DOI: 10.7860/JCDR/2018/35141.11841

Experimental Research

Physiotherapy Section

Effect of Dry-Needling Induced Muscle Soreness (DIMS) on the Severity of Pain Post Deep Trigger Point Needling

SUKUMAR SHANMUGAM[1], LAWRENCE MATHIAS[2], AJAY THAKUR[3]

ABSTRACT

Introduction: Dry-Needling (DN) induced muscle soreness is a common adverse event that takes place in almost majority of patients who received deep dry needling treatment. The effect of soreness on clinical outcomes has not been evidenced in the existing literature.

Aim: To evaluate the correlation between the deep dry-needling induced muscle soreness and severity of shoulder pain in patients with myofascial pain.

Materials and Methods: Seventy six participants in the age group of 30 to 60 years with Myofascial Trigger Points (MTrP) in the shoulder girdle muscles were treated with 10-12 minutes of deep dry needling. Shoulder pain severity was assessed at baseline prior to dry needling and 48 hours after dry needling using 0-10 cm Visual Analog Scale (VAS). The severity of muscle soreness was assessed immediately after dry needling, at 24 hours and 48 hours after the deep dry needling. Correlation between the shoulder pain and muscle soreness was analysed using the Spearman correlation coefficient.

Result: A significant reduction of shoulder pain was observed at 48 hours (Median VAS: 7 at Baseline, 3 at 48 hours, and Median difference = 4, IQR = 2 - 3) after the dry needling. No significant correlation was observed between the original pain severity and needle induced muscle soreness at 24 hours (rho = -.218, p = 0.059) and 48 hours (rho = -.170, p=0.143).

Conclusion: Based on the result, we conclude that there is no significant correlation between the dry-needling induced muscle soreness and shoulder pain severity among the patients who received deep dry-needling for myofascial pain. We also suggest that dry-needling induced muscle soreness has no adverse effect on the shoulder pain severity post deep trigger point dry needling.

Keywords: Correlation, DIMS, Shoulder pain

INTRODUCTION

Myofascial trigger point (MTrP) is a hyperirritable and ischemic spot, which is formed within the cytoskeleton of skeletal muscle fibers with presence or absence of taut band [1]. Trigger points are commonly classified into active and latent, where active trigger point produce spontaneous pain and latent trigger point produce pain while manual muscle palpation and muscle length changes [2]. The increased biochemical substances surrounding areas of trigger points act like nociceptive stimulators, therefore individuals may experience abnormal pain perception at various intensities [3]. The capillary bed is compressed by increased mechanical pressure which was created by the formation of MTrP, causing ischemia to localized areas of the affected muscle fibers. The ischemic crisis over the trigger point area reduces the pH value which also increases the nociceptive stimulation [3,4].

The increased biochemical concentration and presence of ischemic atmosphere in the trigger point areas of skeletal muscle are basically reduced by the several treatment techniques. Oral administration or topical application of pharmacological agents and deep or superficial heating modalities [5] are used to reduce the biochemical concentration and increase the local circulation. The muscle tightness caused by excessive overlapping of actin and myosin filaments is reduced by the application of manual therapy techniques like muscle stretching, muscle energy techniques, massage manipulation etc., [5]. MTrPs deep within the muscles are effectively treated with trigger point DN because of its minimally invasive nature and DN was used as an alternative method where the conventional therapies fail to produce the effective deactivation of MTrPs [6].

Trigger point dry needling (Tr-DN) is one of the effective treatment techniques used in the clinical practice where a thin, solid dry needle is inserted into the muscle's trigger points by the trained clinician [7]. Deep DN is suitable for trigger point deactivation for eliciting the local twitch responses from the overloaded sarcomeres, which helps to increase the length of the muscle fibers [8,9]. The penetration of dry needle deep inside the muscle produces the therapeutic benefits but damage soft tissues on its insertion pathways. Cellular damage and the increased capillary circulation in the dry-needle insertion areas develop inflammatory reactions during the post needling period [10].

External or internal bleeding, hematoma formation, bruises, muscle soreness are the common adverse events developed during the post needling period. Among these complications, the feeling of heaviness over the needling areas is usually described as DN induced muscle soreness or post-needling soreness [10,11]. The patients are usually informed about the possible development of muscle soreness by the clinicians prior to needling, and educate them to differentiate the muscle soreness from their actual pain sensation. Post needling soreness can develop immediately after DN or several hours later. However, this sensation may subside within 24 to 48 hours or longer if the severity of soreness is high or inadequate post needling management given for muscle soreness [11,12].

The severity of DN induced muscle soreness is mild to severe [12], and a clinician might fail to confirm whether the soreness is a positive or negative sign for the patient. The relationship between the occurrence of soreness and its role in clinical outcomes of original pain severity is evidenced in one study [13]. And, according to the perceptual model of pain management, the development of muscle soreness caused by DN may induce the effective tonal regulation

and muscle relaxation. Presence of post-needling soreness from the needled muscle maintain the sustained flow of mechano-receptive stimulus to higher center even after 24 to 48 hours of DN [14]. This mechanical perception may help to induce the endorphin release and muscle relaxation. So, we aimed to evaluate the correlation between DN induced muscle soreness and severity of pain (baseline and post needling). This may help clinicians to take decision to select different types of dry needling techniques, and appropriate steps to reduce the post-needling soreness if there is a possibility of positive correlation between these variables.

MATERIALS AND METHODS

This study was a part of a randomized clinical trial (CTRI/2016/04/006828), conducted in the Department of Physiotherapy, Justice K. S. Hegde Charitable Hospital over a period of 24 months (February 2014 - January 2016). The institutional ethics committee approved this experimental study. A written informed consent was obtained from all the participants prior to the study commencement. A total of 278 subjects who had complaints of shoulder pain were screened for the presence of MTrP in the shoulder girdle muscles. The preliminary medical examination was carried out by Orthopaedic Physician, and routine laboratory investigations were done to rule-out the presence of major systemic illnesses. Manual muscle palpation (pincer/flat/snapping) was used to find out the hyperirritable spots with or without taut bands in the shoulder girdle muscles [15].

A total of 76 participants with complaints of persistent pain in the shoulder (VAS; ≥5/10cm), the presence of active trigger points, age between 30-60 years were included, and remaining 202 subjects were excluded. Not meeting the inclusion criteria (n=101), Diabetes mellitus (n=36), peripheral neuropathies (n=6), cervical radiculopathy (n=12), patients with compromised immune system (n=4), cardiac problems (n=10), autoimmune disorders (n=7), unwilling participants (n=15) and miscellaneous conditions (n=11) were the reasons for exclusion. Participants who met the selection criteria were explained with the study purpose and provided information regarding the treatments.

Deep trigger point DN: Deep trigger point DN was carried out by Physiotherapist (first author of this study) who has expertise in DN therapy for more than six years.

Participants were positioned in a comfortable lying position with adequate pillow support, and skin over the trigger point area of shoulder girdle muscles was cleansed with Sterimax® antiseptic liquid. The maximum tender spot with contractile knots were identified for needle insertion. Active MTrP in the upper trapezius, supraspinatus, levator scapulae, deltoid, infraspinatus, teres minor and major, latisismus dorsi, pectoralis major were selected for needling. Prior to the DN, the participants were instructed to inform to treating clinician if they experience severe pain or any other discomfort while inserting the dry needle [11]. Dry needle with 0.30-mm thickness and 40-mm length (Cloud & Dragon, Jiangsu, China) was used to penetrate into the MTrP. At the suitable angle and perpendicular to the muscles trigger point location, the needles were inserted without causing damage to the neighbouring vital tissues or organs [10,11]. The needle was moved away from trigger point and re-inserted again into trigger points with the gentle strike over it, once the needle reached the trigger point location. The local twitch responses from the trigger points are elicited from each trigger points, and then the needles were placed into the muscle for 10-12 minutes. The needled area was compressed manually with the sterile dry cotton for several seconds to prevent the external bleeding [11].

Outcome Assessment: The intensity of shoulder pain was assessed at baseline prior to the DN and 48 after the DN using the 11-point visual analog scale (0-10). A total of 11 vertical lines are numbered from 0 to 10 where 0 indicate the absence of the subjective experience of pain and 10 indicate severe pain experienced by the subjects. This 11 points numerical rating visual analog scale with instruction in preferred languages was provided to them for selecting most appropriate score based on their pain intensity. VAS is one of the common and valid outcome assessment tool used to assess the pain severity in the clinical population and previous studies have reported that it has a high intra and inter-rater reliability [16]. The post DN muscle soreness was assessed based on their personal experience of soreness severity. All participants were asked to report their maximum level of soreness immediately, 24 hours and 48 hours after the deep DN. The scoring was given from 0 to 3 where 0 for the absence of soreness, 1 for mild, 2 for moderate and 3 for severe muscle soreness. Assessment of pain severity and muscle soreness were assessed by another clinician who was not involved in the DN intervention.

STATISTICAL METHODS

Participant's age was described in mean (standard deviation), gender was represented by frequency (percentage) and the number of trigger points, duration of pain and shoulder pain severity were described in form of the median (inter-quartile range). The correlation between the shoulder pain severity (at baseline and at 48 hours after DN) and DN induced muscle soreness was analysed by using Spearman correlation coefficient (rho). Data were analysed using the IBM: SPSS-version '21' and p-value < 0.05 was considered for statistical significance.

RESULTS

The mean age of participants (n=76) was 44 years with standard deviation of 6.75 years. The average number of active trigger points in the shoulder girdle muscles was 6 (Range: 3 - 8) and the estimated median value of the subjective experience of spontaneous pain in the 0-10 cm VAS scale was 7 (IQR: 6-8). Further, the duration of the subjective experience of shoulder pain in the participants was six weeks (IQR: 5-11) [Table/Fig-1].

A total of 53 out of 76 participants experienced the muscle soreness immediately (within an hour) after the deep DN to the shoulder girdle muscles. Out of the 53 subjects, 40 subjects experienced mild soreness and 13 subjects experienced moderate soreness. A total of 74 participants reported muscle soreness within the last 24 hours

Demographic characteristics		
Age in years: Mean (SD)		44.55 (6.75)
Gender: N (%)	Male	28 (36.8)
	Female	48 (63.2)
Clinical characteristics		Median (IQR)
Number of active trigger points		6 (3 - 8)
Duration of condition in weeks		6 (5 - 11)
Pre intervention pain score (VAS)		7 (6 - 8)
Post intervention pain score (VAS)		3 (2 - 3)

[Table/Fig-1]: Demographic and clinical characteristics of subjects participated in this study.
SD = Standard Deviation, VAS = Visual Analog Scale, IQR = Inter-Quartile Range,

Grade of muscle soreness (0-3)	Number of participants reported about their subjective experience of muscle soreness after deep dry-needling: N (%)		
	Immediate	At 24 hours	At 48 hours
0-Absent	23 (30.3)	02 (2.6)	57 (75)
1-Mild	40 (52.6)	30 (39.5)	19 (25)
2-Moderate	13 (17.1)	35 (46.1)	00 (00)
3-Severe	00 (00)	09 (11.8)	00 (00)

[Table/Fig-2]: Number (Percentage) of participants developed Dry-needling induced muscle soreness post deep trigger point dry needling.
N= No of participants

Timeline of muscle soreness development	Statistics	VAS score of shoulder pain severity pre and post DDN	
		Pre-intervention VAS score Median = 7, IQR= 6-8	VAS score 48 hours after DDN Median = 3, IQR = 2-3)
Immediate after DDN	rho	-0.153	-0.015
	p	0.187	p=0.900
At 24 hours after DDN	Rho	-0.011	-0.218
	p	0.924	p=0.059
At 48 hours after DDN	Rho	0.109	-0.170
	p	0.349	p=143

[Table/Fig-3]: Correlation between the dry-needling induced muscle soreness and shoulder pain severity of pre and post deep dry needling.
VAS = Visual Analog Scale, DDN = Deep Dry Needling, IQR = Inter-Quartile Range, rho = Spearman correlation coefficient

Timeline of muscle soreness development	Statistics	Duration of shoulder pain disorders in weeks: Median = 6 (IQR: 5 - 11)
Immediate after DDN	rho	-0.729
	p	0.001
At 24 hours after DDN	rho	-0.319
	p	0.006
At 48 hours after DDN	rho	-0.039
	p	0.739

[Table/Fig-4]: Correlation between dry needling induced muscle soreness and duration of shoulder pain disorders.
rho = Spearman correlation coefficient, IQR = Inter-Quartile Range

after the DN. A total of 65 participants have reported mild (n=30) to moderate (n=35) muscle soreness whereas nine participants have reported the severe muscle soreness after 24 hours. Most of the participants who have developed mild to severe soreness within 24 hours recovered from the soreness after 48 hours of DN. Only 19 subjects experienced the mild muscle soreness even after the 48 hours of deep DN [Table/Fig-2].

The severity of shoulder pain significantly decreased at 48 hours (Median VAS score = 3) from the baseline pain score (Median VAS score = 7) after the single session of deep DN [Table/Fig-3]. The effect of shoulder pain severity on the development of muscle soreness and vice-versa was evaluated by the Spearman correlation coefficient. The occurrence of DN induced muscle soreness immediate (p=0.187), at 24 hours (p=0.924) and at 48 hours (p=0.349) after the DN was not influenced by the subjective experience of baseline (prior to DN) shoulder pain. Similarly, the shoulder pain score at 48 hours after the DN was also not influenced by the various grades of DN induced muscle soreness immediate (p=0.900), at 24 hours (p=0.059) and 48 hours (p=0.143) after the DN [Table/Fig-3]. There was negative correlation and statistical significance was observed between the duration of shoulder pain disorders and muscle soreness of immediate (p<0.001) and at 24 hours (p=0.006) after the deep DN. But, no existence of correlation (p=0.739) between muscle soreness after the 48 hours and the duration of shoulder pain disorders [Table/Fig-4].

DISCUSSION

Previous studies reported about significant correlation of post deep DN induced muscle soreness with pain during needling, number of needle insertion [17], psychological factors such as pain-related anxiety, kinesiophobia and fear of pain [18]. The current study has evaluated the correlation between deep DN induced muscle soreness and post needling visual analog scale scores of shoulder pain severity to bring out the clinical message regarding the management of muscle soreness caused by the deep DN in the shoulder pain condition.

The shoulder girdle muscles with the clinical presentation of MTrP were treated using deep DN technique (single session: 10-12 minutes). Shoulder pain severity at baseline prior to the DN application and at 48 hours after the DN was assessed. And, DN induced muscle soreness immediately after DN, at 24 & 48 hours after the DN was also assessed. This result [Table/Fig-3] suggests that there is no relationship between post needling muscle soreness and pre or post needling shoulder pain severity. Even the severity of muscle soreness does not influence the improvement from the pain. This result suggests that deep DN can be applied to reduce pain, if the patient complains of severe shoulder pain from the MTrP.

Short-term effect of DN in myofascial pain syndrome has been evidenced in previous studies and our finding from this study also support the existing literature on the DN effects in myofascial pain. The study by Myburgh C et al., evaluated the role of delayed onset of muscle soreness following the DN on the improvement of pain threshold [13]. They found that those participants developed muscle soreness have improved better irrespective of symptom state and also reported that all participants uniformly experienced delayed onset of muscle soreness. Our current study results also indicate that majority of participants experienced the needle induced muscle soreness irrespective of shoulder pain severity prior to the DN.

Martin-Pintado-Zugasti A et al., stated that post needling muscle soreness and hyperalgesia are common phenomenon in subjects treated with deep DN to the latent trapezius trigger points. They also found that pain during needling and number of needles insertion has significant correlation with post needling soreness. Our study finding related to the occurrence of muscle soreness after deep DN to the active MTrP in shoulder girdle muscles also match with the findings of Martin-Pintado-Zugasti A et al., study [17]. These facts give us a clear idea that DN induced muscle soreness can develop following the deep DN treatment of active and latent MTrP.

Another study by Martin-Pintado-Zugasti A et al., found that there was no significant effect of spray and stretch technique on mechanical hyperalgesia after deep DN [19]. Further, they also evidenced a significant correlation of post needling pain severity with psychological factors but not with post needling soreness. This fact is rightly reported in our study where the results showed insignificant correlation between the post needling muscle soreness and post needling pain severity.

Manual pressure over the skin immediately after removal of dry needle from the treatment site is a routine procedure to prevent the occurrence of several adverse events. In order to reduce the severity of post deep DN muscle soreness the ischemic compression over the needled area was experimented through a double blind randomized trial. The intensity and duration of post needling soreness was significantly reduced after application of ischemic compression following dry needling [20]. Our study did not report the role of ischemic compression but future study can use this method as standard post needling adjunct therapy to compare the clinical effectiveness of other post needling treatment techniques.

LIMITATION

In this study, we have focused primarily on the correlation between the DN induced muscle soreness and shoulder pain severity.

CONCLUSION

The severity of shoulder pain prior to dry needling did not have an influencing role in the development of muscle soreness after the deep trigger point dry needling. Similarly, the development of muscle soreness has not affected the pain reduction after the application of dry needling. Overall, results of this study indicate insignificant correlation between these two variables, and we suggest that the clinician can perform the deep dry needling in the multiple muscles.

REFERENCES

[1] Simons DG, Dommerholt J. Myofascial pain syndrome: trigger points. J Musculoskelet Pain 2007;15:63-79.
[2] Gerwin RD. Classification, epidemiology, and natural history of myofascial pain syn-drome. Curr Pain Headache Rep. 2001;5:412-20.
[3] Shah JP, Danoff JV, Desai MJ, Parikh S, Nakamura LY, Phillips TM, et al. Biochemicals associated with pain and inflammation are elevated in sites near to and remote from active myofascial trigger points. Arch Phys Med Rehabil. 2008;89:16-23.
[4] Sikdar S, Ortiz R, Gebreab T, Gerber LH, Shah JP. Understanding the vascular environment of myofascial trigger points using ultrasonic imaging and computational modelling. Conf Proc IEEE Eng Med Biol Soc. 2010;2010:5302-05.
[5] Bron C. Treatment of myofascial trigger points in common shoulder disorders by physical therapy: A randomized controlled trial. BMC Musculoskelet Disord. 2007;8:107-14
[6] Ziaeifar M, Arab AM, Karimi N, Nourbakhsh MR. The effect of dry needling on pain, pressure pain threshold and disability in patients with a myofascial trigger point in the upper trapezius muscle. J Bodyw Mov Ther. 2014;18:298-305.
[7] Liu L, Huang QM, Liu QG, Ye G, Bo CZ, Chen MJ, et al. Effectiveness of dry needling for myofascial trigger points associated with neck and shoulder pain: a systematic review and meta analysis. Arch Phys Med Rehabil. 2015;96(5):944-55.
[8] Shanmugam S, Mathias L. Immediate effects of paraspinal dry needling in patients with acute facet lock induced wry neck. J Clin Diag Resear. 2017;6:YM01-YM03.
[9] Dunning J, Butts R, Mourad F, Young I, Flannagan S, Perreaut T. Dry needling: a literature review with implication for clinical practice guidelines. Phys Ther Rev. 2014;19(40):252-65.
[10] Dommerholt J, Fernández-de-las-Peñas C, editors. Trigger Point Dry Needling An Evidence and Clinical-Based Approach. 1st ed. London: Churchill Livingstone Elsevier; c2013. p.73-118.
[11] Dunning J, Butts R, Mourad F, Young I, Flannagan S, Perreault T. Dry needling: a literature review with implications for clinical practice guidelines. Phys Ther Rev 2014;19(4):252–265.
[12] Cheung K, Hume P, Maxwell L. Delayed onset muscle soreness: treatment strategies and performance factors. Sports Medicine 2003;33(2):145-64.
[13] Myburgh C, Hartvigsen J, Aagaard P, Holsgaard-Larsen A. Skeletal muscle contractility, self-reported pain and tissue sensitivity in females with neck / shoulder pain and upper trapezius myofascial trigger points-a randomized intervention study. Chiropr Man Therap 2012;20(1):36-46.
[14] Shanmugam S. Inverse electrode placement may help to improve electrotherapeutic effects in the field of chronic pain management. Korean J Pain. 2016;29:202-04.
[15] Bron C, Franssen J, Wensing M, Oostendorp RA. Interrater reliability of palpation of myofascial trigger points in three shoulder muscles. J Man Manipulative Ther. 2007;15:203-15.
[16] Boonstra AM, Schiphorst-Preuper HR, Reneman MF, Posthumus JB, Stewart RE. Reliability and validity of the visual analogue scale for disability in patients with chronic musculoskeletal pain. Int J Rehabil Res. 2008;31:165-69.
[17] Martin-Pintado-Zugasti A, Roddriguez-Fernandez AL, Fernandez-Carnero J. Postneedling soreness after deep dry needling of a latent myofascial trigger point in the upper trapezius muscle: Characteristics, sex differences and associated factors. J Back Musculoskelet Rehabil. 2016;29(2):301-08.
[18] Martin-Pintado-Zugasti A, Lopez-Lopez A, Gonzalez Gutierrez JL, Pecos-Martin D, Roddriguez-Fernandez AL, Alguacil-Diego IM, et al. the role of psychological factors in the perception of postneedling soreness and the influence of postneedling intervention. PM R. 2017;9(4):348-55.
[19] Martin-Pintado-Zugasti A, Roddriguez-Fernandez AL, Garcia-Muro F, Lopez-Lopez A, Mayoral O, Mesa-Jimenez J, et al. effects of spray and stretch on postneedling soreness and sensitivity after dry needling of a latent myofascial trigger point. Arch Phys Med Rehabil. 2014;95(10):1925-32.
[20] Martin-Pintado-Zugasti A, Pecos-Martin D, Roddriguez-Fernandez AL, Alguacil-Diego IM, Portillo-Aceituno A, Gallego-Izquierdo T, et al. ischemic compression after dry needling of a latent myofascial trigger point reduces postneedling soreness intensity and duration. PM R. 2015;7(10):1026-34.

PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Neuro-Physiotherapy, NITTE Institute of Physiotherapy, Mangalore, Karnataka, India.
2. Professor, Department of Orthopedics, K. S. Hegde Medical Academy, Mangalore, Karnataka, India.
3. Associate Professor, Department of Neuro-Physiotherapy, NITTE Institute of Physiotherapy, Mangalore, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Sukumar Shanmugam,
Assistant Professor, Institute of Physiotherapy/Nitte, Mangalore, Karnataka, India.
E-mail: suku729@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Dec 13, 2017**
Date of Peer Review: **Feb 19, 2018**
Date of Acceptance: **Apr 30, 2018**
Date of Publishing: **Jul 01, 2018**