




Effect of Neurodynamic Technique on Carpal Tunnel Syndrome "Single Case Report"

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Abstract:

The study was designed to assess the effect of neurodynamic techniques in carpal tunnel syndrome (CTS) patients. The study focused on women with CTS. The phalen's test, compression (durkan's) test, pain assessment (VAS), the Boston Carpal Tunnel Questionnaire (BCTQ) were used to measure symptoms related to CTS. Neurodynamic technique, cervical lateral glide and sliding technique were used as treatment protocol techniques. The patient underwent three sessions weekly for three consecutive weeks. At the end of the last session, the outcome results improved in all data for the patient initially. The patient pain reduced from 9 to 2 degree using VAS scale. The CTS symptoms were decreased using neurodynamic technique. Neurodynamic technique is one of the most important technique used to treat the tension of the nervous system, because it reducing the intrinsic pressure and improving the elasticity of neural tissues. This study's originality lies in its tailored approach to CTS treatment and its contribution to science by shedding light on the effectiveness of neurodynamic techniques in addressing a widely encountered medical issue.

Keywords: *Carpal Tunnel Syndrome; Neurodynamic technique; Physical Therapy; Manipulations.*

Abbreviations: *Carpal Tunnel Syndrome (CTS); Neurodynamic Technique (NDT); Visual Analogue Scale (VAS); Boston Carpal Tunnel Questionnaire (BCTQ); Symptom Severity Scale (SSC); Functional Severity Scale (FSS); Manual Therapy (MT); Electro Physical Modalities (EM).
8 keywords; Sentence case; Separate by colon (,) between keyword.*

تأثير تقنية الديناميكية العصبية على متلازمة النفق الرسغي "تقرير حالة واحدة"

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ملخص:

صُممت هذه الدراسة لتقييم تأثير التقنيات العصبية الديناميكية في مرضى متلازمة النفق الرسغي. ركزت الدراسة على إحدى النساء المصابة بمتلازمة النفق الرسغي. تم استخدام اختبار (Phalen's test) واختبار الضغط (Durkan's test)، وتقييم الألم (VAS)، واستبيان نفق بوسطن الرسغي (BCTQ) لقياس الأعراض المتعلقة بـ (CTS). تم استخدام التقنية الديناميكية العصبية، وتقنية الانزلاق الجانبي لل فقرات العنقية، وتقنية الانزلاق العلاجية كبروتوكول علاجي. خضع المريض لثلاث جلسات أسبوعياً لمدة ثلاثة أسابيع متتالية. تحسنت النتائج في جميع البيانات للمريضة وانخفض ألم المريضة من (9) إلى (2) درجات باستخدام مقياس (VAS)، وتم تقليل أعراض متلازمة النفق الرسغي باستخدام التقنية الديناميكية العصبية. تعدّ تقنية الديناميكا العصبية من أهم التقنيات المستخدمة في علاج توتر الجهاز العصبي؛ وذلك لأنها تُقلّل الضغط الجوهري وتُحسّن مرونة الأنسجة العصبية. تكمن أصالة هذه الدراسة في نهجها المُصمّم خصيصاً لعلاج متلازمة النفق الرسغي ومساهمتها في العلم من خلال تسليط الضوء على فعالية التقنيات الديناميكية العصبية في معالجة مشكلة طبية تمت مواجهتها على نطاق واسع.

الكلمات المفتاحية: متلازمة النفق الرسغي؛ التقنية الديناميكية العصبية؛ العلاج الطبيعي؛ العلاج اليدوي.

1. Introduction

Carpal tunnel syndrome (CTS) is the most prevalent of all compression neuropathies, conduct due pressure or tension on the median nerve at the wrist level. Patients often present with functional neural compromise, paresthesia or sensation deficits in the first three radial fingers and the lateral side of the ring finger. The proximal carpal tunnel specially in the hook of hamate is the most common compression sites for CTS patients (Chammas et al.,2014; Pyun et al., 2005).

CTS symptoms effects with many risk factors include repeated utilization of the hand and wrist, aging, obesity, pregnancy, acromegaly, amyloidosis, diabetes mellitus, kidney diseases, trauma, osteoarthritis and thyroid diseases. Women with middle ages are more common CTS cases, especially in pregnant women (Khosrawi & Maghrouri, 2012). The main symptoms of CTS are numbness, pain and tingling of the first three fingers and radial side of the ring finger, nocturnal awakening due to pain, numbness and impaired fine motor control due to hand weakness (Atroshi et al., 1999).

The CTS diagnosis are based on the clinical symptoms, physical examination findings, and electro-rheological tests. Many tests obtained for clinical CTS diagnosis such as tinel test, phalen's test, reverse phalen's and durkan's carpal. Carpal compression test are used for pathological evaluation of CTS (Ghasemi-Rad et al., 2014).

Physiotherapists using different techniques to treat the CTS patients, one of them is Neurodynamic technique. This technique used to promote peripheral nerve function. It uses specific patterns of joint movement to facilitate nerve glide and help restore normal nerve elasticity (Ridehalgh et al., 2005).

There are few studies on the effect of neurodynamic techniques in patients with carpal tunnel syndrome and few researches did not analyze the effects of this treatment on pain and decrease CTS symptoms. Therefore, the study aimed to examine the effectiveness of neurodynamic techniques for treatment of CTS patients.

2. Methodology

The study was performed at Al-Hakeem Physiotherapy Center, Hebron. The patient has a CTS syndrome, 35 years old female. Patient suffered with severe muscle spasm of the cervical region, shoulder muscles and forearm since two, and she complained from left fingers numbness.

Authorized informed consent was received and the entire analysis was clarified to the individual concerned. The targeted patient pain was assessed by the Visual Analogue Scale (VAS), it is a scale created by Price et al. The scale is valid and reliable, it has a length of 100 mm and is named as two ends on vertical or horizontal line (0 = no pain, 100 = the most severe pain) and Boston Carpal Tunnel Questionnaire (BCTQ), it is a patient-based outcome measure that has been developed specifically for patients with CTS which ranges from 1 to 5, with a higher score indicating greater disability. The BCTQ has been used as an outcome measure in clinical studies, and has also undergone extensive testing for validity, reliability and responsiveness (Levine et al., 1993). Inclusion criteria were as follows: 1) Age of the patient 35 years, 2) Experience numbness, tingling, or burning sensations in the thumb and fingers, in particular the index and middle fingers and radial half of the ring finger, 3) Weakness and atrophy of the thumb muscles may occur if the condition remains untreated, because the muscles are not receiving sufficient nerve stimulation,4) Compression and phalen's test positive 5) Pain at least 9 according to VAS. Exclusion criteria were as follows: 1) Performing physical examination is inappropriate for either physical or psychosocial reasons, 2) Sever pain in which the examination could unnecessarily provoke patient's symptoms, 3) There is

heavy bias towards psychosocial issues, 4) The pain is unstable irritable, hypersensitive, 5) Spinal cord injury or tumor in spinal cord.

2.1 Treatment protocol

Physiotherapy care period 9 sessions at a cumulative frequency of 3 days a week and takes an average of 30 minutes. training involves three exercises of neurodynamic technique, cervical lateral glide, tensioning technique and sliding technique, techniques being performed 10 times during practice. The Approaches to be Applied are as follows:

2.1.1 Neurodynamic technique

The nerve gliding exercises included sliding of the median nerve relative to its nearby tissues by performing joint movements that elongate the nerve bed the tract created by the surrounding components of the nerve (Yagci et al., 2009). Often expands the nerve which enhances the strain of the nerve and the intraneural pressure. Whereas sustained elevated intraneural fluid pressure reduces intraneural blood flow in oedematous neuropathies a dynamic variation in intraneural pressure when correctly applied may facilitate evacuation of intraneural oedema and reduce symptoms (Dincer et al., 2009).

2.1.2 Cervical lateral glide

Purpose: Cervical lateral glides in the neurodynamic are usually used to diagnose presenting patients displaying neck pain with a pattern of radicular symptoms and symptoms into the upper extremity (Armagan et al., 2014).

Step 1: The patient is positioned in a supine position to initiate the neurodynamic examination. Gradual movements are applied to induce strain on the median nerve while maintaining the patient in the appropriate neurodynamic position. The clinician externally rotates and abducts the affected shoulder until it reaches the 90/90 position. The table's height is adjusted to allow the clinician's foot to rest on its base, and the patient's arm is placed on the clinician's knee. Patient is emphasized throughout this process, as achieving the desired position may require persistence. The clinician stabilizes the scapula, preventing it from lifting by utilizing wrist control, forearm support, and spreading the fingers and thumb.

Step 2: While maintaining the established posture, the clinician extends the patient's elbow until the onset of symptoms is reported. Once the patient reaches a state of relative pain relief, the clinician carefully flexes the elbow.

Step 3: The clinician performs a lateral glide of the cervical vertebrae towards the opposite side while ensuring the maintenance of the prescribed posture by the patient.

2.1.3 Tensioning technique

Using a tensioning procedure, nerve gliding is achieved when a stretch is concurrently put on a nerve at both ends (i.e., over the whole nerve length). This tension is created by positioning multiple joints, so the entire nerve is lengthened, creating vascular and axoplasmic flow changes (Shooshtari et al., 2008):

Step 1: The patient is seated, and the clinician maintains the patient in the neurodynamic position while gradually applying tension to stretch the median nerve. This is achieved by first externally rotating the affected shoulder to approximately 30 degrees and then completing the elbow and wrist extension.

Step 2: Once the desired position is achieved, the clinician holds this posture for a duration of 10 seconds while stretching the patient's elbow and wrist. The patient is instructed to report the onset of symptoms. Subsequently, the clinician gradually extends the patient's elbow until they reach a state of complete pain relief.

2.1.4 Sliding technique

A sliding procedure consists of an alternation of synchronized movements in at least two joints in which one movement lengthens the nerve bed while through stress in the nerve while the other movement similarly reduces the duration of the nerve bed that unloads the nerve (Stoianov, 2022):

Step 1: The clinician applies gradual movement along the patient's seated body to induce strain on the median nerve while ensuring the assistant maintains the neurodynamic position. The process involves completing the extension of the elbow and wrist after detaching and externally rotating the affected shoulder to the 90/90 position.

Step 2: The clinician performs lateral bending of the wrist in conjunction with backward movement of the head, followed by reverse movement to stretch the arm and guide the head towards the direction of the extremity. This sequence is repeated ten times before releasing the tension.

3. Results

The presence is one case, 35-year-old female, she is suffering from carpal tunnel syndrome. The feature measures related to patient reported directly from CTS, however the findings of both prior testing after the procedure was found negative outcome. The patient underwent three sessions weekly for three consecutive weeks

Figure 1. shows the comparison between pre and post VAS score within pain scale. The pretreatment pain was 9 degree but the post treatment pain was 2 degree. It means there was a significant difference between pre and post treatment with pain. And also the neurodynamic techniques are effective for decreasing pain on carpal tunnel syndrome.

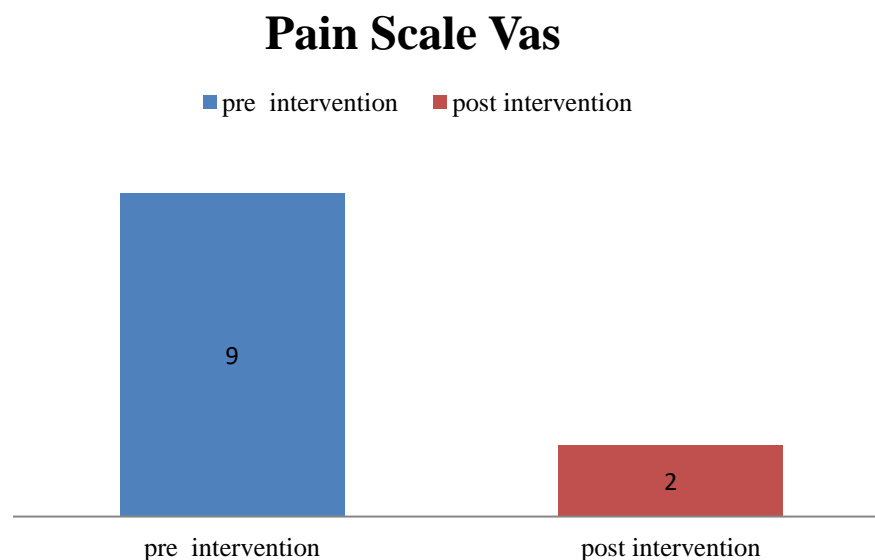


Fig.1 Comparison between pre- and post VAS score within pain scale.

According to the Boston scale the pain is high. The pain is generally was appeared in the first three radial fingers and the lateral side of the ring finger as these areas are innervated by the median nerve which mean there is hand muscle weakness in all of the previous questionnaire referred to (4 - 5 degree) according to the Boston scale. See Table (1).

Table (1). Comparison between pre-and post-intervention within (BCTO) symptoms severity scale.

(BCTQ) Symptom severity scale	Pre intervention	Post intervention
1. How severe is the hand or wrist pain that you have at night?	5	1
2. How often did hand or wrist pain wake you up during a typical night in the past two weeks?	5	1
3. Do you typically have pain in your hand or wrist during the daytime?	5	2
4. How often do you have hand or wrist pain during daytime?	5	2
5. How long on average does an episode of pain last during the daytime?	4	2
6. Do you have numbness (loss of sensation) in your hand?	5	1
7. Do you have weakness in your hand or wrist?	4	1
8. Do you have tingling sensations in your hand?	5	1
9. How severe is numbness (loss of sensation) or tingling at night?	4	1
10. How often did hand numbness or tingling wake you up during a typical night during the past two weeks?	4	1
11. Do you have difficulty with the grasping and use of small objects such as keys or pens?	5	1

* Normal = 1, Slight = 2, Medium = 3, Severe = 4, Very serious = 5

After the NDT intervention, the post-intervention leads to case change by reducing the severity of the condition based on the severity scale of the condition. This suggests a positive distinction between pre-intervention and post-intervention. When the problem is low to (1 and 2 degrees) which means that the patient is almost at normal. The NDT restoration of skeletal system biomechanics to measurably improve function of the nervous system, wellbeing, quality of life, reduction of pain. This cycle is closure linked to one another.

The functional status scale was shown the affected carpal tunnel syndrome to be limited to some everyday activity particularly that required more loading of the upper extremity muscle activity to do hand function such as writing, clothing buttoning, holding a book while reading, Grasping a telephone handle, opening bottles, household chores, carrying the grocery bag, bathing and dressing. In pre-examination, all previous functional states (4 and 5 grade) appeared on a functional status scale suggesting extreme difficulty and not being able to perform any task due to symptoms of the hands and wrists.

Daily living behaviors in patients suffering from CTS affected by the effects of pain, numbness, tingling and weakness. This disorder causes muscle atrophy, leading to a reduction in normal manual functions. The consequence calculation of the functional status scale refers to enhancing the patient as a hand functional during everyday activities after application of NDT. In pre-examination, all previous functional states (4 and 5 grade) appeared on a functional status scale suggesting extreme difficulty and not being able to perform any task due to symptoms of the hands and wrists.

Figure 2. displays the comparison between pre- and post-intervention within functional status scale. Most of the 8 questioners between grade (2 and 1) that mean the patient is not complained of any disability or rather difficult that indicated relieving the severity of the symptoms (pain, tingling, and numbness) by applying NDT because the pressure of the median nerve is eased and the intrinsic

pressure on the neural tissue is decreased. And thus fostering optimum physiological role of the muscle of the hand and restoring muscle power.

Functional Status Scale

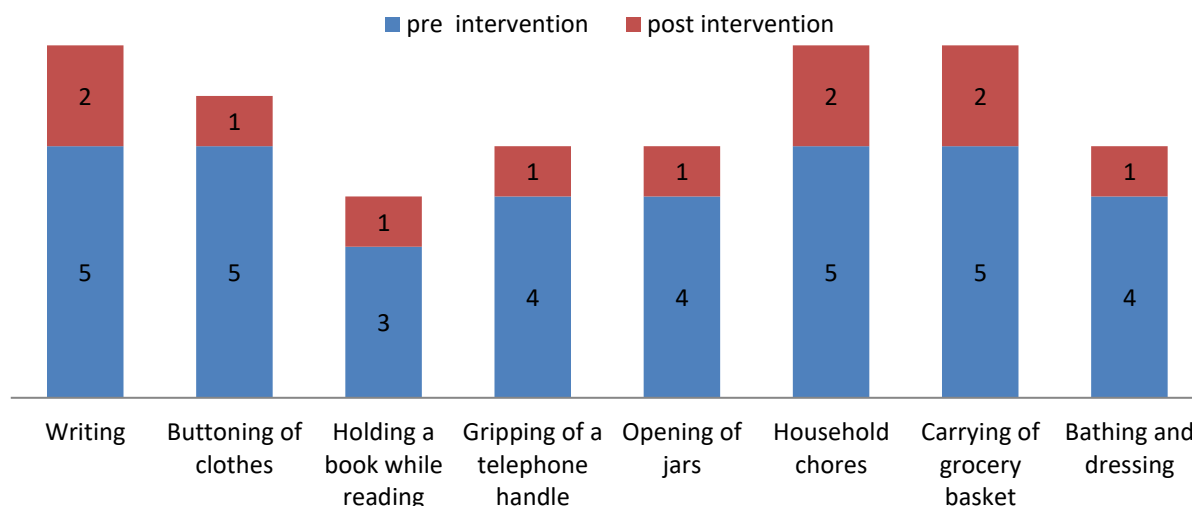


Fig.2 Comparison between pre- and post-intervention within functional status scale.

Neural activation plays a major role in restoring nervous system mobility and elasticity, facilitating a return to normal functions. The technique requires nervous system movement and/or stress, which results in decreased intrinsic neural tissue pressure and can restore neural biomechanics such as elasticity. Furthermore, neural mobilization allows an increase in the recruitment of motor units, thereby increasing muscle strength. In addition, nervous system activation has long been known to reduce pain severity and enhance related symptoms of neurological disorders.

4. Discussion

This study aims to observe the effectiveness of neurodynamic techniques in one patient, 35 years of age with carpal tunnel syndrome.

The findings of this study showed a positive outcome indicating the impact of physiotherapy treatments focused on neurodynamic techniques for carpal tunnel syndrome. With regard to pain, the range of motion during the application technique increases the relation to decreasing the intensity of pain, increased neural vascularity, and enhanced axoplasmic flow, activation of decreasing inhibition of pain.

Ruth Ballesterro-Pérez et al. (2017) reported that effectiveness of nerve gliding exercises on carpal tunnel syndrome. As a result was found limited evidence is available on the effectiveness of neural gliding. Standard conservative care seems to be the most appropriate option for pain relief, although neural gliding might be a complementary option to accelerate recovery of function, more high-quality research is still necessary to determine its effectiveness and the subgroups of patients who may respond better to this treatment (Ballesterro-Pérez et al., 2017). This study results is agreed with our study.

Annalie Basson and collages reported that the effectiveness of neural mobilizations in the treatment of musculoskeletal conditions, the results were indicated which neural mobilization is said to affect the axoplasmic flow, movement of the nerve and its connective tissue and the circulation of the nerve by alteration of the pressure in the nervous system and dispersion of intraneural oedema. Neural mobilization decreases the excitability of dorsal horn cells (Basson et al., 2015).

Outcome metrics such as VAS discomfort, Functional Status Score (FSS) and Symptom Severity Score (SSS) were assessed using the Boston CTS questionnaire before and after two weeks of work.: It is concluded that in the treatment of patients with carpal tunnel syndrome, median nerve mobilization and carpal bone mobilization have been shown to be successful in improving pain, functional status and symptom severity. However, there is no important difference between neural mobilization and carpal bone mobilization in the changes obtained (Sheereen et al., 2022).

Page et al. (2012) reported that efficacy and safety of exercise and mobilization interventions for carpal tunnel syndrome, as finding was found There is limited and very low-quality evidence of benefit for all of a diverse collection of exercise and mobilization interventions for CTS. People with CTS who indicate a preference for exercise or mobilization interventions should be informed of the limited evidence of effectiveness and safety of this intervention by their treatment provider. Until more high quality randomized controlled trials assessing the effectiveness and safety of various exercise and mobilization interventions compared to other non-surgical interventions are undertaken, the decision to provide this type of non-surgical intervention to people with CTS should be based on the clinician's expertise in being able to deliver these treatments and patient's preferences.

In the end, several reports support NDT's effectiveness in treating carpal tunnel syndrome. Develop hand function and Symptom Severity at the pain management stage and demonstrate the successful result is more than other modalities in physical therapy such as low-level laser therapy-ultrasound and bone mobilization and other tools talk of no substantially different differences between neural mobilization and carpal bone mobilization (Bula-Oyola et al., 2021).

5. Conclusion

Neural mobilization plays an important role in restoring the nervous system 's mobility, elasticity, and facilitating the return of normal functions. The procedure includes the movement and stress of the nervous system. Therefore, the intrinsic pressure of the neural tissue were reduced. Furthermore, neural mobilization improved the recruitment of the motor unit, and thus thereby increasing muscle strength. In addition, nervous system activation has long been known to reduce pain severity and enhance related symptoms of neurological disorders.

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