

# Effectiveness of Dry Needling, Manual Therapy, and Kinesio Taping® for Patients with Chronic Myofascial Neck Pain: A Single-Blind Clinical Trial

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## Abstract

**Background:** Chronic neck pain (CNP) is a common disorder associated with substantial morbidity. Different methods of rehabilitation are used to manage chronic myofascial neck pain.

**Objectives:** The present study aims to assess the effects of dry needling (DN), manual therapy (MT) and Kinesio Taping® (KT) methods on the treatment of patients with chronic myofascial neck pain.

**Methods:** Thirty-nine individuals (mean  $\pm$  standard deviation (SD): Age  $35 \pm 10.1$  years; height  $178.6 \pm 7.5$  cm; body mass  $86.9 \pm 7.7$  kg) out of 57 patients (age range: 18 - 55 years) were included in the current single-blinded randomized clinical trial. The subjects were assigned into 3 groups (N=13 subjects in each group) including DN, MT, and KT. Pain intensity, pain catastrophizing scale (PCS), neck disability index (NDI), and cervical spine range of motion (CROM) in different directions were evaluated by self-reported questionnaires and cervical goniometer at baseline and following 5 treatment sessions. Following the evaluation of the normal distribution of variables by Shapiro-Wilk test, the paired-samples t-test and one-way analysis of variance (ANOVA) were used to analyze the data.

**Results:** Pain intensity and catastrophizing, neck disability, and CROM in all directions significantly improved following the 3 interventions ( $P < 0.05$ ). The score changes in CROM for rotation to right and left in MT group were significantly greater than those of the other 2 groups ( $P < 0.001$ ). Comparisons of changes in scores of other variables between the 3 groups revealed no significant differences ( $P > 0.05$ ).

**Conclusions:** It is assumed that DN, MT, and KT can improve pain and neck disability and increase CROM in patients with myofascial CNP. The MT techniques are more effective in increasing CROM for rotation compared to the other 2 methods.

**Keywords:** Cervical Spine, Taping, Mobilization, Range of Motion, Disability, Myofascial, Pain

## 1. Background

Neck pain is a common musculoskeletal disorder with a prevalence of 10% - 15%, which is more common in females than males (1). It is reported that neck pain complications (i.e., absence from work, decreasing quality of life and physical ability) may be similar to those of low back pain (2-4). A possible reason for neck pain may be myofascial pain which occurs as the result of myofascial trigger points (MTrPs) (5). MTrPs in cervical and shoulder muscles often occur in concomitant neck problems and may produce cervical pain symptoms. Thus, there is strong evidence to demonstrate the important role of MTrPs in neck pain (6). Trapezius muscle, particularly upper fibers, is a

muscle mostly affected by the presence of MTrPs in the cervical spine region (7-9). Results of a recent study showed that trapezius motor control pattern altered in shoulder isometric exercises (10). Zygoapophysial joints (or facet joints) are other regions causing neck pain (11). Current treatment strategies for individuals with neck pain are medication and physical therapy (12). Manual therapy, including manipulation and mobilization are commonly utilized to manage neck pain (13). It is suggested that preferred therapeutic techniques for articular origin pain can be in the form of affected segment manipulation or mobilization (14-17). Various treatment options, such as ischemic compression (IC) technique (18) or dry needling (DN) (19) can lead to positive effects for patients with MTrPs

in upper trapezius muscle and neck pain. Additionally, another systemic review study stated that the effect of injection therapies was possibly associated with the physical prick of the needle rather than the type of injected substance (20). Kinesio Taping® (KT) is another clinical intervention used for patients with neck pain (21). Although medical practitioners and physical and occupational therapists commonly utilize KT in sports injuries (21-25), there is limited scientific evidence of its effectiveness (26-28). The authors and therapists believe that a holistic approach is required to treat neck pain (29), since clinical manifestations of these patients do not effectively respond to a single intervention. Therefore, patients with neck pain refer with multiple complications in a clinical situation, but only a single specific intervention is utilized to manage their symptoms, often with no proper effects. Above-mentioned literature made us investigate the effects of 3 different interventions (DN, manual therapy (MT), and KT) on chronic neck pain (CNP) symptoms and then to compare them with each other.

## 2. Objectives

The current study aims to assess the effects of DN, MT and KT methods on the treatment of patients with chronic myofascial neck pain.

## 3. Methods

### 3.1. Research Design and Participants

The current randomized quasi-experimental clinical trial was performed in Karaj, Iran, in 2015. Fifty-seven males with cervical spine pain originated from muscles referred for physical therapy management were assessed for inclusion criteria. Cervical pain was explained as mechanical pain in cervical region muscles that can be aggravated with sustained posture and different cervical motions (12, 15, 16). Inclusion criteria included: 1) bilateral involving upper trapezius and levator scapulae muscles, 2) Pain for at least 3 months, 3) a pain intensity of 2 out of 10 based on visual analogue scale (VAS), 4) symptoms of neck pain provoked either by neck postures or neck motions, 5) neck disability index over or equal to 15 points, 6) cervical spine range of motion restriction, and 7) MTrPs in upper trapezius and levator scapulae muscles. Exclusion criteria were identified as (14, 30): 1) Manipulation application contraindication, 2) Orofacial pain or temporomandibular joint disorders, 3) History of traumatic injuries (such as contusions and fractures), 4) systemic diseases (fibromyalgia and psoriatic arthritis), 5) neurological diseases, 6) presence of neck pain concomitant to headache (i.e., tension type headache

or migraine), 7) history of surgery in cervical region, 8) clinical diagnosis of cervical radiculopathy or myelopathy, 9) unilateral neck pain, 10) needle phobia, 11) history of skin irritability, and 12) previous history of receiving physical therapy, KT or manipulation in the past 6 months. According to the above criteria, 39 eligible patients finally participated in the study as the sample size. Research aims and procedures were clearly explained to each participant and they completed and signed an informed consent form.

### 3.2. Outcome Measures

Basic data of subjects were collected using a personal information questionnaire and then they were randomly allocated to 3 groups of DN (n = 13), MT (n = 13) and KT (n = 13). The primary outcome measures included pain intensity, pain catastrophizing scale (PCS) and neck disability index (NDI). The measurements of all variables were performed by a blinded examiner who had no information regarding group allocation of patients.

The PCS instructions ask the subjects to reflect on past painful experiences and indicate the degree to which they experienced items when experiencing pain (31). Another self-reported outcome was NDI. This index consists of ten items to assess different functional activities and uses a 6-point Likert scale ranging from 0 (no disability) to 5 (complete disability). The study used the Iranian version of this questionnaire introduced by Mousavi et al. (32). Pain was measured on a VAS, where 0 mm was the least pain imaginable and 100 mm was the worst pain imaginable (33). The range of cervical motion was objectively measured by a goniometer called a cervical range of motion as secondary outcome (34).

### 3.3. Procedures and Interventions

All 39 participants received their interventions in 5 sessions during 10 days. The treatment programs for the 3 groups were DN method plus passive stretching (PS), MT and KT.

#### 3.3.1. Dry Needling

Bilateral ND method for upper trapezius and levator scapulae muscles followed by PS were the treatment options for the subjects in the first group. Based on the high prevalence of MTrPs in upper trapezius and levator scapulae muscles in patients with cervical spine pain (15, 20, 30), these 2 muscles were selected for DN application (35, 36). After 20 minutes of needling, PS was bilaterally applied to the levator scapulae and trapezius muscles.

### 3.3.2. Manual Therapy

The subjects in the second group received a bilateral MT treatment based on the IC technique over both the levator scapulae and upper trapezius muscles, but also a dynamic soft tissue mobilization (DSTM) was applied on the upper trapezius for 4 minutes (18, 37). Thereafter, 3 manual therapy techniques were performed by the physical therapist as follows: 1) Anterior-posterior mobilization of the upper cervical spine for 4 minutes (38), 2) Cervical lateral glide mobilization technique (39), and 3) Neural thoracic mobilization (40).

### 3.3.3. Kinesio Taping

The Kinesio Taping® used in the present study (Temtex, South Korea) was waterproof, porous, and adhesive with 5 cm width and 0.5 mm thickness. The patient position was sitting on the treatment table with 90° hip and knee flexion. The first layer of tape consisted of an orange Y-strip placed over cervical extensor muscles. In the current study, stretching applied on tape was approximately 15% to 25% (30, 41, 42). Figure 1 demonstrates the final attachment of KT. Star-shaped KT was also performed for upper trapezius MTrPs. Four I-strips were cut, as displayed in Figure 2. The 4 strips were anchored on the upper trapezius muscle while the MTrP was exactly centered at the intersection of the 4 strips. The tension for each strip (paper-off tension) was 50% (40, 41).



**Figure 1.** Y- and I-Strips Kinesio Taping® Application

### 3.4. Analysis of Data

Normal distribution was confirmed by the Shapiro-Wilk test ( $P > 0.05$ ) for the demographic and dependent variables, hence, parametric statistics were used. The baseline and demographic data at pretreatment were compared among groups using a one-way analysis of variance



**Figure 2.** Star-Shaped Kinesio Taping®

(ANOVA). Paired samples t-test was administrated to evaluate within-group differences before and after treatments for each group separately. Then, one way ANOVA and Scheffe Post-hoc test were used to evaluate between-group differences for changes in measurement scores pre and post interventions. The level of significance was  $P < 0.05$ .

## 4. Results

Thirty-nine patients with chronic mechanical neck pain, aged 19 to 53 (mean  $\pm$  SD =  $35.8 \pm 10.1$  years) were included in the study and assigned to 1 of the 3 groups (Table 1). No significant differences were observed among the groups regarding age ( $F = 0.06$ ,  $P = 0.93$ ), height ( $F = 0.19$ ,  $P = 0.82$ ), body mass ( $F = 0.23$ ,  $P = 0.79$ ), body mass index (BMI) ( $F = 1.87$ ,  $P = 0.16$ ), and duration of symptoms ( $F = 0.91$ ,  $P = 0.41$ ). Therefore, the groups seemed to be homogenous at baseline. In Table 2, pre and post intervention data of dependent variables of the 3 groups are expressed. The statistical analysis revealed significant differences between pre and post treatment scores of all variables in the 3 groups ( $P < 0.05$ ). In other words, pain intensity, PCS, neck disability, and cervical range of motion in all 6 directions significantly improved by application of DN method, MT techniques and KT. Thereafter, the difference in pre and post intervention scores of all variables was calculated and recorded as the mean of changes before and after using the treatment options and then were compared between the 3 groups (Table 3). The results confirmed significant differences in the mean changes in only 2 dependent variables including neck right and left rotation between the participants ( $P < 0.05$ ). Then, post hoc tests were followed and it was found that the patients who received MT techniques had more statistically significant improvement in cervical

spine rotation in both directions compared to the other 2 groups. However, no significant difference was observed between DN and KT interventions regarding neck right and left rotation ( $P > 0.05$ ) (Table 3).

## 5. Discussion

The current study compared 3 various therapeutic clinical interventions for individuals with chronic myofascial neck pain and found that the outcome measures of patients in all groups improved after application of intervention. However, according to more statistical analysis, the patients who underwent MT techniques interestingly improved in cervical right and left rotation better than either DN or KT.

### 5.1. Pain Intensity

Since the magnitude of changes of clinically important differences of pain intensity was reported 8.5 mm (43), it was logical to consider that the changes in this factor were clinically relevant between DN (16.9 mm), MT (20 mm), and KT (24.6 mm). The reduction of pain intensity represented a change of 32% for DN group, 37% for MT group and finally 40% for KT group. There was an agreement between the authors that changes of 30% or more can be considered clinically meaningful improvements in spinal pain conditions (44). The results of the study indicated that the changes of pain intensity scores before and after interventions were not significantly different among the groups. The study findings were supported by the results of the studies conducted by Ay et al. (19) and De Venancio et al. (45).

### 5.2. Pain Catastrophizing Scale and Neck Disability

There are different ideas about the suitable score for minimum clinically important difference of NDI (46, 47). The values of changes in pre and post interventions for NDI in DN, MT and KT groups were 4.9, 4.8, and 5.2 points, respectively. As observed, these changes cannot be considered as clinically important differences for NDI, based on the results of the 2 mentioned studies. Therefore, it may be necessary to use combined therapeutic protocols (i.e., receiving DN, MT and KT concomitantly) to meet clinical effectiveness for the results of PCS and NDI as subjective measurements.

### 5.3. Range of Motion of Cervical Spine

The cervical spine range of motion in all directions significantly improved following the interventions compared to baseline for the whole participants in the groups, but the only between-group significant difference was observed in right and left neck rotation. The results showed

that cervical rotation range of motion can be increased by MT methods including segmental mobilization and manipulation techniques. The current randomized controlled trial explained that both treatment options including local analgesic injection and DN for upper trapezius muscle can increase cervical spine range of motion in patients with myofascial pain syndrome after a single therapeutic session (19). The results of other similar studies strongly supported the positive effects of intra-muscular injections of neck region on myofascial pain syndrome (48, 49). Former evidence suggests that active MTrPs were more common in patients with nerve root compression compared to healthy peers (37). This supports the idea that neural pain might be present in MTrPs, and then the current study subjects who received MT method including mobilization techniques as their treatment program achieved more enhancement in right and left cervical rotation. Another possible reason for better effects of manual therapy on right and left neck rotation can be attributed to the facet joints (37-40). However, it was previously believed that underlying mechanisms for the effectiveness of manual therapy techniques had biomechanical aspect, while more recent studies recommend neurophysiologic approach, too (50, 51). A possible explanation for the effectiveness of KT may be associated with neural feedback caused by patient. This feedback enhances the patient ability to move cervical spine with decreased mechanical irritation on soft tissues. In addition, it is stated that KT may generate soft tissue tension acting as an afferent stimuli, subsequently facilitate pain-inhibitory mechanism (gate control theory), and thereby experience decreased levels of pain by the patient (30, 41). On the other hand, DN as an aggressive treatment option is popularly utilized by therapists (36). As stated above, there was no superiority in effects of DN and KT on intensity of pain, PCS, NDI, and cervical range of motion in the current study, but the therapists are recommended to use KT as a safe method instead of DN to decrease the mentioned adverse effects. Many mechanisms are clarified to understand the effectiveness of DN, focusing on physiological approaches originating from historical studies based on acupuncture techniques. However, it is stated that DN as a non-conservative treatment strategy can decrease pain levels by affecting the biomechanical feature and local blood circulation around the MTrPs and finally central nervous system (CNS). Shah et al. realized that employing DN for patients with myofascial neck pain significantly caused temporary accumulation of P substance and calcitonin around the MTrPs subsequent to achieving local twitch response (52, 53). Cagnie et al. (54) concluded that a single session of DN intervention for upper trapezius MTrPs increased blood circulation and oxygen saturation around the MTrPs for 15 minutes after emitting the nee-



**Table 1.** Demographic Characteristics of the Study Subjects<sup>a</sup>

Groups	Variables				
	Age, y	Height, cm	Body Mass, kg	BMI, kg/m <sup>2</sup>	Symptoms Duration, Month
Dry needling (N = 13)	34.6 ± 10.5	179.6 ± 6.8	87.0 ± 4.7	26.9 ± 1.3	12.6 ± 4.4
Manual therapy (N = 13)	35.9 ± 11.4	178.4 ± 8.7	85.7 ± 10.4	26.7 ± 1.3	15.1 ± 7.5
Kinesio Taping (N = 13)	34.6 ± 9.1	177.8 ± 7.6	87.8 ± 7.6	27.6 ± 0.9	16.1 ± 7.6

Abbreviations: BMI, body mass index.

<sup>a</sup>Values are expressed as mean ± SD.**Table 2.** Pain, Disability, and Neck Range of Motion at Baseline and After Interventions<sup>a</sup>

Variables	Dry Needling		Manual Therapy		Kinesio Taping®	
	Pre-Test	Post-Test	Pre-Test	Post-Test	Pre-Test	Post-Test
Pain intensity	56.1 ± 19.3	39.2 ± 20.1	53.8 ± 16.0	33.8 ± 12.6	61.5 ± 18.1	36.9 ± 14.9
Pain catastrophizing scale	19.8 ± 5.5	15.2 ± 4.9	23.7 ± 10.7	17.0 ± 6.7	24.3 ± 8.7	16.9 ± 5.1
Neck disability index	21.6 ± 4.8	16.7 ± 3.9	24.4 ± 7.6	19.6 ± 6.5	26.6 ± 7.8	21.4 ± 6.0
Neck flexion ROM	49.2 ± 8.8	55.1 ± 7.6	47.7 ± 11.6	52.7 ± 10.8	46.7 ± 9.3	50.6 ± 10.2
Neck extension ROM	49.4 ± 8.0	53.1 ± 7.6	46.8 ± 8.7	51.1 ± 8.4	47.6 ± 10.3	53.5 ± 8.8
Neck right side flexion ROM	37.6 ± 6.0	41.9 ± 6.3	35.4 ± 6.8	39.5 ± 6.5	35.3 ± 6.3	39.9 ± 6.0
Neck left side flexion ROM	37.1 ± 5.5	39.8 ± 5.5	34.1 ± 6.4	37.2 ± 6.1	32.5 ± 6.1	35.6 ± 5.8
Neck right rotation	75.3 ± 7.5	77.8 ± 7.3	75.0 ± 9.9	83.3 ± 8.6	73.1 ± 5.3	74.4 ± 4.9
Neck left rotation	75.0 ± 6.5	77.5 ± 6.1	74.7 ± 8.7	82.3 ± 6.8	72.2 ± 4.8	74.5 ± 5.2

<sup>a</sup>Values are expressed as mean ± SD.**Table 3.** Mean of Changes for All Dependent Variables<sup>a</sup>

Variables	Dry Needling	Manual Therapy	Kinesio Taping®	F	P
Pain intensity	16.9 ± 10.3	20.0 ± 11.5	24.6 ± 12.6	1.46	0.245
Pain catastrophizing scale	4.6 ± 1.1	6.6 ± 4.2	7.4 ± 4.1	2.31	0.144
Neck disability index	4.9 ± 2.0	4.8 ± 1.5	5.2 ± 2.5	0.12	0.887
Neck flexion ROM	5.9 ± 4.1	5.0 ± 1.4	3.9 ± 3.0	1.35	0.271
Neck extension ROM	3.6 ± 1.1	4.3 ± 1.5	5.8 ± 3.8	2.67	0.086
Neck right side flexion ROM	4.2 ± 1.0	4.0 ± 1.0	4.5 ± 0.8	0.75	0.480
Neck left side flexion ROM	2.6 ± 0.6	3.0 ± 0.7	3.1 ± 1.3	0.85	0.433
Neck right rotation	2.4 ± 0.8	8.2 ± 2.5	1.3 ± 2.9	33.83	0.000 <sup>b</sup>
Neck left rotation	2.5 ± 0.9	7.6 ± 2.8	2.5 ± 0.9	33.08	0.000 <sup>b</sup>

<sup>a</sup>Values are expressed as mean ± SD.<sup>b</sup>Indicates significant difference at  $P < 0.05$ .

dle. It is feasible that increasing regional blood circulation may assist in removing the debridement causing pain (52, 55). Moreover, DN can influence pain levels based on neural mechanisms. Chae et al. (56) examined the changes in brain activity following DN in an acupuncture model ther-

apeutic method. They observed that inserting acupuncture needle can either fire or deactivate some regions in the brain involved in sensitive and cognitive aspects of pain. However, the current study had a weak point due to the lack of a control group. But, in conclusion, the 5 sessions of

using the 3 methods involving DN for upper trapezius and levator scapulae muscles followed by PS, KT application for posterior structures of neck and also MTrPs, and MT techniques such as IC of upper trapezius and levator scapulae muscles and DSTM for upper trapezius muscle can lead to pain and neck disability improvements and cervical spine range of motion increase in patients with chronic myofascial neck pain.

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## Footnote

**Authors' Contribution:** Study concept and design: Vahid Sobhani, Vahid Mazloun, and Alireza Shamsoddini; acquisition of data: Vahid Mazloun and Vahid Sobhani; analysis and interpretation of data: Vahid Mazloun and Alireza Shamsoddini; drafting of the manuscript: Alireza Shamsoddini and Amideddin Khatibi-Aghda; editing of the manuscript: Vahid Mazloun, Alireza Shamsoddini, Vahid Sobhani, and Hamid Hesarikia.

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