,22] which explain the improvement recorded in the neural mobilization group.

Carpal bone mobilization designed for CTS are directed to decompression and relieving pressure of the carpal tunnel, by passively mobilizing and separating carpal bones and stretching of the flexor retinaculum[2,26,33]. Decompression and reduction of pressure of carpal tunnel eventually lead to improvement of axonal transport and conduction. It was reported that nerve compression causes hypoxia and decrease axonal transport[27].

Our finding showed that there was significant differences in the posttest measures between the three groups, and when comparing neural mobilization and carpal bone mobilization groups to untreated control group, there was significant reduction of motor distal latency of both treated groups than untreated group.

These results are in consistent with other reported studies that demonstrated that manipulative therapy designed to decompression of the median nerve produced significant improvement of nerve function and relieve of patients symptoms by improving gliding of tendons and nerves within the carpal canal and inducing stretching and elongation of the soft tissues[10,25,28,33].

Tal-akabi and Rushton (2000) conducted a study to investigate the effect of neurodynamic mobilization and carpal bone mobilization on wrist range of motion and pain perception in cts and found significant effect of both techniques on pain perception only with higher effect in neurodynamic group[33].

In the current study the two techniques utilized were to improve median nerve function either directly through neural mobilization or indirectly through carpal bones mobilization to breakdown adhesion and improve sliding and gliding of nerve in the tunnel. Median nerve motor distal latency was used to document changes in the neural function of the nerve. Electrodiagdositc studies were reported to be the most definitive tests used to diagnose CTS and can objectively confirm median nerve dysfunction in CTS[15,30].

The neural mobilization technique utilized in the current study was ULTT1. This test was designed to work directly and stress median nerve by moving it against the mechanical interface. Lewis et al., (1998) found that certain maneuvers increase tension on the median nerve which could affect neural tension in the assessment and treatment of median nerve neural stretching. They reported increase tension when the ipsilateral movement of elbow extension and wrist extension were applied and that exactly the movements we emphasis in our study as sensitizing component during treatment[19].

When comparing the results of both treated groups to determine the potential difference between the two intervention, neural mobilization produced significant reduction of median nerve motor distal latency than carpal mobilization. The explanation for the superior effect of neural mobilization technique over carpal bone mobilization technique in improving median nerve function might be the fact that neural mobilization has direct effect on the nerve by inducing neural movement and sliding of the nerve against its mechanical interface and breaking down intraneural and extraneural adhesions and fibrosis. Also neural mobilization induce

elongation and tension and enhance equalization of pressure around the nerve[5-7,29].

CONCLUSION

From this study, it might be concluded that both neural mobilization technique and carpal bones mobilization technique were effective in improving median nerve function and reducing median nerve motor distal latency in patients with carpal tunnel syndrome. In addition neural mobilization technique produced better effect than carpal bone mobilization technique. Further follow up study is needed to establish the long term effect of the two techniques.

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الملخص العربي

المعالجة اليدوية للعصب والمعالجة اليدوية لعظام الرسغ في حالات الضغط على عصب الرسغ الأوسط

تم إجراء هذه الدراسة لدراسة تأثير كل من المعالجة اليدوية لعصب الرسغ الأوسط والمعالجة اليدوية لعظام الرسغ على زمن توصيل عصب الرسغ الأوسط، والمقارنة بين تأثير كل منهما .

أجريت هذه الدراسة على ستين سيدة تتراوح أعمارهم ما بين ٤٠ ، ٦٠ سنة ومتوسط أعمارهم ٥٢ ± ٤,٠٧ وذلك بعد التأكد بالفحص الإكلينيكي و التشخيص الكهربي الفيسيولوجي من الإصابة بضغط بسيط على عصب الرسغ الأوسط .

و قد تم تقسيم العينة إلى ثلاث مجموعات:

١-المجموعة الأولى: وقد تم علاجها بواسطة التحريك اليدوي لعصب الرسغ .

٢- المجموعة الثانية: وقد تم علاجها بواسطة التحريك اليدوي لعظام الرسغ .

٣- المجموعة الثالثة: وهي المجموعة الضابطة (بدون أي تدخل علاجي) .

تم العلاج بمعدل ثلاث مرات أسبوعياً و ذلك لمدة شهر، و تم قياس زمن توصيل العصب قبل و بعد مدة العلاج .

أثبتت المعالجات الإحصائية للنتائج وجود نقصان ذو دلالة إحصائية في زمن توصيل العصب في كل من المجموعتين الأولى والثانية بينما كان هناك زيادة ليست ذات دلالة إحصائية في زمن التوصيل للمجموعة الثالثة (الضابطة)، وبالمقارنة بين المجموعتين الأولى والثانية ثبت وجود تحسن ذو دلالة إحصائية في المجموعة الأولى عنه في المجموعة الثانية .

المضمون: أثبتت هذه الدراسة فاعلية كلتا الوسيلتين في العلاج لحالات الضغط على عصب الرسغ الأوسط وكذلك زيادة فاعلية التحريك اليدوي للعصب عن التحريك اليدوي لعظام الرسغ لمثل هذه الحالات .

دور الدكتورة/ أمل فوزى
المدرس بقسم العلوم الأساسية
فى البحث المشترك

Neural Mobilization and Carpal Bones Mobilization in Carpal Tunnel Syndrome

المعالجة اليدوية للعصب والمعالجة اليدوية لعظام الرسغ فى حالات الضغط على عصب الرسغ الأوسط

إشتركت الدكتورة/ أمل فوزى المدرس بقسم العلوم الأساسية فى البحث المشترك مع الدكتور/ محمد الجندى المدرس بقسم العلوم الأساسية.

قام الباحث بما يلى:

١- إختيار فكرة البحث.

٢- تحديد الغرض وأهمية المشكلة محل البحث.

٣- معالجة النتائج الخاصة بالبحث.

٤- إستخلاص التوصيات والإرشادات العلمية والتطبيقية من البحث وكيفية الإستفادة منها.

وشارك الباحث فيما يلى:

١- فرض الفروض واختيار العينة للتجربة.

٢- تجميع الأبحاث والمراجع ذات الصلة بموضوع البحث.

٣- إجراء تجربة البحث.

٤- تنظيم القياسات ونتائج التجربة.

٥- مناقشة وتفسير النتائج فى ضوء الثوابت العلمية.

٦- كتابة المراجع حسب عموم النشر.

٧- تحويل البحث إلى مقالة علمية منشورة تفيد الباحثين فى مجال العلاج الطبيعى.

٨- كتابة الملخص باللغتين العربية والإنجليزية لتعم الفائدة على الباحثين.

الدكتورة/ أمل فوزى

الدكتور/ محمد الجندى