

# Effects of dry needling on pain, range of motion and function in patients with upper cross syndrome

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## ABSTRACT

**Background:** In upper cross syndrome, upper trapezius, levator scapulae, sub occipital, sternocleidomastoid, pectoralis major and minor become tight. Whereas, the phasic muscle including lower and middle trapezius, deep neck flexor and serratus anterior muscle weaken.

**Objectives:** To determine the effects of dry needling on pain, range of motion and function in upper cross syndrome.

**Methods:** This randomized clinical trial was conducted at Sheikh Zaid Hospital Rahim yar khan. Ethical approval REC/RCRS/20/1049 was obtained from Riphah International University Lahore. Group A was treated with dry needling along with conventional therapy and group B was treated with conventional therapy and 34 subjects were allocated in both groups. The duration of study was of 2 weeks with 1 session per week. The pre and post intervention scores were taken for Visual analogue scale, Neck disability index and neck range of motion. The data was analyzed using SPSS 25.

**Results:** There was no significant difference ( $p < 0.05$ ) between groups based on demographic data at baseline. The BMI in group A was 24.38(1.14) and in group B 23.19(2.59). The mean difference of VAS in group A was 2.89(1.68) with CI [1.98,3.76] ( $p < 0.05$ ) and in group B was 2.87(1.03) with CI [2.33,3.42] ( $p < 0.05$ ). The mean difference for NDI in group A was 21.25(10.85) with CI [15.46,27.03] ( $p < 0.05$ ) and in Group B was 14.68(8.42) with CI [10.20,19.17] ( $p < 0.05$ ). In VAS and NDI between group analysis did not show significant result ( $p > 0.05$ ).

**Conclusion:** Dry needling along with conventional therapy only improves range of motion but in term of pain and functionality, dry needling and conventional therapy are equally effective.

**Clinical Trial Number:** NCT04674904

**Keywords:** dry needling, muscle spasm, muscle stretching, muscle weakness.

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## Introduction:

In upper cross syndrome, the tonic muscle becomes tight and phasic muscle becomes weak. The tight group of muscle includes upper trapezius, levator scapulae, sub occipital, sternocleidomastoid, and pectoralis major and minor. The weak group of muscle includes lower and middle trapezius, deep neck flexor and serratus anterior muscle. The muscle imbalance is caused by sedentary lifestyle. This imbalance in muscle groups causes pain, movement restriction and triggers points

and muscle imbalance.(1-5) This condition leads to forward head posture, rounded upper back and elevated shoulders.

The physical therapy treatment approach for upper cross syndrome includes joint mobilization, strain counter strain, proprioceptive neuromuscular facilitation, soft tissue release technique, strengthening, and active isolated stretching. The kinesiotaping, hot packs and TENS are the modalities used in treatment.(6-10)

The practice of dry needling (DN) is the use of thin needle without any injectable to treat soft tissue conditions.(11) Dry needling technique is used in physiotherapy for musculoskeletal conditions and upper motor neuron disease to treat myofascial pain and spasticity.(12-14) Majority of studies find the relation between dry needling and muscle extensibility, neural sensitization, circulation which effects ROM, pain and

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quality of life.(15-19)

The data is available about implication of dry needling for trigger points and muscle spasm treatment. Unlimited data available on dry needling effect with conventional therapy for muscle spasm and trigger points in upper cross syndrome. The current study aims to examine the effect of DN in upper cross syndrome on ROM, pain and functional status.

### Methods:

This study was a randomized controlled trial carried out at Sheikh Zaid Hospital Rahim Yar Khan. The duration of the study was from March 2020 to January 2021 after the approval of ethical committee with reference no: REC/RCRS/20/1049. Study was clinically registered by Clinical Trials, gov ID: NCT04674904. Sample size was 34 calculated by using online epi tools assuming power (0.8), margin of error (5%) and confidence interval (95%), the means (5.3,4.7) of VAS were used.(20)

The diagnosed patients of upper cross syndrome referred from orthopedics and neurology specialist of Sheikh Zaid Hospital Rahim Yar Khan for physiotherapy, patients with stiffness and gradual pain in neck and shoulder region, patients aged between 30-50 years and with complains of pain resulting from postural dysfunction or insidious onset were included.(21) Any individual with needle phobia, or is unable to give consent or is mentally retarded, patients with systemic soft tissue and bony disease, tumor, fracture, metabolic disease, rheumatoid arthritis, osteoporosis, with resting BP greater than 140/90 mmHg, or prolonged history of steroid use, atrophy of neck muscles or cervical Neuropathy, were excluded from this study.(22)

Patients were recruited into the study through convenience sampling and were randomly assigned into two groups by lottery method. Safety identity numbers were assigned, and assessors were blinded. Group A was treated with dry needling along with conventional therapy. Group B was treated only with conventional therapy. Conventional therapy includes hot pack, stretching and Transcutaneous Electrical Nerve Stimulation (TENS). (Figure1)

The tight muscle groups in upper cross syndrome include upper trapezius, Levator Scapulae, Sternocleidomastoid. MTrP and tight band were palpated by expert therapist according to criteria determined by Simons et al.(23) The dry needling

consists of acupuncture needle of 0.30 mm and 50 mm length was applied. The needle was moved up and down 3 to 5 times and then removed.(24) Hot pack was applied for 20 min, TENS was applied for 10 min with 100 Hz frequency and pulse duration was 0.05 to 0.07. Stretching was maintained for 30 seconds with 15 seconds rest between each stretch( 4-5 repetitions).(6)

The participants completed pre and post treatment scoring by performing neck goniometry for flexion, extension and right-side bending. The universal goniometer is a reliable tool for neck's range of motion (ICC=0.85;[0.90-0.99]).(25) NDI consists of 10 sections of a self-reporting questionnaire. 0 means no disability and 50 means complete disability. Neck Disability Index (NDI) shows excellent reliability (ICC=0.88;[0.63-0.95]).(26) The visual analog scale (VAS) is 10-cm scale 0 for no pain and 10 for extreme pain and had excellent reliability(ICC=0.81;[0.79-0.85]).(27) The treatment duration was 2 weeks with 1 session/week.

Data was analysed by using SPSS 25. The data was not normally distributed when checked by Shapiro Wilk Test. The data was analyzed using Wilcoxon's Test. For between group comparisons, Mann-Whitney U Test was used. The effect size of Mann-Whitney Test was calculated using formula  $z/\sqrt{n}$ .

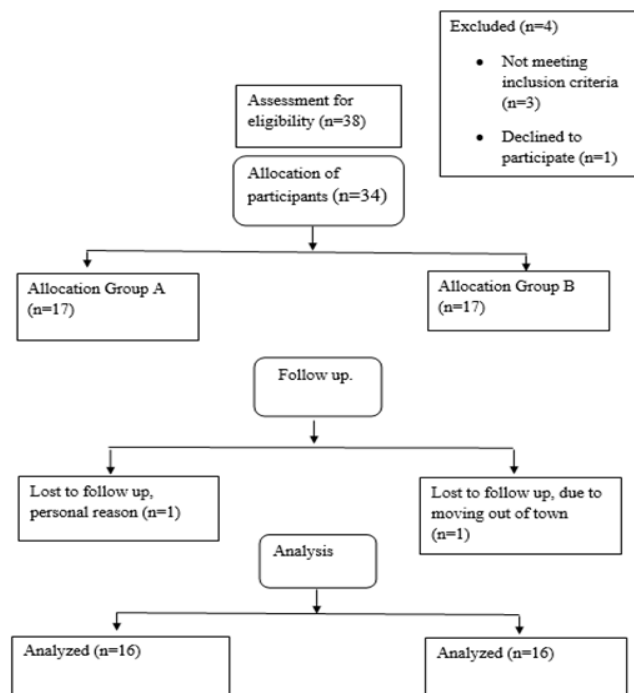


Figure 1: Consort diagram

**Table 1: Results of demographic data.**

Variable		Group A Mean±SD	Group B Mean±SD	p-value
Age		35.38±6.52	31.63±6.52	0.114
Height		167.81±2.71	174.25±3.70	0.00
Weight		69.63±5.15	69.63±6.96	1.00
BMI		24.38±1.14	23.19±2.59	0.104
Work time		7.25±2.01	6.88±2.63	0.654
Sitting time		4.25±3.00	5.56±3.41	0.256
Computer use		3.13±2.74	6.57±3.16	0.041
Gender	Male	7(43.8%)*	8(50%)*	0.733
	Female	9(56.3%)*	8(50%)*	

\*= Frequency (percentage)

**Table 2: Between and within group analysis.**

		Pre-test x̄± SD	Pre-test Median Q1-Q3	Post-test x̄± SD	Post-test Median Q1-Q3	Within Group p-value	Between Group p-value	r
<b>VAS</b>	<b>Group A</b>	4.44±1.09	4.5 3.25-5.0	1.56±0.73	1.0 1.0-2.0	<0.01	0.77	0.05
	<b>Group B</b>	4.44±0.73	5.0 4.0-5.0	1.56±0.51	2.0 1.0-2.0	<0.001		
	<b>M.D</b>	0.00		0.00				
<b>NDI</b>	<b>Group A</b>	49.503±14.13	53.0 37.0-60.0	28.25±12.43	27.0 18.5-37.5	<0.01	0.72	0.12
	<b>Group B</b>	42.06±13.25	44.0 34.25-46.75	27.37±13.38	26.0 18.0-31.50	<0.01		
	<b>M.D</b>	7.44		0.87				
<b>Flexion</b>	<b>Group A</b>	41.38±10.97	37.5 34.25-45.75	47.50±12.57	43.50 40-50	<0.01	<0.01	0.69
	<b>Group B</b>	64.06±6.61	66 60.50-68.75	70.50±6.79	73.50 69.25-75	<0.01		
	<b>M.D</b>	22.69		23.00				
<b>Extension</b>	<b>Group A</b>	53.88±5.80	52.25 52-55	60.63±6.66	60 55-64.75	<0.01	<0.01	0.51
	<b>Group B</b>	60.50±6.39	60 59-63.5	67.00±6.37	68 63.5-69.75	<0.01		
	<b>M.D</b>	6.62		6.37				
<b>Rotation right</b>	<b>Group A</b>	67.19±10.95	73 57.75-76.75	76.00±10.64	80 70-85	<0.01	0.268	0.19
	<b>Group B</b>	72.38±11.78	75.50 69.50-77.75	78.63±13.01	84.50 74-85	<0.01		
	<b>M.D</b>	5.19		2.62				
<b>Rotation left</b>	<b>Group A</b>	67.50±10.72	73.50 57.75-76.75	75.56±10.44	79 67.75-84.75	<0.01	0.191	0.23
	<b>Group B</b>	72.56±11.57	75.50 69.75-77.75	78.63±12.98	84 74-85	<0.01		
	<b>M.D</b>	5.06		3.06				
<b>Side bending right</b>	<b>Group A</b>	29.38±6.16	28.50 25-35	34.19±7.47	33.50 27.75-40	<0.01	0.01	0.42
	<b>Group B</b>	38.19±7.37	37 36-37.75	42.31±7.53	40 40-42	<0.01		
	<b>M.D</b>	8.81		8.13				
<b>Side bending left</b>	<b>Group A</b>	29.66±6.29	29 25-35	34.00±7.18	33.50 29-40	<0.01	0.01	0.45
	<b>Group B</b>	38.38±7.58	37 36-38	42.31±7.55	40 40-42	<0.01		
	<b>M.D</b>	8.94		8.31				

x̄: mean, S.D: standard deviation, M.D: mean difference, r: effect size, VAS: visual analogue scale, NDI: Neck Disability Index

## Results:

A total of 34 patient were included in the study. Each group had 17 patients and there were 2 dropouts, one from each group, so a total of 32 patients were analysed. Gender distribution between in group A, females 9 (56.3%) and males 7 (43.8%) and in group B both were equal in number. The participants in both groups were of adult age with normal BMI. The working time of participants in group A (7.25) was greater than group B (6.88). The duration of sitting and computer use was greater in group B (5.56, 6.57) than group A (4.25, 3.13). (Table 1)

In table 2, the pain was measured by VAS and functional disability was measured by NDI and there were significant results ( $p < 0.01$ ) in both group A and B. However, there were insignificant results ( $p > 0.05$ ) while comparing both groups. For all ROM's, there were significant results ( $p < 0.01$ ) in both groups, while group A had more significant results than group B in flexion, extension and side bending ( $p < 0.01$ ).

## Discussion:

The following parameters NDI, VAS and goniometer were included to measure the levels of neck disability, pain and range of motion. Both groups had significant improvement in NDI, VAS and ROM. Dry needling along with conventional therapy had better effects in improving flexion ( $p < 0.01$ ), extension ( $p < 0.01$ ) side bending right and left ( $p < 0.01$ ) but did not have better effect than conventional therapy in improving pain ( $p > 0.05$ ) disability ( $p > 0.05$ ), rotation right and left ( $p > 0.05$ ).

MTrP causes pain, decrease range of motion and dysfunction of muscle fibers and motor end plate dysfunction; dry needling is observed to be effective for these dysfunctions. Dry needling improves micro circulation, decrease sensitization both central and peripheral and MTrP vicious cycle break down.(28) DN may play an important role in treating active MTrPs via inhibition of sympathetic nervous activity and reduction of NMJ hyperactivity.(29-31)

Stretching lengthens the muscle and improves ROM but studies showed that stretching increases sensitization in MTrP. A study mentioned that stretching in only beneficial after desensitizing the MTrP (31). Graff-Radford mentioned that TENS desensitizes the MTrP. TENS along with stretching can improve muscle length.(32, 33) Hot pack increases location circulation.(34) Thus, in the current study, both groups'

treatments improve blood circulation, sensitization and pain.

In the current study, DN was applied with conventional therapy and there was a significant improvement ( $p < 0.05$ ) in pain (M.D:2.88±0.36), NDI (M.D:21.25±1.73), flexion (M.D:6.12±1.53), extension (M.D:6.75±0.86), rotation right (M.D:8.81±0.31), rotation left (M.D:8.06±0.28), side bending right (M.D:4.81±1.31), side bending left (M.D:4.34±0.89) The stretching was applied along with TENS and hot pack in group B and there was significant improvement ( $p < 0.05$ ) in pain (M.D:2.88±0.22), NDI (M,D:14.59±0.13), flexion (M.D:6.44±0.18), extension (M.D:6.5 ±0.02), rotation right (M.D:6.25 ±1.23), rotation left (M.D:6.07 ±1.41), side bending right (M.D: 4.12±0.16), side bending left (M.D:3.93 ±0.03).

In a previous study, static stretching applied on trapezius, levator scapulae and pectoralis along with infrared, TENS and cervical mobilization in upper cross syndrome and duration was 3 weeks with 2 sessions per week. There was significant improvement in pain (M . D 2 ± 0 . 0 ) , N D I ( M . D 2 . 0 5 ± 0 . 3 5 ) , flexion (M.D5±1.25), extension (M.D4.25±0.5), rotation right (M.D5±3.50), rotation left (M.D2.7±0.59), side bending right (M.D5.35±0.46) and side bending left (M.D3.6±0.07).(35) In the current study there was more improvement in NDI and ROM than in the previous study because hot pack and TENS were applied for long duration and sternocleidomastoid was also treated.

Another study applied static stretching along with home exercises in upper cross syndrome for 16 sessions and 3 sessions per week. There was significant improvement in pain (M.D3.42±0.2), NDI (M.D9.81±0.4), flexion (M.D12.5±0.28), extension (M.D11.92±0.78), rotation right (M.D10.97±2.01), rotation left (M.D10.96±1.26), side bending right (M.D8.39±2.12), side bending left (M.D8.08±2.1).(36) In the current study, there was less improvement as compared to the previous study. In the previous study, the number of sessions were greater than in the current study and also a home plan of self-stretching was given in previous study.

Another study applies stretching of pectoralis along with hot pack and strengthening of trapezius and neck flexors and rhomboids for upper cross syndrome. The duration of study was 8 weeks with 3 sessions per week. There was significant improvement in pain



(M.D $\pm$ 0.0)) and NDI (M.D16.25 $\pm$ 0.0).(37) The results of this study are similar to current study.

A study determines the effect of DN on sternocleidomastoid muscle MTrP in neck pain. There was no significant effects on pain (M.D0.2 $\pm$ 1.99) but there was significant effect on NDI (M.D5.1 $\pm$ 7.82), flexion (M.D3.1 $\pm$ 10.60), extension (M.D3.4 $\pm$ 8.07), rotation right (M.D3.7 $\pm$ 10.60), rotation left (M.D0.3 $\pm$ 9.79). The effect side for VAS was 0.005, for NDI was 0.209, for flexion was 0.265, for extension was 0.572, for rotation right was 0.505, for rotation left was 0.302.(38) This was a single session study, and no conventional therapy was added. The results mean difference and effect size of this study are less than current study because in current study three muscles were targeted and conventional therapy was also used. Also, the number of sessions of current study were greater than previous study.

Another study determines the effect of DN on levator scapulae in neck rotation. This was a single session study and instead of right and left this study focused more on ipsilateral and contralateral rotation according to DN applied for particular side muscle. The result showed significant improvement in ipsilateral rotation (M.D2.71 $\pm$ 1.26) and non-significant for contralateral rotation (M.D0.99 $\pm$ 0.61).(39) There was greater improvement of rotation in current study as compared to the previous one. Because in current study, a group of muscles were included, and convention therapy was also used.

Another study determines the effect of DN on trapezius muscle in neck pain. The treatment was for 3 weeks with 2 interventions per week. One group was treated by DN along with stretching and other group was treated with stretching only. The median for pain in DN group changed from 5.8 to 0 and for stretching group from 5 to 3. The DN group had significant effects on neck flexion-extension, side bending and rotation. In stretching group, only rotation significantly improved as compared to other movements.(40) Another study compares DN and stretching with stretching alone in trigger point and concluded that DN along with stretching had same effect as applying stretching alone to minimize pain.(41) The outcomes are similar to current study.

Another study determines the effect of dry needling on mechanical neck pain where the target muscle was upper trapezius. There was significant improvement in pain (M.D=5.3 $\pm$ 0.4), flexion (M.D=6.1 $\pm$ 0.4), extension

(M.D=7.5 $\pm$ 3.1), rotation right(M.D=6.5 $\pm$ 3.5) left (M.D=4.7 $\pm$ 3), side bending right (M.D=6.2 $\pm$ 0.74) left(M.D=6.8 $\pm$ 0.3).(42) In current study target muscles were SCM, pectoralis major, minor and upper trapezius. The improvement in pain was greater in previous study but there was similar increase in range of motion in both studies. In previous study DN effect was assessed on mechanical neck pain but in the current study, upper cross syndrome was included.

The pathophysiological effects of both groups' interventions were almost similar so stretching along with TENS and hot pack have similar effects on pain and disability as DN along with stretching, hot pack and TENS. Stretching increases the neural sensitization and TENS inhibits these phenomena. Stretching alone is not effective so hot pack and TENS prior to stretching give significant results. There are significant outcomes when interventions are applied to a group of muscle instead to single muscle, because upper cross syndrome involves group of muscles.

There are some limitations of current study. The follow up was not done as DN effect remains for a long term so follow up can be included in next studies. Home exercises were not included. The third group was not added in which sham DN with conventional therapy can be applied.

#### **Conclusion:**

The conventional therapy and dry needling had equal effects on pain in term of VAS, functional disability in term of NDI. In range of motion, dry needling had better effects on flexion, extension and side bending than conventional physical therapy.

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**Conflict of Interest:** None to declare.

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**Rehman SS:** Conceptualization, Validation, Resources, Supervision, Project Administration

**Sanaullah M:** Software, Data Curation, Draft, Writing-review and editing, Visualization

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