Journal of
Modern Rehabilitation
April 2020, Volume 14, Number 2

Research Paper: Application of Combined Laser and Compression Therapy on the Pain and Level of Disability on Trigger Points in Upper Trapezius Muscle

Saeed Rezaei[1], Azadeh Shadmehr[1*], Siamak Bashardoust Tajali[1], Behrooz Attarbashi Moghadam[1], Shohreh Jalaei[1]

1. Department of Physiotherapy, School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran.

Use your device to scan and read the article online

Citation: Rezaei S, Shadmehr A, Bashardoust Tajali S, Attarbashi Moghadam B, Jalaei S. Application of Combined Laser and Compression Therapy on the Pain and Level of Disability on Trigger Points in Upper Trapezius Muscle. Journal of Modern Rehabilitation. 2020; 14(2):97-104. http://dx.doi.org/10.32598/JMR.14.2.3

http://dx.doi.org/10.32598/JMR.14.2.3

Article info:
Received: 02 Oct 2019
Accepted: 10 Feb 2020
Available Online: 01 Apr 2020

Keywords:
Myofascial pain syndrome, Pain, Trigger points, Laser therapy

ABSTRACT

Introduction: Musculoskeletal disorders are among the main causes of disability in modern life. Myofascial trigger points are very common among musculoskeletal disorders and may occur through ordinary common activities. This study aimed to determine the combined effects of laser therapy and Ischemic Compression (IC) on the treatment of Myofascial Trigger Points (MTrPs) at the upper trapezius muscle.

Materials and Methods: Twenty men with at least one active trigger point at their upper trapezius muscle voluntarily participated in this study. Trigger points were under treatment of laser irradiation (6 Joules per point) and also ischemic compression. Treatment approaches were applied over the pain point every other day for 5 sessions in 10 days. Neck disability index, pain intensity by visual analog scale, pressure pain threshold by algometry, and cervical lateral flexion by goniometer were assessed and recorded before the intervention, and immediately after the last session.

Results: At the end of treatment, statistically significant improvements were seen in the neck disability index, VAS value, pressure pain threshold, and cervical lateral flexion. VAS values of the treatment and control groups were compared with the baseline ($P<0.001$).

Conclusion: Application of combined laser and compression therapy was effective on the pain and level of disability of patients with trigger points in the upper trapezius muscle.

*** Corresponding Author:**
Azadeh Shadmehr, PhD.
Address: *Department of Physiotherapy, School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran.*
Tel: *+98 (912) 3703379*
E-mail: *shadmehr@tums.ac.ir*

1. Introduction

Musculoskeletal disorders are among the common causes of disability in modern life. There are three major and critical causes of musculoskeletal disorders that cause myofascial pain (caused by trigger points, fibromyalgia known as tender points, and articular disorders) [1]. Myofascial pain syndrome is distinguished by one or more hypersensitive nodules at involved muscle which are called trigger points. A trigger point is a point of high irritability in a taut band of skeletal muscle, which can be painful by either compression or stretch [2, 3]. Features of myofascial pain syndrome are painful taut band, referral pain, local twitch response, muscle stiffness, and limited range of motion of the affected joints. The signs and symptoms may be worsened by stress [4].

People of all ages may develop myofascial trigger points (MTPs) which may lead to myofascial pain syndrome [3]. Trigger points are classified as active and latent. Active trigger points cause spontaneous pain, which means the points are painful even without any touch. In contrast, latent trigger points include all features of an active trigger point such as taut band, local twitch, and possible referral pain when the point is under pressure. Nevertheless, the latent trigger points do not automatically cause any symptoms [3, 5]. Trigger points are common and may occur during ordinary life once or more [1].

The upper trapezius muscle is one of the muscles commonly affected by trigger points [6]. As a result, the musculoskeletal disorders associated with trigger points at upper trapezius muscle may cause neck pain, headache, and shoulder disorders. The pattern of referral pain caused by trigger points at the upper trapezius muscle is usually unilateral, which extends to the involved side from posterior and outside of the neck and back of the ear to the temporal region [7]. Some common treatment methods with proven efficacy across the studies were ischemic compression, strain counter strain, ultrasound, laser therapy, and Transcutaneous Electrical Nerve Stimulation (TENS) [8].

In recent years, laser therapy has become popular in physiotherapy for the treatment of musculoskeletal disorders and skin injuries [9]. Because of the effectiveness of laser in the treatment of many musculoskeletal disorders, it is widely utilized as a complementary therapy along with other therapeutic methods in physiotherapy. It is known that low power lasers can improve local circulation and metabolism [10]. Moreover, ischemic compression or manual pressure is one of the techniques proposed for the treatment of myofascial trigger points [3].

Some researchers clarified that both taut band and nodules are caused by short sarcomeres in muscle fibers [1]. It has been assumed that manual pressure applied to these knots reduces the height and therefore, increases the length of the sarcomeres at the involved muscles [11]. Regarding time and cost management on the trigger point's treatment, it is critical to study the effectiveness of treatment methods. As such, this research aims to utilize and combine two known therapeutic approaches for the treatment of active trigger points to clarify whether low-level laser therapy and ischemic compression together can affect the pain and function in patients with upper trapezius muscle trigger points. The results of this study can help the clinicians to choose the appropriate treatment methods for the patients suffering pain on active trigger points of the upper trapezius muscle.

2. Materials and Methods

Twenty men with only one active trigger point at the upper trapezius muscle were referred to physiotherapy clinic at the School of Rehabilitation, Tehran University of Medical Sciences. The participants were voluntarily attended in the study with the following inclusion criteria: age between 18 to 35 years, neck pain started at least three months ago (to be defined as chronic pain), the pain level of at least at 3 based on the VAS [12], presence of an active trigger point as defined by Simons, (local pain, referral pain, taut bundle, tender-point, and decreased range of motion in the neck) [13]. The volunteers would be excluded from the study if they had any of the following criteria: willingness to withdraw from the study, discomfort and any intolerance, a history of muscle diseases such as fibromyalgia and myopathy, malignancy or susceptibility to infection, central nervous system disorders, radicular pain and neck surgery, vascular disease, diabetes, history of migraines.

The participants who met the inclusion criteria signed the consent form and entered the study. All initial examinations of the patients' characteristics were recorded by a therapist. In the practical stage, the patient was lying prone and the therapist examined the upper trapezius muscle of the involved side. The trigger point was marked and then a designed transparency sheet was applied on the MTP to clarify the location [14]. Afterward, the variables were evaluated on order and as following: the neck disability index (NDI) was completed for any participant (The NDI questionnaire consists of 10 sections, each has 6 items ranging 0-5). The questionnaire was completed by the

Figure 1. Visual analog scale to assess the pain severity level

JMR

patient (zero scale if the primary item was selected, and 5 if the last item was chosen). Then the total score was recorded for any individual. The Visual Analog Scale (VAS) was used to measure the severity of pain. In this study, the horizontal line of 100 mm in length was placed in front of the patients and explained to them that zero indicated no pain and the end of the line indicated extreme pain. The patient marks a point on the line that represents the severity of the pain, and then the length of the point mark is measured by the therapist in millimeters to clarify the level of pain (Figure 1).

In the next stage, the pressure pain threshold was measured by an algometer (Lutron Electronic Enterprise, Taiwan FG-5020) in Newton. With its acceptable reliability and validity, it is an effective tool in the evaluation of trigger points [15]. The patient stayed in a comfortable sitting position while his head was in neutral. The instrument was located at the surface of the subject's body, with an angle of approximately 90 degrees [16]. Then, the patient was instructed to notify the therapist when he started to feel pain or discomfort, and then the pressure was gradually increased. The amount of pressure that caused the patient's pain and discomfort was recorded by the therapist three times with an interval of 30 seconds for each trigger point. Next, the obtained mean value was calculated and recorded as the pressure pain threshold score by N/cm^2 (Figure 2) [17].

Cervical lateral flexion was measured by a goniometer in degrees as follows: The patient sat upright in a comfortable position and was instructed to move his ear to the shoulder without extra movement at the neck and/or shoulder. Then, the goniometer axis was placed on the spinous process of C7, while the fixed arm was perpendicular to the ground and the movable arm was posterior to the midline of the skull. Afterward, the patient was asked to perform the lateral movement as described, then the therapist read the degree of the movable arm [18]. The mean measurement was recorded three times.

In the next stage, ten patients were randomly (random allocation rule) underwent laser therapy and then ischemic compression, while for the others, the treatment was started with ischemic compression and then followed by laser therapy. The gallium aluminum arsenide low-power laser (808 nm - Novin Company) with a maximum power of 500 mW at the dosage of 6 J/cm^2 was continuously applied to the identified area over the trigger point. Then, the patient was lying prone while his head was in a neutral position. The therapist applied the pressure slowly until the patient reported it as moderate but tolerable pain. Then, while preserving the pressure and when the patient's pain was decreased, the therapist increased his hand pressure to the same level as before. This pressure was maintained for 60 seconds [17]. The treatment was carried out with laser therapy for 5 sessions for 12 sec-

Figure 2. Placement of the algometer on the trigger point of the upper trapezius muscle

JMR

onds per point every other day. Ultimately, the variables were evaluated at the end of the fifth session.

Statistical analysis

The Kolmogorov-Smirnov test was utilized to analyze data normal distribution. As all variables were distributed normally, the parametric statistical analysis was employed to compare the results. Besides, the paired t test was implemented to investigate before and after data through five treatment sessions. The statistical analysis was carried out with SPSS V. 18. The significant level was considered as 0.05.

3. Results

Table 1 presented the demographic data. Table 2 presents and compares the numerical indicators (such as Mean±SD, minimum, and maximum) of all variables, including NDI, the lateral range of motion, VAS, and Pressure Pain Threshold (PPT) before and after five treatment sessions. As can be seen, the NDI ($P<0.001$) and VAS ($P<0.001$) significantly decreased and the range of motion of cervical lateral flexion ($P<0.001$) and PPT ($P<0.001$) significantly increased after the intervention (Table 2) (Figure 3).

4. Discussion

According to the analysis, all variables showed improvement after 5 sessions of combined laser therapy and ischemic compression. The previous similar study of our team identified the immediate effects of the combination of these two interventions on the upper trapezius trigger point [19]. Kanan and colleagues studied and compared the effects of laser therapy and ischemic compression on the patients with clinically active, palpable MTPs on one side or both sides of the upper trapezius muscle [20]. Many researchers had conducted studies on these two treatments approaches on outpatient clinics with the diagnosis of active trigger point [21, 22]. There is a growing interest among the researchers to accomplish studies on laser application on trigger points, such as Hantan study [23]. The power of this study was its various variables (VAS, lateral cervical range of motion, algometric evaluation, and NDI) to clarify both pain and disability levels on trigger points at the upper trapezius muscle following combination therapy.

Based on the obtained results over time and intervention, the NDI level decreased at the study groups and the combination method had positive effects. The disability level was moderate before the intervention and improved to the mild level after the intervention. The NDI was an

Table 1. Numerical indicators of age and duration of disease of the participants (n=20)

Variables	Mean±SD	Min-Max
Age (y)	25.45±3.95	20-32
Duration (mo)	8.55±3.26	3-12

JMR

Table 2. Mean and standard deviation of neck disability index, cervical lateral flexion (degree), visual analog scale (mm) and Pressure pain threshold (N/cm^2) before and after the intervention (n=20)

Variables	Before the Intervention		After the Intervention		P of Paired t-test	Effect Size (d)
	Mean±SD	Min-Max	Mean±SD	Min-Max		
Neck disability index	21.05±4.08	16-34	11.90±1.83	8-16	<0.001	>1
Cervical lateral flexion (degree)	32.90±3.02	28-36	35.80±2.19	30-40	<0.001	>1
Visual analog scale (mm)	54.65±7.85	38-70	26.80±5.70	11-36	<0.001	>1
Pressure pain threshold (N/cm^2)	14.62±2.73	7.26-21.12	23.02±3.33	15.68-28.18	<0.001	>1

JMR

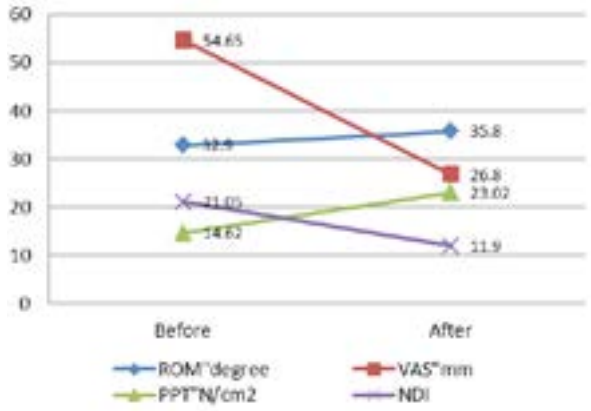

Figure 3. Mean difference of variables before and after the intervention

JMR

appropriate indicator to evaluate the patients' responses to this treatment approach and showed a clinically significant improvement in the patients [24].

The VAS changes, before and after the interventions, represented that pain level decreased with time and after interventions. These results are consistent with the other relevant studies for these two therapeutic interventions [25-28]. The results of the VAS changes have supported the results of another study [19], that did not show any significant effects on pain reduction following a single session of combined laser therapy and ischemic compression. As a result, the appropriate benefits might be because of the multi-session effects of treatment. Inconsistent effects of laser therapy on the reduction of musculoskeletal pain are probably due to the insufficient dose of laser irradiation; thus, repeated sessions may be necessary.

The range of motion was also a useful indicator to evaluate neck function and treatment progression for the patients [29]. A comparison of changes in cervical lateral flexion before and after five sessions was significant in our study. The unilateral activity of the upper trapezius muscle is needed to shrug the ipsilateral shoulder, bend the head and neck in the same direction, and rotate the head to the opposite side. In disorders such as trigger points, the activity of upper trapezius muscle is restricted and the extent of ipsilateral neck flexion may decrease. However, most restrictions will be on the non-involved side of cervical lateral flexion due to the shortening of muscle sarcomeres. According to the results of this study, combined laser therapy and ischemic compression have significant effects on the cervical range of motion that may happen because of local blood flow improvement and mechanical effects of ischemic compression.

The effects of combined treatment on the PPT indicated significant effects on the level of the pain threshold. The positive effects of laser therapy and ischemic compression have been reported by former studies such as Gemmell et al. [22] and Gulick et al. [30].

One of the laser irradiation benefits in identified dosages is an improvement in cellular function. The anti-inflammatory and analgesic effects of laser irradiation have been already studied [31]. Laser therapy may affect blood circulation that contributes to the supply of tissue oxygen and disposal of waste items and as such leads to break the pain cycle [32]. Aluminum gallium arsenide laser is the most commonly used laser on pain relief because of its depth of penetration [31].

Ischemic compression is an effective treatment method for the trigger points [33]. Immediate positive and long-term effects of ischemic compression have been reported before [34]. Ischemic compression has positive effects on increasing local blood circulation. By increasing local blood flow, waste materials were removed from the area. Ischemic compression also has positive effects on the regulation of sarcomeres length [35]. Ischemic compression, as a manual therapy technique, causes fatigue at the muscle that persists for up to 48 hours after the intervention [36]. Significant improvement in pain level in this study could be attributed to the effects of both complementary laser therapy in addition to ischemic compression, which might eliminate the effects of ischemic compression fatigue.

The increasing amount of energy through the laser therapy sessions might increase the appropriate level of energy on the area and lead to decrease pain levels. Laser therapy, with all its positive therapeutic effects and appropriate acceptance by the patients, does have a major problem which is the lack of a proper standard to specify

therapeutic parameters in various disorders [37]. Effects of laser therapy have been attributed to the production of endorphins, effects on C fibers, reduction of bradykinin, and pain relief via gait theory mechanism [38]. Regarding the effects of ischemic compression technique on pain and subsequent tenderness, laser therapy can add beneficial effects of treatment on pain and disability improvement and also decrease fatigue and subsequent tenderness at the patients with trigger points. Laser, on the other hand, helps in the pain modulation by effects on pain pathways at the spinal cord level, central nervous system, secretion of endogenous opioids, and perception of localized pain [32].

Ischemic compression can also affect blood supply and sarcomere length, which in turn helps in flushing out the muscle of inflammatory exudates and increasing the range of motion. As a result, the soreness and discomfort after the application of ischemic compression may decrease. Regarding the results of the other study that showed one treatment session with laser therapy and ischemic compression did not have a positive effect on pain level [19], our study clarified that pain level tends to decrease progressively in subsequent sessions. The benefits of these two modalities may help improve the quality of life and is a more cost-effective approach for the deactivation of the MTPs.

One of the limitations of this study was the lack of follow-up sessions. The NDI was also evaluated immediately after the fifth session, and clearly could not be extended to all five therapeutic sessions. This study could not distinguish between the effects of these two interventions and merely referred to the effects of two methods together. It is suggested that this study be compared with the other interventions and evaluate the long-term effects of these combined therapy methods. Based on the results of this study, the combined method of laser therapy and ischemic compression may improve the patients with active trigger points at the upper trapezius muscle.

5. Conclusion

The application of combined laser and compression therapy was effective on the pain and level of disability in patients with trigger points in the upper trapezius muscle.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article.

Funding

This research was supported by the Tehran University of Medical Sciences (TUMS) and Health Services (Grant No.: 98-01-32-40003).

Authors contributions

All authors contributed in preparing this article.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgements

The authors would like to thank the staffs of the School of Rehabilitation, Tehran University of Medical Sciences.

References

[1] Mense S, Simons DG, Jon Russell I. Muscle pain: Understanding its nature, diagnosis, and treatment. Philadelphia: Lippincott Williams & Wilkins; 2001. https://books.google.com/books?id=qyu1sJf-8GkC&dq

[2] Chao YW, Lin JJ, Yang JL, Wang WTJ. Kinesio taping and manual pressure release: Short-term effects in subjects with myofasical trigger point. Journal of Hand Therapy. 2016; 29(1):23-9. [DOI:10.1016/j.jht.2015.10.003] [PMID]

[3] Simons DG, Travell JG, Simons LS. Travell & Simons' myofascial pain and dysfunction: Upper half of body. Philadelphia: Lippincott Williams & Wilkins; 1999. https://books.google.com/books?id=sU0XupX7DGsC&dq

[4] Evan Rivers W, Garrigues D, Graciosa J, Norman Harden R. Signs and symptoms of myofascial pain: An international survey of pain management providers and proposed preliminary set of diagnostic criteria. Pain Medicine. 2015; 16(9):1794-805. [DOI:10.1111/pme.12780] [PMID]

[5] Giamberardino MA, Affaitati G, Fabrizio A, Costantini R. Myofascial pain syndromes and their evaluation. Best Practice & Research Clinical Rheumatology. 2011; 25(2):185-98. [DOI:10.1016/j.berh.2011.01.002] [PMID]

[6] Sciotti VM, Mittak VL, DiMarco L, Ford LM, Plezbert J, Santipadri E, et al. Clinical precision of myofascial trigger point location in the trapezius muscle. Pain. 2001; 93(3):259-66. [DOI:10.1016/S0304-3959(01)00325-6]

[7] Dommerholt J, de las Penas CF, editors. Trigger point dry needling: An evidence and clinical-based approach. Edinburgh: Elsevier; 2013. https://books.google.com/books?id=0mExwRfXTw8C&dq

[8] Rickards LD. The effectiveness of non-invasive treatments for active myofascial trigger point pain: A systematic review of the literature. International Journal of Osteopathic Medicine. 2006; 9(4):120-36. [DOI:10.1016/j.ijosm.2006.07.007]

[9] Beckerman H, de Bie RA, Bouter LM, De Cuyper HJ, Oostendorp RAB. The efficacy of laser therapy for musculoskeletal and skin disorders: A criteria-based meta-analysis of randomized clinical trials. Physical Therapy. 1992; 72(7):483-91. [DOI:10.1093/ptj/72.7.483] [PMID]

[10] 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]

[11] Simons DG. Understanding effective treatments of myofascial trigger points. Journal of Bodywork and Movement Therapies. 2002; 6(2):81-8. [DOI:10.1054/jbmt.2002.0271]

[12] Gemmell H, Miller P, Nordstrom H. Immediate effect of ischaemic compression and trigger point pressure release on neck pain and upper trapezius trigger points: A randomised controlled trial. Clinical Chiropractic. 2008; 11(1):30-6. [DOI:10.1016/j.clch.2007.09.001]

[13] Király M, Bender T, Hodosi K. Comparative study of shockwave therapy and low-level laser therapy effects in patients with myofascial pain syndrome of the trapezius. Rheumatology International. 2018; 38(11):2045-52. [DOI:10.1007/s00296-018-4134-x] [PMID]

[14] Tabatabaiee A, Ebrahimi-Takamjani I, Ahmadi A, Sarrafzadeh J, Emrani A. Comparison of pressure release, phonophoresis and dry needling in treatment of latent myofascial trigger point of upper trapezius muscle. Journal of Back and Musculoskeletal Rehabilitation. 2019; 32(4):587-94. [DOI:10.3233/BMR-181302] [PMID]

[15] Fischer AA. Pressure algometry over normal muscles. Standard values, validity and reproducibility of pressure threshold. Pain. 1987; 30(1):115-26. [DOI:10.1016/0304-3959(87)90089-3]

[16] Ylinen J, Nykänen M, Kautiainen H, Häkkinen A. Evaluation of repeatability of pressure algometry on the neck muscles for clinical use. Manual Therapy. 2007; 12(2):192-7. [DOI:10.1016/j.math.2006.06.010] [PMID]

[17] Fryer G, Hodgson L. The effect of manual pressure release on myofascial trigger points in the upper trapezius muscle. Journal of Bodywork and Movement Therapies. 2005; 9(4):248-55. [DOI:10.1016/j.jbmt.2005.02.002]

[18] Reese NB, Bandy WD. Joint range of motion and muscle length testing. Amsterdam: Elsevier Health Sciences; 2016. https://books.google.com/books?id=oAzhCwAAQBAJ&dq

[19] Rezaei S, Shadmehr A, Bashardoust Tajali S, Attarbashi Moghadam B, 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]

[20] Kannan P. Management of myofascial pain of upper trapezius: A three group comparison study. Global Journal of Health Science. 2012; 4(5):46-52. [DOI:10.5539/gjhs.v4n5p46] [PMID] [PMCID]

[21] 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. 2003; 33(5):339-43. [DOI:10.1002/lsm.10241] [PMID]

[22] Gemmell H, Allen A. Relative immediate effect of ischaemic compression and activator trigger point therapy on active upper trapezius trigger points: A randomised trial. Clinical Chiropractic. 2008; 11(4):175-81. [DOI:10.1016/j.clch.2009.01.007]

[23] Hanten WP, Olson SL, Butts NL, Nowicki AL. Effectiveness of a home program of ischemic pressure followed by sustained stretch for treatment of myofascial trigger points. Physical Therapy. 2000; 80(10):997-1003. [DOI:10.1093/ptj/80.10.997] [PMID]

[24] Young BA, Walker MJ, Strunce JB, Boyles RE, Whitman JM, Childs JD. Responsiveness of the Neck Disability Index in patients with mechanical neck disorders. The Spine Journal. 2009; 9(10):802-8. [DOI:10.1016/j.spinee.2009.06.002] [PMID]

[25] Uemoto L, Garcia MAC, Gouvêa CVD, Vilella OV, Alfaya TA. Laser therapy and needling in myofascial trigger point deactivation. Journal of Oral Science. 2013; 55(2):175-81. [DOI:10.2334/josnusd.55.175] [PMID]

[26] 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]

[27] Gur A, Sarac AJ, Cevik R, Altindag O, Sarac S. Efficacy of 904 nm gallium arsenide low level laser therapy in the management of chronic myofascial pain in the neck: A double-blind and randomize-controlled trial. Lasers in Surgery and Medicine. 2004; 35(3):229-35. [DOI:10.1002/lsm.20082] [PMID]

[28] Cagnie B, Dewitte V, Coppieters I, Van Oosterwijck J, Cools A, Danneels L. Effect of ischemic compression on trigger points in the neck and shoulder muscles in office workers: A cohort study. Journal of Manipulative and Physiological Therapeutics. 2013; 36(8):482-9. [DOI:10.1016/j.jmpt.2013.07.001] [PMID]

[29] Capuano-Pucci D, Rheault W, Aukai J, Bracke M, Day R, Pastrick M. Intratester and intertester reliability of the cervical range of motion device. Archives of Physical Medicine and Rehabilitation. 1991; 72(5):338-40. [PMID]

[30] Gulick DT, Palombaro K, Lattanzi JB. Effect of ischemic pressure using a Backnobber II device on discomfort associated with myofascial trigger points. Journal of Bodywork and Movement Therapies. 2011; 15(3):319-25. [DOI:10.1016/j.jbmt.2010.06.007] [PMID]

[31] Uemoto L, de Azevedo RN, Alfaya TA, Reis RNJ, de Gouvêa CVD, Garcia MAC. Myofascial trigger point therapy: Laser therapy and dry needling. Current Pain and Headache Reports. 2013; 17(9):357. [DOI:10.1007/s11916-013-0357-4] [PMID]

[32] 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]

[33] Bialosky JE, Bishop MD, Price DD, Robinson ME, George SZ. The mechanisms of manual therapy in the treatment of musculoskeletal pain: A comprehensive model. Manual

Therapy. 2009; 14(5):531-8. [DOI:10.1016/j.math.2008.09.001] [PMID] [PMCID]

[34] Wilke J, Vogt L, Banzer W. Immediate effects of self-myofascial release on latent trigger point sensitivity: A randomized, placebo-controlled trial. Biology of Sport. 2018; 35(4):349-54. [DOI:10.5114/biolsport.2018.78055] [PMID] [PMCID]

[35] Hou CR, Tsai LC, Cheng KF, Chung KC, Hong CZ. Immediate effects of various physical therapeutic modalities on cervical myofascial pain and trigger-point sensitivity. Archives of Physical Medicine and Rehabilitation. 2002; 83(10):1406-14. [DOI:10.1053/apmr.2002.34834] [PMID]

[36] Salvo SG. Massage therapy: Principles and practice. Amsterdam: Elsevier Health Sciences; 2015. https://books.google.com/books?id=Rti4BwAAQBAJ&dq

[37] Tengrungsun T, Mitriattanakul S, Buranaprasertsuk P, Suddhasthir T. Is low level laser effective for the treatment of orofacial pain? A systematic review. Cranio. 2012; 30(4):280-5. [DOI:10.1179/crn.2012.042] [PMID]

[38] López-Ramírez M, Vílchez-Pérez MÁ, Gargallo-Albiol J, Arnabat-Domínguez J, Gay-Escoda C. Efficacy of low-level laser therapy in the management of pain, facial swelling, and postoperative trismus after a lower third molar extraction: A preliminary study. Lasers in Medical Science. 2012; 27(3):559-66. [DOI:10.1007/s10103-011-0936-8] [PMID]