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Research Article

EFFECTIVENESS OF DRY NEEDLING ON PAIN AND FUNCTIONS ON SHOULDER IMPINGEMENT IN POPULATION WITH UPPER QUADRANT DYSFUNCTION: A RANDOMIZED CONTROL TRIAL

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ABSTRACT

The aim of the study was to study the effect of dry needling on pain and functions in shoulder impingement in a population with upper quadrant dysfunction. Total 50 subjects with impingement syndrome were selected for the study. Subjects were randomly allocated to the two groups i.e. control group and experimental group. Subjects having a positive Neer's or Hawkin's Kennedy impingement test were included in the study. Detailed assessment of pain and disability was done using the Disability of Arm, Shoulder and Hand (DASH) and Patient Specific Functional Scale (PSFS). Shoulder ranges were recorded using the universal goniometer. All the outcome measures were assessed pre and post 5 days of treatment. The control group received conventional treatment which included hot packs and conventional exercises for shoulder impingement. The experimental group received trigger point dry needling along with conventional treatment. Home exercises were advised to both the groups. Data was collected and analyzed. The study concluded that both conventional treatment and dry needling as an adjunct to conventional treatment along with home exercise program are effective in reducing pain, disability and improving the shoulder ranges in impingement syndrome but on comparison of both the groups, the experimental group was more effective than control group.

INTRODUCTION

Upper quadrant pain represents high costs for health care systems. The upper quadrant includes conditions such as idiopathic neck pain, shoulder pain, elbow pain and wrist pain. There is evidence of peripheral and central sensitization mechanisms in different local pain syndromes of the upper quadrant[1]. Shoulder pain is the third most common musculoskeletal condition with a prevalence of 70%[2].

Shoulder impingement can be either primary or secondary[5,6]. The factors causing primary impingement are rotator cuff weakness, chronic inflammation of tendons of the rotator cuff or subacromial bursa, rotator cuff degenerative tendinopathy, and posterior capsular tightness leading to abnormal anterior or superior translation of humeral head. A relative decrease in subacromial space due to glenohumeral joint instability, degenerative changes and abnormal kinematics of the scapulothoracic joint contribute to secondary shoulder impingement. Shoulder impingement is usually diagnosed by positive results of clinically performed tests. Neer impingement test is performed by passively and forcibly elevating the subject's arm in the scapular plane with arm in medial rotation. The passive stress causes the greater tuberosity to jam against the anteroinferior border of the acromion. A positive test result is reflected by depicting pain on the subjects face. Hawkins-kennedy impingement test is performed by forward flexing the subjects arm to 90 degrees and then forcibly medially rotating the shoulder. Pain indicates a positive test for secondary impingement[7,8,9,10,11,12].

Overhead motion leads to stress in the postero-inferior structures of the shoulder that cause repetitive microtraumas and consequently tightness of the poteroinferior portion of the capsule and rotator cuff muscles generating a glenohumeral internal rotation deficit (GIRD). Recent studies show deleterious effects of postero-inferior capsule tightness. It is hypothesized that tightness of the postero-inferior capsule leads to postero-superior shift in the humeral head[21]. This proves that there is abnormal translation of the humeral head during glenohumeral rotation. The translation occurs in the opposite direction of the capsular tightening. This mechanism is called capsular constrained mechanism. This mechanism will lead to symptoms of impingement syndrome[22].

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Myofascial trigger points (MTrPs) are localised, hyperirritable spots in skeletal muscles associated with palpable nodules in muscle fibers. The trigger point has an abnormal biochemical composition with elevated concentrations of acetylcholine, noradrenaline and serotonin and a lower pH. These sustained contractions of muscle sarcomeres compresses local blood supply restricting the energy needs of the local region. This crisis of energy produces sensitizing substances that interact with some nociceptive (pain) nerves traversing in the local region which in turn can produce localized pain within the muscle at the neuromuscular junction Myofascial trigger points are common in patients with shoulder impingement syndrome. Several therapeutic approaches, pharmacological and non-pharmacological, are proposed for the management of active TrPs, with manual therapies, trigger point injections, and dry needling (TrP-DN) being among the most commonly used. Hence, this study was undertaken to study the effectiveness of dry needling on pain and functions on shoulder impingement in a population with upper quadrant dysfunction.

METHODOLOGY

The study was approved by ethics committee of the institute and was conducted at tertiary care centers and physiotherapy OPD centers affiliated with parental institute. The subjects with shoulder impingement who met the inclusion and exclusion criteria were recruited. Subjects were explained about the procedure, benefits and risks of the study and they were asked to sign the informed consent form (Annexure 4) in the language best understood by them. The subjects were randomly allocated into 2 groups. Group A was the control group and group B was the experimental group. Their case record form which also included the demographic data was filled (Annexure 1), shoulder active range of motion was assessed and they were asked to fill the DASH (Annexure 5) and Patient Specific Functional Scale(PSFS). Total of 50 patients were included in the study (25 in each group) and there were 6 dropouts which were not included in total no of samples. Subjects in both the groups were given treatment for 5 continuous days. All the outcome measures were taken pre-treatment and post 5 days of treatment. Subjects were advised to perform 2sets of exercises taught to them, as home programme.

Group A: Conventional treatment: Hot pack was given to the affected shoulder for 15-20mins[34,43].The conventional exercises include wand exercises, multiple angle isometrics, pendulum exercises, posterior capsular stretches and posture correction exercises.

Group B: Dry needling and conventional treatment. The conventional exercises were given as mentioned in group A.Upper trapezius, supraspinatus, infraspinatus, deltoid and biceps brachii muscles were palpated for trigger points. The muscles having trigger points were given dry needling. The depth of needle insertion was dependent on the muscle and ranged from 10-15mm for infraspinatus or deltoid and 30-35mm for the supraspinatus. After the first local twitch response was obtained, the needle was moved up and down (vertical motions) 3-5mm with no rotations until no more twitch responses were elicited. The duration of trigger point dry needling was 5-10mins for all the participants[42].

Home program: All the patients were advised to perform a home exercise program. It included wall walking, pendulum exercises, wand exercises, posture correction exercises and Self Stretching (pectorals and cross-chest stretch).

RESULTS

A total of 50(25-experimental group, 25-control group) patients were enrolled for the study. The mean age of subjects in the study was 40.42 ± 7.84. Out of 50 subjects, 12of the subjects were males and 38 subjects were females. The effectiveness of dry needling on pain and functions on shoulder impingement in population with upper quadrant dysfunction were studied. The outcome measures used were- Disability of Arm, Shoulder and Hand(DASH) and Patient Specific Functional Scale(PSFS). Data obtained was entered using MS-EXCEL 2010 and statistically analyzed using SPSS24 software. The data was tested for normal distribution using the Shapiro-wilk test. Parametric tests were used to analyze the data under normal distribution. Paired t test was used for comparison within the groups and independent t test for in between the groups. Non-parametric tests were used to analyze the categorical data and the data which did not follow normal distribution. Within the group, determination of differences of data was done using the Wilcoxon signed rank test. Between the groups, determination of differences of data was done using the Mann Whitney U test.

Table 1 Descriptive Data for Gender Distribution

Gender	Control group	Experimental group
Males	8(32%)	4(16%)
Females	17(68%)	21(84%)

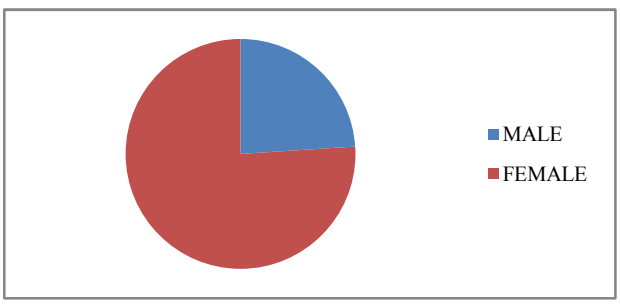
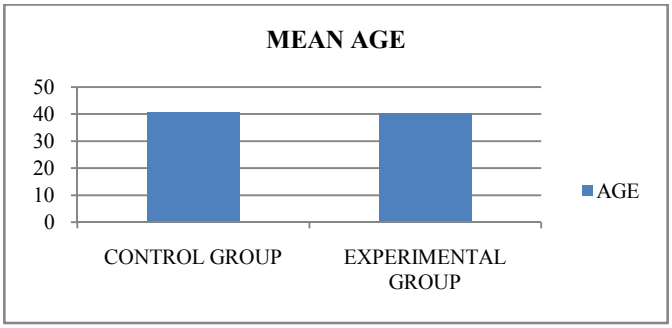


Table 2 Descriptive Data for Age (Years)

	N	Mean	Standard Deviation(SD)
Experimental group	25	40.40	±7.83
Control group	25	40.44	±8.01



Graph 1 Mean Age

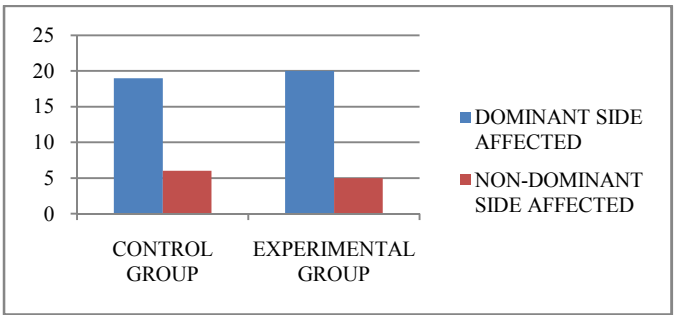
Table 2 and graph 1 shows mean age of subjects in control and experimental groups.

Table 3 Descriptive Data for Dominance

Dominance	Control group	Experimental group
RIGHT	21(84%)	21(84%)
LEFT	4(16%)	4(16%)

Table 4 Descriptive Data for Affected Side

Affected side	Control group	Experimental group
Dominant	19	16
Non- dominant	6	9



Graph 2 Dominance and Affected Side

Table 3, 4 and graph 2 shows that the dominant side was the affected side in most of the subjects in both experimental and control groups.

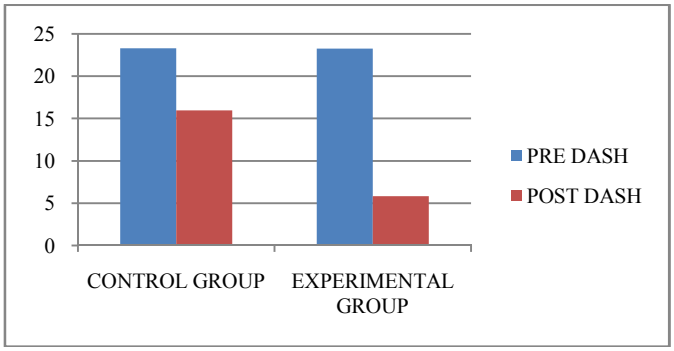
Non parametric statistical analysis of DASH and PSFS scores was performed. To determine within the group differences, Wilcoxon signed rank test was used. For determining between the two groups differences, Mann-Whitney U test was used.

Table 5 Dash Scores Pre and Post Treatment in Control Group

Dash	Median	95% Confidence Interval(CI)	Wilcoxon Test (z Value)	Two Tailed Probability
PRE	23.30	21.06-29.58	-4.16	0.000
POST	15.95	13.22-18.43		

Table 6 Dash Scores Pre and Post Treatment in Experimental Group

Dash	Median	95% Confidence Interval(CI)	Wilcoxon Test (z Value)	Two tailed probability
PRE	23.27	19.03-32.49	-4.37	.000
POST	5.83	3.44-8.57		

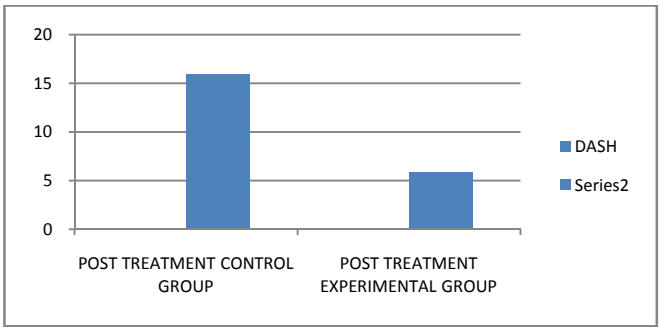


Graph 3 Pre-Post Dash Scores

Table 5, 6 and graph 3 shows median values for DASH scores. The Wilcoxon signed rank test was used for comparison. The test revealed statistically significant reduction in the disability scores for both control and experimental groups (Table 5, 6), p= 0.000.

Table 7 Comparison of Dash Scores Between 2 Groups

	Mann-Whitney (Z Value)	Two Tailed Probability
DASH	-5.20	0.000



Graph 4 Post Dash Scores

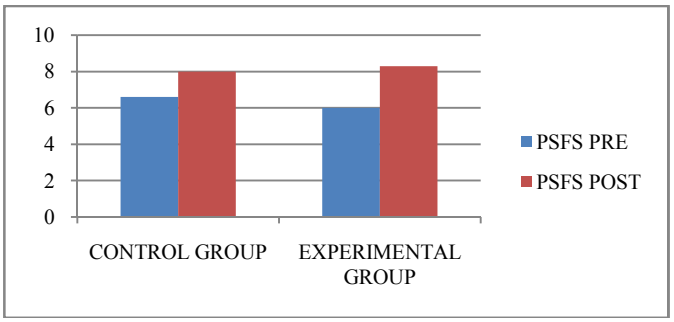
Table 7 and graph 4 shows comparison of DASH scores in between control and experimental group on 5th day of treatment. A significant reduction in disability was seen in the experimental group as compared to the control group (p=0.000).

Table 8 PSFS Scores Pre and Post Treatment in Control Group

PSFS	Median	95% Confidence Interval(CI)	Wilcoxon Test (z Value)	Two Tailed Probability
PRE	6.60	6.00-7.25	-4.09	.000
POST	8	7.04-8.30		

Table 9 PSFS Scores Pre and Post Treatment In Experimental Group

PSFS	Median	95% Confidence Interval(CI)	Wilcoxon Test (Z Value)	Two tailed probability
PRE	6	5.30-6.94	-4.38	.000
POST	8.3	8-8.55		

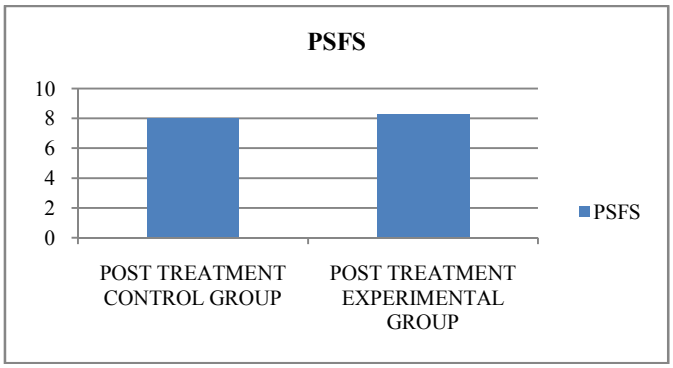


Graph 5 Pre-Post PSFS Scores

Table 8, 9 and graph 4 shows median values for PSFS scores. The Wilcoxon signed rank test was used for comparison. The test revealed statistically significant reduction in the disability scores for both control and experimental groups (Table 5, 6), p=0.000.

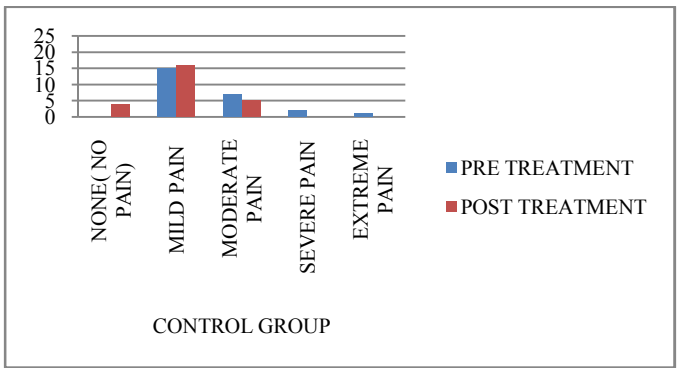
Table 10 Comparison of PSFS Scores between Two Groups

	Mann-Whitney (Z value)	Asymp. SIG (2 Tailed)
PSFS	-1.73	.082

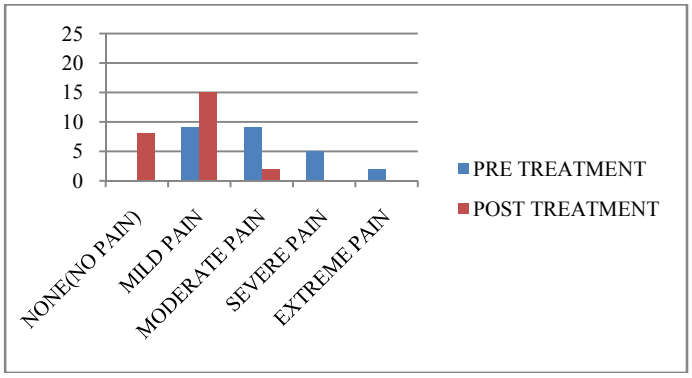


Graph 6 Post PSFS Scores

Table 10 and graph 6 shows comparison of PSFS scores in between control and experimental group on 5th day of treatment. There was no significant difference in disability in PSFS scores in the two groups(p=0.082).



Graph 15 Number of Subjects In Pre And Post Treatment, According To Pain Scale of Dash In Control Group



Graph 16 Number of Subjects In Pre And Post Treatment, According To Pain Scale of Dash In Experimental Group

Graph 15 and 16 shows that although there were many subjects having moderate and mild pain in the experimental group than the control group, but post treatment majority of subjects in experimental group were having mild or no pain and none having severe or extreme pain.

DISCUSSION

The interventions given to the control group included hot packs to the affected shoulder and conventional exercises for impingement syndrome.

Hot Packs

Hot packs have a great effect on cutaneous blood vessels, which results in the greatest temperature change within the first 1cm of tissue depth. With increase in superficial tissue temperature there is release of chemical mediators such as histamines and prostaglandins which results in vasodilatation. Stimulation of cutaneous thermoreceptors synapse on cutaneous blood vessels, causes release of bradykinin which relaxes the smooth muscle walls, resulting in vasodilatation. Vasodilatation leads to increase in blood flow to reduce ischemia of injured tissue and wash out of waste products resulting in decreased activity of pain receptors and thus elevating the pain thresholds[13].

Posterior Capsule Stretch

The stretching of the posterior capsule results in improved capsular extensibility leading to an improvement in the arthrokinematics thereby reducing the subacromial pressure thereby reducing pain[14,15].

Wand Exercises

These help to maintain and improve range of motion[14,15].

Multiple Angle Isometrics

In isometric contraction, muscle fiber length is constant, so muscle contraction occurs without joint movement. Isometric exercises are very useful when the strength of a muscle is to be maintained or increased but the movement of the joint is undesirable because of pain[14,15].

Pendulum (Codmans) Exercises

These exercises relaxes the muscles and helps to improve range of motion[14,15].

The interventions given to the experimental group included trigger point dry needling as well as conventional treatment.

Dry Needling

In dry needling technique, a needle is inserted into the trigger point to produce a local twitch response.

By eliciting a local twitch response there is an influence of spontaneous electrical activity (SEA). Insertion of needle at the end plate region may lead to increased discharges and immediately reduce acetylcholine (Ach) stores, leading to lesser SEA.

Dry needling also stimulates Aδ sensory afferent fibers and C fibers which send afferent signals to the dorsolateral tracts of the spinal cord and activate the supraspinal and higher centres involved in pain processing[16].

From the study it can be concluded that Conventional treatment and dry needling as an adjunct to conventional treatment along with home exercise program are effective in reducing pain, disability and improving the shoulder ranges in impingement syndrome.

Comparison between the two groups showed that dry needling along with conventional treatment is somewhat effective than conventional treatment, which proves the alternate hypothesis of the study.

After performing intergroup comparison, by using the Mann Whitney U test on the data for DASH scores, as evident from table 7 this study showed a significant improvement in the

experimental group as compared to the control group. Thus, supporting the experimental hypothesis and rejecting the null hypothesis. This improvement can be attributed to the use of dry needling for myofascial trigger points along with conventional exercises for shoulder impingement. The effect size for DASH scores in the current study was large (r=0.73) which suggests that there was a significant improvement in the experimental group as compared to the control group.

After performing intergroup comparison, by using the Mann Whitney U test on the data for PSFS scores, as evident from table 10 this study did not show any significant improvement statistically for physical function on PSFS. The effect size for PSFS scores in the current study was small (r=0.24) which suggests that there was no statistically significant improvement in PSFS scores in experimental group as compared to the control group.

Functional mobility can be affected by pain, reduced range of motion, and impaired muscle functions. As seen above there is an improvement in all the above factors which improved the functional mobility (as seen by improvement in DASH and PSFS scores).

Disablity of Arm, Shoulder and Hand (DASH) questionnaire assesses patient's functional disability mainly while using the upper extremity during different activities of daily living (ADLs). DASH is a validated and a highly reliable (α=0.96)[61] outcome measure used for shoulder pathologies which constitutes of pain and a disability index within. DASH has 30 items assessing- degree of difficulty during the preceding week in performing physical activities because of problems in the upper extremity (21 items); severity of each pain symptom, activity-related pain, tingling, weakness, and stiffness (5 items); and the problem's effect on social activities, work, and sleep, and its psychological impact (4 items). Each item is answered on a 5points scale ranging from 1 (no difficulty to perform, no symptom, or no impact) to 5 (unable to do, very severe symptom, or high impact).

Despite having used DASH, since the problems pertaining to the Indian population vary compared to other counter parts, the Patient Specific Functional Scale (PSFS) was used for the subject's additional complaints and to determine the effect of physical therapy on the activities in which subjects complained maximum discomfort. PSFS is a validated and reliable outcome (α= 0.92)[61]. The patients were asked to enlist upto 3-5 activities with which they have difficulty due to their condition and then rate their functional limitation associated with these activities. Discomfort due to shoulder pain may affect concentration, ease of working and performing ADLs. Reduction in pain may help in decreasing disability scores in these domains. Lifting weights during ADLs may also be comfortable due to reduction in pain. Patients may also have refrained from recreational activities due to pain and stress. Pain reduction and better mobility reduces stress to some extent. This would have helped in further reduction of the disability scores.

Hence, due to all these factors, there might have been reduction in the DASH and PSFS scores post treatment.

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