Effects of local anesthetics (neural therapy) on pain and hand functions in patients with De Quervain tenosynovitis: A prospective randomized controlled study

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Abstract

Objective: De Quervain tenosynovitis is the most common cause of lateral wrist pain. The diagnosis can be made with the Finkelstein test when pain is provoked with wrist ulnar deviation. Conservative treatment including rest, non-steroidal anti-inflammatory medication and physical therapy is applied first, then there may be a need for corticosteroid injections, and in resistant cases, surgery. The aim of this study was to evaluate the effectiveness of neural therapy (NT) on pain and hand functions in patients with De Quervain tenosynovitis. Methods: A total of 36 patients admitted between May 2019 and March 2020 were randomly assigned to neural therapy (NT) and control groups. Hand rest and thumb spica splint were applied to all the patients, and NT interventions to the NT group only. A visual analog scale (VAS) and the Duruöz Hand index (DHI) were used to measure pain and functionality at baseline, then at 1 and 12 months after the end of the treatment. Results: The NT and control groups both showed improvements in VAS and DHI scores at 1 and 12 months compared to baseline. The VAS scores were significantly lower at both 1 and 12 months compared to baseline in the NT group. The DHI scores were lower in the NT group at 1 month, and at 12 months there was no significant difference between the two groups. No adverse effects were seen in any patient. Conclusion: NT seems to be effective in reducing pain and improving hand functions in patients with De Quervain tenosynovitis.

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Conclusion: NT seems to be effective in reducing pain and improving hand functions in patients with De Quervain tenosynovitis.

Key words: Local anesthetics, De Quervain tenosynovitis, Wrist pain

Introduction

De Quervain tenosynovitis is the most common cause of lateral wrist pain. It occurs with stenosis of the abductor pollicis longus and extensor pollicis brevis tendons in the first dorsal extensor compartment of wrist. Thumb extension occurs with the contraction of these muscles, which is why thumb extension and ulnar deviation exacerbates pain. The prevalence of De Quervain tenosynovitis has been reported to be 0.5% in males and 1.3% in females.[1,2] It is seen more commonly in middle-aged females and in the dominant hand. In De Quervain tenosynovitis, fibrous tissue deposits cause thickening of the tendon sheaths, but the cause of these fibrous tissue deposits is unclear.

Diagnosis of De Quervain tenosynovitis is based on clinical examination. The diagnosis can be made with the Finkelstein test, in which pain is provoked with wrist ulnar deviation.[3,4] Plain radiography may be useful for differential diagnosis. Conservative treatment of rest, non-steroidal anti-inflammatory drugs (NSAID), and physical therapy is applied first, then there may be a need for corticosteroid injections, and in resistant cases, surgery.[5] In some resistant cases, complementary and alternative methods are preferred, as in other chronic musculoskeletal diseases.[6-9]

Neural therapy (NT) is a regulatory therapy using local anesthetics for the management of chronic musculoskeletal pain. Neural therapy resolves the underlying autonomic dysregulation by regulating the autonomic nervous system. It occurs through the membrane stabilizing effect of local anesthetic agents used during neural therapy. As a result of autonomic regulation, tissue perfusion increases, pain mediators are removed, and it provides an anti-inflammatory effect. Neural therapy targets painful areas, segments of these areas and trigger points, so includes local therapy (infiltration of trigger points) and segmental therapy (infiltration of sympathetic ganglia, nerve roots, or peripheral nerves).[10,11]

To the best of our knowledge, the effect of neural therapy on patients with De Quervain tenosynovitis has not been previously evaluated. Therefore, the aim of this study was to highlight the short and long-term effects of neural therapy on this condition.

Material and methods

Subjects

This prospective, randomized, controlled study included 41 patients diagnosed with De Quervain tenosynovitis, which had been ongoing for more than 4 weeks, and who were admitted to ..... between May 2019 and March 2020. The patients were diagnosed clinically using the Finkelstein test, in which the patient flexes the thumb and wraps the fingers over thumb, then the physician stabilizes the forearm and ulnarly deviates the wrist. The presence of pain over the abductor pollicis longus and extensor pollicis brevis tendons is accepted as positive test result. Patients were excluded from the study if they had chronic widespread or local musculoskeletal pain due to rheumatological diseases (i.e., fibromyalgia, rheumatoid arthritis), neurological diseases (i.e., multiple sclerosis, cervical discopathy or plexopathy), trauma or surgery to the related region (wrist, elbow or hand), or were aged <18 years or >65 years. From the total 41 patients initially enrolled, 2 did not wish to participate in the study, 2 did not complete the treatment sessions and 1 patient did not attend the evaluations at 1 month and 1 year after the end of the therapy. Final evaluation was made of a total of 36 patients (NT group:18; control group:18). Approval for the study was granted by the Ethics Committee of .....

Clinical Trials Registration was approved (NCT04384536). Informed consent was obtained from all the study participants.

Evaluation

The study subjects were separated into neural therapy (NT) and control groups using computer-based randomisation. Treatment of a thumb spica splint and rest was given to both groups, and the NT group also received neural therapy treatment. Injections of neural therapy treatment were applied to all the patients in that group by the same physician. The socio-demographic and clinical characteristics of the patients in both groups were recorded, including age, gender, body mass index (BMI), occupational status, the presence of repetitive trauma, dominant hand, and duration of complaints. The patients were evaluated with a visual analog scale (VAS) and the Duruöz Hand Index (DHI) at the beginning of the study, then at 1 and 12 months after the end of the neural therapy. In addition, the success of the treatment of both patient groups after the treatment they received was questioned. Successful treatment was defined as relief of the symptoms in such a way that the patients did not need to consult for further intervention.

Visual analog scale (VAS)

A 10-cm VAS was used by patients for the self-assessment of pain intensity associated with tenosynovitis. Patients were asked to score the level of pain severity on a scale marked from 0-10, where 0= no pain and 10= intolerable pain. [12]

Duruöz Hand Index (DHI)

The DHI is a self-reporting scale for the evaluation of hand functions, which was first developed in 1996 for patients with rheumatoid arthritis. It consists of 18 items in 5 domains of kitchen tasks, personal hygiene, dressing, office tasks, and others. Each item is scored between 0-5, to give a total score of 0-90, with higher scores indicating increased hand disability. [13]

Intervention

In each session, 20 ml of local anesthetic (1:100 mixture of 10 mg/mL procaine) was used. Local injection, C5-T8 segmental injections, injection of the trigger points of the forearm muscles and stellate ganglion injections were applied in each session, using a 27-gauge, 4-6 cm needle. The local injection was applied first in the first extensor compartment at the point of maximal tenderness and was directed proximally toward the radial styloid (3 mL of the mixture). Then the forearm muscles were investigated by palpation to determine the trigger points. If any trigger point was detected, approximately 5 mL lidocaine was injected to that point. C5-T8 segmental injections were applied intradermally to each spinous process and to 0.5-2 cm lateral of each process on the affected side (approximately 0.25-0.5 ml per injection). Finally, the stellate ganglion injection was applied using Fischer's modified technique. The sternocleidomastoid muscle was palpated by the physician between the middle part of the muscle and distal third of the muscle, gently pulling the muscle laterally with the neurovascular bundle. Following palpation of the anterior tubercle of the transverse process of the sixth cervical vertebra, the cervical spine was extended and rotated 45° to the opposite side. The needle entry point was 1 mm below the tubercle, then the needle was directed first 45° caudally, then 45° medially and then 45° dorsally for each injection. If the aspiration was negative, 3mL procaine was injected.[14](Figure 1,2,3)

The neural therapy procedure was applied twice a week for 2 weeks. All the patients were evaluated at baseline, then at 1 and 12 months after the end of the therapy sessions. This study was performed in accordance with the Declaration of Helsinki.

Statistical analyses

Data obtained in the study were analyzed statistically using SPSS version 24.0 software (IBM Corporation, Armonk, NY, USA). Continuous variables were given as mean± standard deviation (SD) values and categorical data as number (n) and percentage (%). Conformity of the continuous variables to normal distribution was assessed with the Kolmogorov- Smirnov test. Normally distributed continuous variables were compared

with the t-test between the groups. Continuous variables without normal distribution were compared with the Mann Whitney U-test between groups. In-group analyses were evaluated using the repeated measures ANOVA (Post hoc: LSD) test. The Chi-square test was applied to categorical data. A value of $p < 0.05$ was accepted as statistically significant.

Results

The sociodemographic and clinical characteristics of the patients are shown in Table 1. Age, gender, BMI values, occupational status, duration of complaints, history of repetitive trauma, dominant hand, and the treated hand were similar in both the NT and control groups ($p>0.05$).

The VAS and DHI values are shown in Table 2. The pre-treatment VAS scores were similar in both groups (7.88±1.18 vs 7.61±1.24). The VAS scores of the first month follow-up (1.66±0.90 vs 4.22±1.47) and the 12th month follow-up (1.66±1.78 vs 3.83±2.09) in the NT group were statistically significantly lower than those of the control group ($p<0.001$ and $p=0.002$, respectively).

The DHI scores were higher in the NT group than in the control group at baseline (40.55±13.11vs 26.83±13.16). The DHI scores of the first month follow-up were found to be lower in the NT group than in the control group (8.94±5.81 vs 16.61±10.27) ($p=0.009$). The DHI scores of the 12th month follow-up were lower in the NT group than in the control group, but the difference was not found to be significant (8.83±11.49 vs 12.66±7.89) ($p=0.252$).

In the NT group, the VAS scores of the first month (1.66±0.90) and 12th month follow-up (1.66±1.78) were significantly lower than baseline (7.88±1.18) ($p<0.001$), with no significant difference between the first and 12th month of follow-up ($p=1.00$). In the control group, the VAS scores of the first month (4.22±1.47) and 12th month follow-up (3.83±2.09) were significanly lower than baseline ($p<0.001$) with no significant difference determined between the first month and 12th month follow-up ($p=0.360$).

A similar significant relationship was found for DHI values. In the NT group, the DHI scores were decreased at 1 month (8.94±5.81) and 12 months (8.83±11.49) compared to baseline (40.55±13.11) ($p<0.001$), with no statistically significant difference determined between the 1 and 12 month scores ($p=0.965$). In the control group, the DHI scores of the baseline were significantly higher than the DHI scores of the first month (16.61±10.27) and 12th month (12.66±7.89) ($p<0.001$), with no statistically significant difference determined between the 1 and 12 month scores ($p=0.194$) (Table 2, Figure 1-2)

The Finkelstein test was positive in all the patients at the first evaluation. At the first month follow-up, no patients in the NT group tested positive, but for half of the patients in the control group, the test was positive. The difference between the two groups in respect of the first month follow-up Finkelstein test positivity was found to be statistically significant ($p=0.001$). At the 12th month follow-up Finkelstein test positivity was 16.7% in the NT group and 50% in the control group, but statistical significance was not demonstrated between the two groups (Table 3).

Treatment success in the NT group was 88% and 83% at the first and 12th month follow-up examinations, respectively. In the control group, the treatment success rate was 55% and 44%, respectively.

Discussion

This prospective randomized controlled study included 36 patients diagnosed with De Quervain tenosynovitis. Patients were evaluated with VAS and DHI at baseline then at 1 and 12 months after the end of the treatment. Hand functions seemed to be improved at the first and 12th month follow-up examinations in both groups. The 12th month follow-up VAS scores were lower in the NT group than in the control group therefore, and there was no significant difference in hand functions between the two groups in long-term follow-up. In the NT group, no patient had Finkelstein test positivity at the first month follow-up, and the positivity rate at 12 months was 16.7%.

Pain is the most common problem in accomplishing daily living activities for patients with De Quervain tenosynovitis. The primary goal of treatment of tenosynovitis is pain relief and regaining hand functions.

The effectiveness of treatment in De Quervain tenosynovitis has been previously evaluated in many studies. In a retrospective study of 222 hands, which investigated the effectiveness of corticosteroid injection, treatment success was achieved in the first 2 injections in 73% of patients in total. In 26% of patients, corticosteroid injection treatment failed or there was a need for surgery.[2]

In another study, Lane et al. reported 76% treatment success in a study population treated with corticosteroid injection and there was need for surgery in 4% of the patients.[15] In the current study, the treatment success rate in the short and long-term follow-up after treatment was >80% in the neural therapy group.

When viewed in terms of adverse effect profile, in previous studies that have paid particular attention to the side-effects of corticosteroid injections, the authors have reported difficulty in maintaining blood glucose regulation for a few days after the injection, especially in patients with diabetes mellitus. [16]

Another study investigating the effectiveness of corticosteroid injections reported adverse effects such as skin atrophy and hypopigmentation at a high rate of up to 60% even in ultrasound-guided injections. [17] Therefore, it has been emphasized that corticosteroid injection should not be considered as completely free of adverse effects. In the current study, no adverse effects were detected in any patient in the neural therapy group.

In a study in which the long-term treatment efficacy for De Quervain tenosynovitis was evaluated, 13.7% of the patients required repeated injections during the mean follow-up period of 54 months, 5.9% had a partial response, and 2% had no response. [18] In the current study, the treatment success rate in the NT group at 12 months was 83%.

Acupuncture is a rarely used treatment modality for De Quervain tenosynovitis and few studies have been conducted on this subject. In a study which evaluated the short-term effectiveness of corticosteroid injection versus acupuncture treatment, there was reported to be no superiority of one method over the other in the short term in respect of pain. [6] However, some authors have stated that acupuncture should not be recommended as a priority treatment in De Quervain tenosynovitis. [19] Comprehensive long-term results investigating the effect of acupuncture on hand functions and pain are not available.

Recent studies have shown that De Quervain tenosynovitis is not just stenosing of the tendons but also has a tissue inflammation aspect.[20] Local anesthetics have anti-inflammatory effects in addition to nerve blocking and membrane stabilizer effects.[21] Therefore, local injection of procaine can provide an anti-inflammatory effect and reduce edema, resulting in reduced stenosis in the fibro-osseous canal. This could explain the decrease in pain and functional improvement in the current study.

To the best of our knowledge no previous study in the literature has evaluated the

efficacy of local anesthetics in the treatment of De Quervain tenosynovitis, but another issue that should be noted is that local anesthetics have been added to the injection solution with corticosteroids in many studies, because as stated above, local anesthetics also have anti-inflammatory activity.[4,6,18,22] Therefore, corticosteroids alone may not be responsible for all the pain relief and functional improvement demonstrated in these studies.

Trigger points are described as palpable and hypersensitive spots in muscles, which may lead to the referred pain. [23,24]Trigger point injection contributed to the treatment in the current study to eliminate the effect caused by referred pain. Nazlıkul et al. reported that local anesthetic injection to trigger points of the piriformis muscle decreased pain and improved function in patients with low back pain. [25]

In the human body, the sympathetic system has an effect on pain, by affecting tissue perfusion. Decreased perfusion causes hypertonus of the muscles and hyperalgesia. Neural therapy can regulate the autonomic nervous system and restore decreased blood flow to tissue by blocking the pathological signals of the sympathetic system.[26]In addition it has also been shown that the sympathetic nervous system has a pathological memory responsible for musculoskeletal pain.[10,27] This pathological memory, also known as neuronal signature, is considered to start when pro-inflammatory cytokines released from sympathetic nerve endings cause nociceptive stimulation due to tissue damage. The sympathetic efferent-nociceptive afferent connection,

which occurs as a short circuit over time, may result in central sensitization. If this system is activated with continuous stimulation at the spinal cord and brain level, neuroplasticity develops and pathological pain memory occurs.

This is the most important mechanism of neural therapy approaches. However, the pathophysiology of chronic pain still remains unclear. It is known that chronic nociceptive stimulation leads to overactivation of central sensory transmission and causes central sensitization. Nociceptive transmission at spinal-supraspinal levels and sympathetic activity in a wide dynamic range of neurons can be stopped by membrane stabilization that is achieved by local anesthetic injection.[26,28] The pain-free condition seen in the long-term follow up of the patients who underwent neural therapy may have been caused by the effect of local anesthetics to erase the pathological memory in these sympathetic system neurons and prevent nociceptive transmission at spinal-supraspinal levels. Similarly, this mechanism seems to be effective in Finkelstein test negativity in long-term follow-up.

Stellate ganglion injection may alleviate the pain by breaking this vicious circle.[29,30,31] The decrease in pain and improvement in hand function may have been achieved by these mechanisms in the NT group patients.

Procaine was used as the local anesthetic in this study. The anti-inflammatory and autonomic nervous system regulatory effect of procaine can be considered responsible for the decrease in pain and improvements in functionality. No adverse effects were seen in any patient.

There were some limitations to this study, primarily the low number of patients. Further studies with a greater number of patients will provide more valuable results. Another limitation of the current study was the non-blinded method, so it can be suggested that further studies should be performed double blinded.

Conclusion

De Quervain tenosynovitis is a condition that can be treated non-surgically with thumb spica splint, non-steroid anti-inflammatory drugs, physical therapy and corticosteroid injections. Neural therapy is a safe and effective method for the treatment of De Quervain tenosynovitis. To the best of our knowledge, this is the first study to have evaluated the long-term effect of neural therapy in patients with De Quervain tenosynovitis. Nevertheless, there is a need for further studies with larger sample sizes to confirm the widespread application of these results.

Authors' contributions: Bölük Şenlikci, Odabaşı Yılmaz were responsible for designing the study protocol, conducting the search, analysing data, and interpreting results.

Odabaşı Yılmaz, Nazlıkul Ural, were responsible for writing the study protocol, analysing data and screening relevant studies.

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Table 1. The socio-demographic and clinical characteristics of the participants

	NT Group (n=18)	**Control Group (n=18)**	P
Age(years) (Mean±SD)	48.50±10.85	46.61±12.07	0.625*
BMI (kg/m²) (Mean±SD)	28.32±4.59	25.76±4.00	0.084*
Duration of complaints (months)(Mean±SD)	6.88±7.46	6.16±5.59	0.988**
Gender(n,%) Female Male	14 (77.8%) 4 (22.2%)	16 (88.9%) 2 (11.1%)	0.658***
Occupational status Deskjob Heavy-duty Homemaker Retired	2 (11.1%) 4 (22.2%) 11 (61.1%) 1 (5.6%)	6 (33.3%) 3 (16.7%) 9 (50.0%) 0 (0.0%)	0.342***
Repititive trauma Yes No	11 (61.1%) 7 (38.9%)	8 (44.4%) 10 (55.6%)	0.317***
Dominant Hand Right Left	18 (100.0%) 0 (0.0%)	16 (88.9%) 2 (11.1%)	0.486***
Side of intervention Right Left	12 (66.7%) 6 (33.3%)	13 (72.2%) 5 (27.8%)	0.717***
* T Test ** Mann Whitney U Test *** Chi-square Test NT: Neural therapy	* T Test ** Mann Whitney U Test *** Chi-square Test NT: Neural therapy	* T Test ** Mann Whitney U Test *** Chi-square Test NT: Neural therapy	* T Test ** Mann Whitney U Test *** Chi-square Test NT: Neural therapy

Table 2. Comparisons of VAS values and DHI values between the groups and within the groups

	NT Group (n=18)	**Control Group (n=18)**	p^1
Mean±SD	**Mean±SD**	**Mean±SD**	

		NT Group (n=18)	**Control Group (n=18)**	p^1
VAS				
Pre-treatment	7.88±1.18	7.88±1.18	7.61±1.24	0.481*
First month after treatment	1.66±0.90	1.66±0.90	4.22±1.47	**<0.001***
12th month after treatment	1.66±1.78	1.66±1.78	3.83±2.09	**0.002***
	p^2<**0.001****	p^2<**0.001****	p^2<**0.001****	
DHI				
Pre-treatment	40.55±13.11	40.55±13.11	26.83±13.16	**0.004*****
First month after treatment	8.94±5.81	8.94±5.81	16.61±10.27	**0.009*****
12th month after treatment	8.83±11.49	8.83±11.49	12.66±7.89	**0.252***
	p^2<**0.001******	p^2<**0.001******	p^2<**0.001******	
* Mann Whitney U test ** Wilcoxon signed rank test *** t test **** t test in dependent groups NT: Neural therapy; VAS: Visual Analog Scale; DHI: Duruöz Hand Index	* Mann Whitney U test ** Wilcoxon signed rank test *** t test **** t test in dependent groups NT: Neural therapy; VAS: Visual Analog Scale; DHI: Duruöz Hand Index	* Mann Whitney U test ** Wilcoxon signed rank test *** t test **** t test in dependent groups NT: Neural therapy; VAS: Visual Analog Scale; DHI: Duruöz Hand Index	* Mann Whitney U test ** Wilcoxon signed rank test *** t test **** t test in dependent groups NT: Neural therapy; VAS: Visual Analog Scale; DHI: Duruöz Hand Index	* Mann Whitney U test ** Wilcoxon signed rank test *** t test **** t test in dependent groups NT: Neural therapy; VAS: Visual Analog Scale; DHI: Duruöz Hand Index

Table 3. Comparisons of Finkelstein test positivity after treatment

	NT group n	**NT group %**	**Control group n**	**Control group %**	**Total N**	**Total %**	p
First month follow-up							**0.001***
Finkelstein test positivity	0	0.0	9	50.0	9	26.0	
Finkelstein test negativity	**18**	**100.0**	9	50.0	27	75.0	
12th month follow-up							0.075*
Finkelstein test positivity	3	16.7	9	50.0	12	33.3	

Finkelstein test negativity	15	83.3	9	50.0	24	66.7	
* Chi-Square test (Fisher's Exact Test) NT: Neural therapy	* Chi-Square test (Fisher's Exact Test) NT: Neural therapy	* Chi-Square test (Fisher's Exact Test) NT: Neural therapy	* Chi-Square test (Fisher's Exact Test) NT: Neural therapy	* Chi-Square test (Fisher's Exact Test) NT: Neural therapy	* Chi-Square test (Fisher's Exact Test) NT: Neural therapy	* Chi-Square test (Fisher's Exact Test) NT: Neural therapy	* Chi-Square test (Fisher's Exact Test) NT: Neural therapy

Figure 1: Participant flowchart

Figure 2: Local tenosynovitis injection

Figure 3: Segmental therapy, Intracutaneous quaddle applications to C5-T8 spinous processes

Figure 4: Stellate ganglion injection, after pulling the distal third of the sternocleidomastoid muscle laterally and palpated the anterior tubercle of the transverse process of the sixth cervical vertebra, entry point was 1 mm below the tubercle.

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