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Research Paper: Effects of Low-Level Laser Irradiation and Dry Needling on the Symptoms of Myofascial Pain Syndrome: A Controlled Pilot Study

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ABSTRACT

Introduction: This study aimed to compare the effects of Low-Level Laser Therapy (LLLT) combined with Dry Needling (DN) with DN alone on pain and neck disability index following myofascial pain syndrome.

Materials and Methods: Sixteen women with active Trigger Points (TrPs) in their upper trapezius muscles participated in this study. They were divided into two groups: Experimental and control. The experimental group received one session of the DN plus the LLLT with 6 j/cm^2 energy at their TrPs. The patients in the control group were under a similar procedure, but they did not receive any energy by the LLLT (placebo). The pain score was assessed before, immediately, and 48 hours after the treatment. Neck Disability Index (NDI) was assessed before and 48 hours after the treatment.

Results: There was a significant improvement in pain intensity and NDI scores 48 hours after the treatment in both groups compared with the baseline scores ($P<0.05$). The pain was also significantly reduced at the patients following laser therapy immediately after the treatment ($P=0.01$).

Conclusion: A combination of the LLLT and DN might be more effective compared with using DN alone, and reduce immediate pain at the patients with the active TrPs. There was no difference between the groups 48 hours after the treatment. It seems that LLLT has no considerable effect on NDI and pain intensity 48 hours after the treatment.

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1. Introduction

Myofascial Pain Syndrome (MPS) is one of the most common distressful disorders that is frequently seen in clinical practice. The MPS is initiated through Myofascial Trigger Points (MTrPs) that are hypersensitive spots located in the taut bands of skeletal muscles. They are painful by compression or palpation and may end in characteristic referral pain, tenderness, and autonomic response to a remote area [1-4]. Upper trapezius muscle is the most common muscle for the MTrPs. The MPS causes pain, tenderness, limited Range of Motion (ROM), and functional disability in the neck and shoulder area. It can also have a big impact on patients' social, work activities, and quality of life [3-5]. Several approaches have currently been used to treat the MTrPs. However, a specified protocol as the best treatment option for the MTrPs does not exist [4].

Dry Needling (DN) is a well-known technique to care for MTrPs [2]. DN is an invasive technique with side effects like bleeding and inflammation [3]. However, DN helps to improve the MTrPs signs and symptoms through different mechanisms, such as mechanical, chemical, and neurophysiological. DN can normalizes the chemical environment of an active MTrPs, removes the source of muscle irritation, normalizes peripheral nerve sensitization, releases muscle shortening, decreases spontaneous muscle activity, and helps to promote self-healing of injured tissue [6].

Low-Level Laser Therapy (LLLT) is a non-invasive treatment and is widely used as a pain relief modality [7, 8]. Some studies have stated that LLLT may help reduce rigidity and thereby increase blood circulation [9]. Following microcirculation recovery, LLLT enhances oxygenation and reduces inflammation during the healing process of the MTrPs [3, 10]. Some previous research reported that LLLT significantly improved pain, pain threshold, cervical ROMs, and quality of life in people with the MPS [3]. However, controversial results have been reported regarding the effects of the LLLT in musculoskeletal pain in patients with MPS [11].

The purpose of this research was to investigate the synergic effects of combined LLLT and DN versus DN application alone on pain intensity and neck disability in women with the MTrPs at their Upper Trapezius Muscles (UTMs).

2. Materials and Methods

This research was a randomized clinical pilot study. This was a double-blind study in which both patients and the assessor were not aware of the laser type that was used (low power laser or the placebo laser). Sixteen women, aged 18-25 years, with an active trigger point of UTM were recruited for this study. Most volunteers were students at the Tehran University of Medical Sciences. The inclusion criteria were the patients who had neck pain for the past three months with a moderate level of pain intensity (between 3 to 7 based on 10 grades of visual analog scale [VAS]), with the presence of one trigger point at UTM that interfered with palpation based on the international Delphi panel[1] [12]. The patients would be excluded from the study if they had fibromyalgia, cervical radiculopathy, history of cervical surgery or background of injury, as well as contraindications for dry needling such as local infection, skin ulcers in the area of treatment, taking anticoagulants, or anything that may disrupt the correct assessment such as alcohol and drug, as well as communication and cognitive impairment. This study was approved by the Medical Ethics Committee of Tehran University of Medical Sciences.

All participants signed voluntarily an informed consent form after they were informed about the study objectives and procedures. The volunteers were randomly assigned to the experimental (DN + LLLT) and control groups (DN + placebo laser). The demographic data such as age and body mass index were evaluated before the treatment.

The trigger point was determined before the intervention. If there were several MTrPs, the most active painful trigger point would be selected and marked with an anti-sensitive stick. All volunteers were asked to lay in a prone position. The specified MTrP was held with a pincer grasp by the therapist, and that was repeatedly needled forward and backward until no more local twitch responses were elicited (Figure 1). Then, they were put under a sham laser or LLLT application where they kept their prone position. In the experimental group, the subjects received a dose of 6 J/cm^2 energy on the needled site by an 810-nm continuous-wave laser device (model 860B- made by Novin) with the optimal power of 100 MW. In the control group, the probe of the laser was placed at the same point in the off situation and for 30 seconds. The patients wore protective eyeglasses in both groups. There was just one session of treatment for each group. All assessments were performed by the assessor

1. Delphi panel criteria are referral pain with a specific distribution, presence of a palpable taut band in muscle, hypersensitive tender spot within taut band [12].

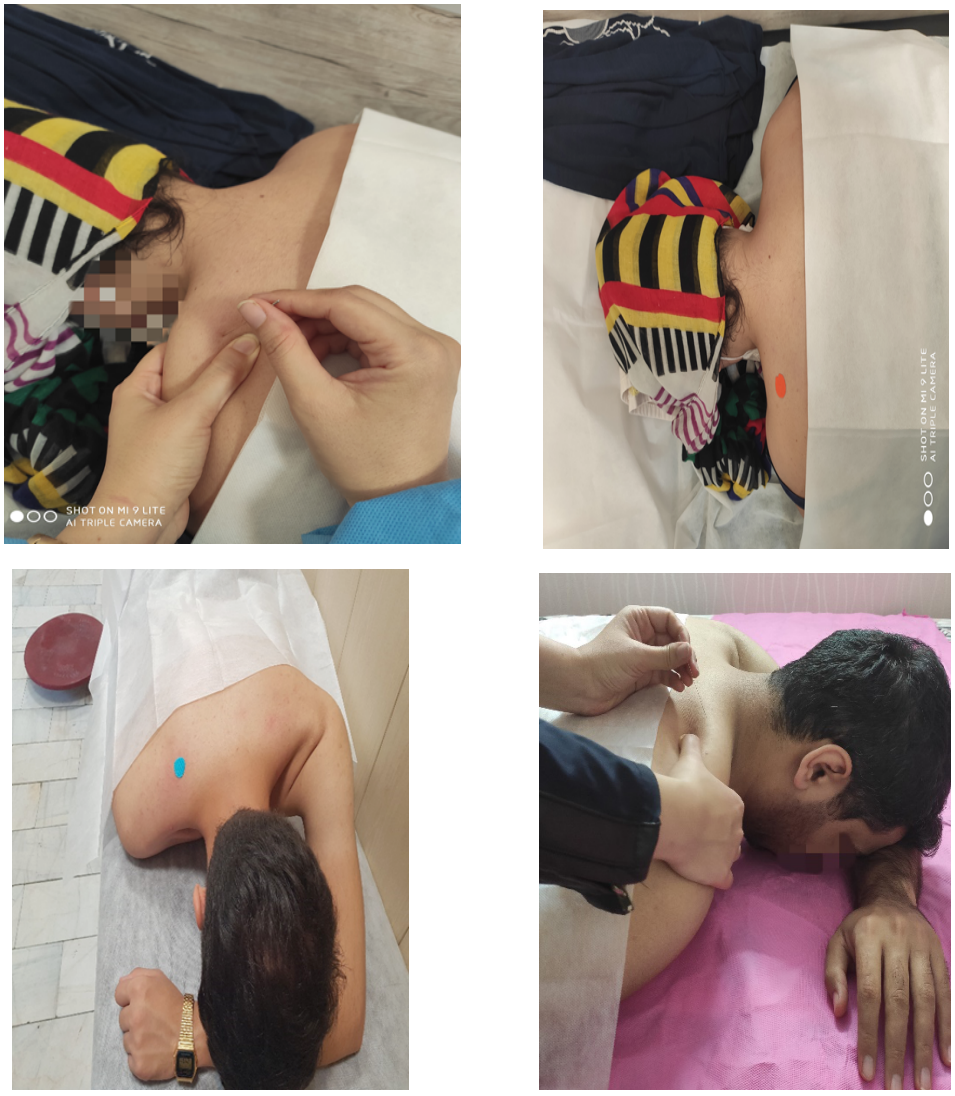

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Figure 1. Dry needling process, the selected TrP was marked with an anti-sensitive stick. The volunteers were asked to lay in a prone position. The specified MTrP was held with a pincer grasp by the therapist, and that was repeatedly needled forward and backward until no more local twitch responses were elicited.

who was a professional physical therapist. The assessor left the room at the time of treatment, and the intervention was performed by another physical therapist.

Outcome measures

The pain intensity was assessed before, immediately after, and 48 hours after the treatment session for both groups. Besides, the Neck Disability Index (NDI) questionnaire was administered before and 48 hours after the treatment session.

Pain intensity

The severity of pain was measured based on a 10-cm Visual Analog Scale (VAS) that represents "no pain" at one end (0 cm) and "very, very painful" at the other end (10 cm). We asked all patients to mark their pain senses on this scale. This method has been demonstrated as a reliable and valid instrument to measure neck pain [13].

Neck Disability Index

The Iranian version of the NDI questionnaire was administered for the assessment of disability. This tool is a valid and reliable method of measuring the functional status in Persian-speaking patients with neck pain. It presents acceptable reliability with an Intraclass Corre-

lation Coefficient (ICC) of 0.90 to 0.97 [14]. The questionnaire is composed of 10 questions related to daily functional activities with a minimum score of 10 and a maximum score of 60 that shows the disability level.

Statistical analysis

The statistical analysis was accomplished by the SPSS version 21. The alpha level was considered as 0.05 for all measurements. The Kolmogorov-Smirnov test was performed to assess the normality of data distribution. The Student t test was applied to compare baseline data between two groups. Two-way repeated-measures ANOVA was employed to measure the VAS and NDI scores. The VAS had got three levels of the time factor (before treatment, immediately after treatment, and 48 hours after treatment) with two levels of group factor (LLLT+ DN and DN only), and NDI had got two levels of time factor (before treatment and 48 hours after treatment) with two levels of group factor (LLLT+ DN and DN only).

3. Results

Distributions of all variables were normal before and after the measurement sessions. There were also no differences at the baseline between the two groups (Table 1). Demographic information and pre- and post-outcome measures of the VAS and NDI for both groups are presented in Table 1.

VAS

Two-way repeated measures ANOVA revealed a significant effect for time factor (F=5.28, P=0.01) that clarified that the VAS decreased in patients of both groups. Moreover, repeated measures ANOVA showed a significant interaction between group and time factors (F=52,87, P< 0.001) for changes in VAS, but there was no significant effect for group factor (F=3.77, P=0.07). Bonferroni post hoc analysis demonstrated that the DN+LLLT application had greater effects on pain decrease, immediately after the intervention (P=0.014) compared with that in the control group. It was also effective 48 hours after treatment for both groups (P< 0.05) with no significant differences between the two groups. Table 2 presents the changes in VAS in both groups during the time.

VAS

Two-way repeated measures ANOVA revealed that group main effect was not significant for VAS, while the time main effect and interaction effect were statistically significant. Bonferroni post hoc analysis revealed that within the intervention group, the VAS was significantly increased immediately after the treatment as compared with that before the treatment (P =0.014), while no such differences were observed in the control group. Also, in both groups, the VAS significantly increased 48 hours after the treatment compared to that before the treatment (PLLLT<0.001, Pcontrol=0.001)

NDI

Two-way repeated measures ANOVA showed a significant effect for time factor (F=28.75, P<0.001). It revealed the NDI increased in the patients of both groups. There was no significant interaction between group and time (F=3.75, P=0.07) and also no significant effect for group factor (F=1.70, P=0.21). Table 3 presents the changes in VAS in both groups during the time.

NDI

The ANOVA showed group main effect and interaction effect were not significant for NDI, while the time main effect was significant. Bonferroni reflected, in both groups, that the NDI were significantly increased 48 hours after the treatment compared to that before the treatment (P<0.001).

4. Discussion

This study compared the synergistic effects of laser therapy and DN with DN application alone on patients with chronic myofascial pain syndrome at the trapezius muscle. Pain and neck disability of the patients with the MTrPs were improved 48 hours after the treatment in both experimental and control groups. There were no significant differences between the two groups 48 hours after the treatment. However, there was an immediate and significant improvement in pain level just in the experimental group. The results of this study were similar to the studies accomplished by Ziaeifar et al. [4], and Dominik et al. [15] who examined the effects of dry needles on patients with the MTrPs at upper trapezius muscles. The results of this study clarified that laser therapy application with the DN leads to an immediate reduction in pain compared to the DN application alone. This result was consistent with the study of Ilbuldu, Ebru et al. [16] that evaluated the effects of laser therapy and DN on MTrPs at the upper trapezius muscle. However, Agung et al. [17] reported that the LLLT and DN were equally efficient in alleviating pain and increasing the pain threshold and cervical ROMs in patients with a myofascial pain syndrome of the upper trapezius muscle. Edwards et al. [18] studied the DN application followed by an active

Table 1. Demographic data and the VAS and NDI values at the baseline

Variabels		Mean±SD		P
		Low-Level Laser Therapy + DN Group	Placebo Laser + DN Group	
Demographic data	Age, y	25.00±3.16	24.25±5.99	0.759
	Body mass index, kg/m²	21.47±2.79	23.45±3.29	0.216
Visual Analog Scale	Baseline	4.37±0.92	3.81±0.99	0.260
Neck Disability Index	Baseline	8.37±2.25	5.25±2.12	0.089

There were no differences at the baseline between the two groups.

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Table 2. Changes in VAS values during the time and the main effects for VAS according to the two-way repeated measures ANOVA

Group	Baseline	Mean±SD		Time Main Effect P Value	Interaction Effect P	Group Main Effect P
		Immediately After the Intervention	Forty-Eight Hours After the Intervention			
Low-level laser therapy + dry needling group	4.37±0.92	1.94±1.26	0.40±0.42	0.011*	0.000*	0.073*
Placebo Laser + dry needling group	3.81±0.99	3.37±0.52	1.27±1.23			

*Significant Difference

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Table 3. Changes in neck disability index values during the time and the main effects for visual analog scale according to the 2-way repeated measures ANOVA

Group	Mean±SD		Time Main Effect P	Interaction Effect P	Group Main Effect P
	Baseline	Forty-Eight Hours After the Intervention			
Low-level laser therapy + dry needling group	8.37±2.25	2.25±1.75	0.000*	0.073	0.213
Placebo laser + DN group	5.25±2.12	2.37±2.44			

* Significant Difference

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stretching technique at the patients with musculoskeletal pain and reported that the method could be much effective than stretching alone, or no treatment, to reduce pain and sensitivity.

The DN application may improve the symptoms of myofascial pain syndrome with several mechanisms, including mechanical, neurophysiologic, and chemical ones [6]. Laser therapy can be advantageous in many areas of healthcare by its biochemical, bioelectric, and bioenergetic effects. Laser therapy can increase local microcirculation, decrease pain level, and modulate the inflammatory process [19, 20]. Ceylan et al. evaluated the impacts of infrared laser on trigger points and concluded that this type of laser would decrease the pain by releasing an important mediator of pain inhibition, i.e., serotonin [21]. LLLT decreases mitochondrial membrane potential and so to decrease the ATP production. Eventu-

ally, this procedure leads to neural blockade. Nociceptor blockade leads to immediate pain relief [22]. Decrease of peripheral sensitization lowers the activation threshold of receptors and also decreases the release of inflammatory neurotransmitters [22]. DN with repetitive needling insertion causes neuromuscular damage, local bleeding, and irritation. This is the secondary effect of DN that is called post needling soreness [23]. This effect could be the reason why there is no reduction of pain in the control group immediately after the treatment. Laser therapy following injury could inhibit the release of factors that play a key role in the inflammatory process [24]. Probably this effect may decrease the pain in LLLT immediately after the treatment, but in the control group, we could not see the relief of pain immediately after the treatment.

This study had some limitations, including small sample size and lack of long-term follow-up. Moreover, we performed the treatment in one session and only on the upper trapezius muscle. Future studies can investigate the synergic impact of the LLLT and DN application on more sessions or the other relevant muscles on the shoulder girdle and neck.

5. Conclusion

The application of laser therapy with dry needling could significantly improve pain immediately after the treatment compared with applying dry needling alone. There were no identified differences between the two groups regarding pain and neck disability index 48 hours after the treatment.

Ethical Considerations

Compliance with ethical guidelines

The research project was ethically approved by the Ethics Committee of Nursing and Midwifery and Rehabilitation schools at the Tehran University of Medical Sciences (IR.TUMS.FNM.REC.1398.054).

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Authors contributions

Study design, project development, data collection and analysis, manuscript writing, and revising: Maryam Motavalian, Siamak Bashardoust Tajali; Study design, project development, data interpretation, manuscript writing, and revising: Behrouz Attarbashi Moghadam; Data collection: Seyedeh Zohreh Hosseini.

Conflict of interest

The authors declared no conflict of interest.

References

[1] Lee SH, Chen CC, Lee CS, Lin TC, Chan RC. Effects of needle electrical intramuscular stimulation on shoulder and cervical myofascial pain syndrome and microcirculation. Journal of the Chinese Medical Association. 2008; 71(4):200-6. [DOI:10.1016/S1726-4901(08)70104-7]

[2] León-Hernández JV, Martín-Pintado-Zugasti A, Frutos LG, Alguacil-Diego IM, de la Llave-Rincón AI, Fernandez-Carnero J. Immediate and short-term effects of the combination of dry needling and percutaneous TENS on post-needling soreness in patients with chronic myofascial neck pain. Brazilian Journal of Physical Therapy. 2016. (AHEAD). [DOI:10.1590/bjpt-rbf.2014.0176] [PMID] [PMCID]

[3] Shahimoridi D, Shafiei A, Yousefian B. The effectiveness of the polarized low-level laser in the treatment of patients with myofascial trigger points in the trapezius muscles. Journal of Lasers in Medical Sciences. 2020; 11(1): 14–19. [Doi:10.15171/jlms.2020.04]

[4] 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. Journal of Bodywork and Movement Therapies. 2014; 18(2):298-305. [DOI:10.1016/j.jbmt.2013.11.004] [PMID]

[5] Hadizadeh M, Tajali SB, Moghadam BA, Jalaie S, Bazzaz M. Effects of intramuscular electrical stimulation on symptoms following trigger points; a controlled pilot study. Journal of Modern Rehabilitation. 2017; 11(1):31-6. [DOI:10.18869/nirp.jmr.11.1.31]

[6] Dommerholt J. Dry needling in orthopedic physical therapy practice. Orthopaedic Physical Therapy. 2004; 16(3):15-20. https://www.researchgate.net/publication/275330222_

[7] Hakgüder A, Birtane M, Gürcan S, Kokino S, Nesrin Turan F. Efficacy of low level laser therapy in myofascial pain syndrome: an algometric and thermographic evaluation. Lasers in Surgery and Medicine: The Official Journal of the American Society for Laser Medicine and Surgery. 2003; 33(5):339-43. [DOI:10.1002/lsm.10241] [PMID]

[8] Simunovic Z. Low level laser therapy with trigger points technique: A clinical study on 243 patients. Journal of Clinical Laser Medicine & Surgery. 1996; 14(4):163-7. [DOI:10.1089/clm.1996.14.163] [PMID]

[9] Jafri M S. Mechanisms of myofascial pain. International Scholarly Research Notices. 2014; 2014. [DOI:10.1155/2014/523924] [PMID] [PMCID]

[10] Rezaei S, Shadmehr A, Tajali SB, Moghadam BA, Jalaei S. The effect of laser therapy and ischemic compression on active

trigger points in upper trapezius muscle. Journal of Modern Rehabilitation. 2019; 13(4):221-6. [DOI:10.32598/JMR.13.4.221]

[11] Tsai CT, Hsieh LF, Kuan TS, Kao MJ, Chou LW, Hong CZ. Remote effects of dry needling on the irritability of the myofascial trigger point in the upper trapezius muscle. American Journal of Physical Medicine & Rehabilitation. 2010; 89(2):133-40. [DOI:10.1097/PHM.0b013e3181a5b1bc] [PMID]

[12] Fernández-de-las-Peñas C, Dommerholt J. International consensus on diagnostic criteria and clinical considerations of myofascial trigger points: A delphi study. Pain Medicine. 2018; 19(1):142-50. [DOI:10.1093/pm/pnx207] [PMID]

[13] Dworkin RH, Turk DC, McDermott MP, Peirce-Sandner S, Burke LB, Cowan P, et al. Interpreting the clinical importance of group differences in chronic pain clinical trials: IMMPACT recommendations. Pain. 2009; 146(3):238-44. [DOI:10.1016/j.pain.2009.08.019] [PMID]

[14] Mousavi SJ, Parnianpour M, Montazeri A, Mehdian H, Karimi A, Abedi M, et al. Translation and validation study of the Iranian versions of the Neck Disability Index and the Neck Pain and Disability Scale. Spine. 2007; 32(26):E825-E31. [DOI:10.1097/BRS.0b013e31815ce6dd] [PMID]

[15] Irnich D, Behrens N, Gleditsch JM, Stör W, Schreiber MA, Schöps P, et al. Immediate effects of dry needling and acupuncture at distant points in chronic neck pain: Results of a randomized, double-blind, sham-controlled crossover trial. Pain. 2002; 99(1-2):83-9. [DOI:10.1016/S0304-3959(02)00062-3]

[16] Ilbuldu E, Cakmak A, Disci R, Aydin R. Comparison of laser, dry needling, and placebo laser treatments in myofascial pain syndrome. Photomedicine and Laser Therapy. 2004; 22(4):306-11. [DOI:10.1089/pho.2004.22.306] [PMID]

[17] Agung I, Murdana N, Purba H, Fuady A. Low-level laser therapy and dry needling for myofascial pain syndrome of the upper trapezius muscle: An interventional study. Journal of Physics: Conference Series. 2018; 1073(6):062045. [DOI:10.1088/1742-6596/1073/6/062045]

[18] Edwards J, Knowles N. Superficial dry needling and active stretching in the treatment of myofascial pain-a randomised controlled trial. Acupuncture in Medicine. 2003; 21(3):80-6. [DOI:10.1136/aim.21.3.80] [PMID]

[19] Huang YY, Sharma SK, Carroll J, Hamblin MR. Biphasic dose response in low level light therapy-an update. Dose-Response. 2011; 9(4):11-009. [DOI:10.2203/dose-response.11-009.Hamblin] [PMID] [PMCID]

[20] Cardoso LM, Campos Kraychete D, Correia de Araújo RP. Effectiveness of laser therapy in the treatment of myofascial pain. American International Journal of Contemporary Research. 2016; 6(4):46-52. http://www.aijcrnet.com/journals/Vol_6_No_4_August_2016/6.pdf

[21] Ceylan Y, Hizmetli S, Siliğ Y. The effects of infrared laser and medical treatments on pain and serotonin degradation products in patients with myofascial pain syndrome. A controlled trial. Rheumatology International. 2004; 24(5):260-3. [DOI:10.1007/s00296-003-0348-6] [PMID]

[22] Cotler HB, Chow RT, Hamblin MR, Carroll J. The use of Low Level Laser Therapy (LLLT) for musculoskeletal pain. MOJ Orthopedics & Rheumatology. 2015; 2(5):00068. [DOI:10.15406/mojor.2015.02.00068] [PMID] [PMCID]

[23] Martin-Pintado-Zugasti A, Pecos-Martin D, Rodriguez-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. The Journal of Injury, Function, and Rehabilitation. 2015; 7(10):1026-34. [DOI:10.1016/j.pmrj.2015.03.021] [PMID]

[24] Parr JJ, Larkin KA, Borsa PA. Effects of class IV laser therapy on exercise-induced muscle injury. Athletic Training and Sports Health Care. 2010; 2(6):267-76. [DOI:10.3928/19425864-20100630-04]

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