

The contribution of dry needling and Kinesio taping to classic physical therapy in myofascial pain syndrome

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Abstract

Introduction. This study aimed to investigate the contribution of dry needling and Kinesio taping to classic physical therapy applied in myofascial pain syndrome (MPS) and to determine whether either method was superior.

Methods. This prospective randomized controlled study included 30 patients with MPS with at least 1 active trigger point in the upper trapezius. They were randomly divided into 3 equal groups: classic therapy group (ultrasound + Hot Pack + transcutaneous electrical nerve stimulation + massage + exercise), classic therapy + dry needling group, and classic therapy + Kinesio taping group. All groups received 10 sessions (3 sessions/week). Patients were evaluated at baseline and at the end of therapy. Visual analogue scale (VAS) was used to assess neck pain and 36-item Short Form Survey (SF-36) served to assess quality of life.

Results. At 4 weeks of follow-up, there was a statistically significant decrease in VAS scores in each group compared with baseline ($p < 0.05$) and no significant difference in outcomes between the groups ($p > 0.05$). In the SF-36 assessment, a significant improvement was observed in the physical function, physical role, pain, and general state of health in all groups compared with baseline ($p < 0.05$). All groups were similar in terms of SF-36 improvement ($p > 0.05$).

Conclusions. VAS and SF-36 results improved in all treatment groups. We suggest that all these methods, including classic therapy, Kinesio taping, and dry needling should be applied to reduce pain and improve quality of life in MPS patients. Further research with larger samples is warranted to determine optimal treatment duration in order to obtain long-term efficacy.

Key words: myofascial pain syndrome, Kinesio taping, dry needling

Introduction

Myofascial pain syndrome (MPS) is defined as sensory, motor, and autonomic symptoms that are caused by trigger points in skeletal muscles, associated with a hypersensitive palpable nodule [1, 2]. It is a chronic pain disorder resulting in some of the most important chronic problems that are encountered in clinical practice, including muscle or fascia pain, tenderness, taut bands, limited joint movement, motor dysfunction, fatigue, and, sometimes, autonomic dysfunctions, such as changes in body temperature, sweating, piloerection, proprioceptive disturbances [1, 2].

The aetiology of MPS and its mechanism of producing disturbing symptoms are not fully understood [3–6]. However, muscle biopsy and the analysis of morphologic and metabolic characteristics of muscle fibres showed that there was an increased fibre area of type 1 muscle fibres in the myalgic muscle [3]. Besides, many hypotheses of pathophysiology of myofascial trigger points associated with MPS have been put forward, including the integrated trigger point hypothesis, Cinderella hypothesis, chemical activation of afferent nerves, peripheral and central sensitization, and biochemical changes around trigger points [5, 6].

MPS is a very common condition, indicated as one of the foremost challenges for health care [4, 5]. The prevalence varies from 30% to 80%. It is reported that the incidence is higher in women than in men [4]. The point prevalence in middle-aged adults (30–60 years of age) is reported as 37% and 65% in males and females, respectively [5].

A variety of treatments are employed in the management of MPS. In acute cases, non-invasive methods such as ischemic compression, spray stretching, Kinesio taping, and physical therapy are used, as well as invasive methods, such as dry needling, local anaesthetics, or botulinum toxin injections. Treatment of more chronic conditions includes activity modification, lifestyle changes, ergonomic adjustments, and investigation of the underlying psychological factors [1, 5, 7].

For the management of MPS, the mechanism of Kinesio taping is thought to be mediated by cutaneous mechanoreceptors, which would provide sensorimotor and proprioceptive feedback, and/or by mechanical restraint and inhibitory and excitatory nociceptive stimuli. Consequently, Kinesio taping exerts some physiological effects, such as decrease in pain and muscular spasms and/or increase in the range of motion [8].

Another modality for MPS is dry needling. Studies have shown that dry needling can modify the biochemical environment surrounding a myofascial trigger point by hyper-stimulating the pain-production area and thereby decreasing the local sensory signals and/or by firing inhibitory interneurons, thus preventing normal pain conduction to the sensory cortex [1, 9, 10].

Though many practitioners can attest to improvements in pain levels among MPS patients, current data suggest that MPS is associated with a high symptom burden and a negative impact on function, both physical and psychosocial [11]. Choosing the most effective modality among the treatment options will benefit the patient and shorten the treatment.

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Therefore, in the present study, we aimed to compare the clinical efficacy of dry needling, Kinesio taping, and classic physical therapy as evaluated by a visual analogue scale (VAS) and the 36-item Short Form Survey (SF-36) during a 4-week follow-up period.

Subjects and methods

Participants

In total, 30 patients (9 males and 21 females) aged 18–60 years were included in the study. Their mean age was 32.5 years. The subjects participated in the study for 4 weeks. The inclusion criteria were as follows: female or male sex; age of 18–60 years; diagnosis of MPS in the upper trapezius muscle; at least 1 active trigger point diagnosed by a physical therapist; being literate; and volunteering to participate in the study. The exclusion criteria involved cervical disc herniation; radiculopathy or myelopathy; a tumoral, infectious, psychiatric, or systemic disease; bleeding diathesis; shoulder pathologies associated with trapezius; diagnosis of fibromyalgia in accordance with the American College of Rheumatology 2010 criteria; and inability to cooperate. This prospective and randomized controlled study was conducted between January 2017 and May 2017 in Acibadem Fulya Hospital, Physiotherapy and Rehabilitation Department, located in Istanbul, Turkey.

The patients were randomly divided into 3 groups with 10 individuals in each group. The intervention was as follows:

- 1st group: classic therapy (ultrasound + Hot Pack + transcutaneous electrical nerve stimulation [TENS] + massage + exercise);
- 2nd group: classic therapy as described above + dry needling;
- 3rd group: classic therapy as described above + Kinesio taping.

Classic therapy group

Classic therapy included ultrasound, Hot Pack, TENS, massage, and exercise. Ultrasound was applied via an Enraf-Nonius branded ultrasound device at a frequency of 1 MHz, dosage of 1.0 W/cm², in the *continue* mode, with the trigger point at the centre in the upper trapezius for 8 minutes. Hot Pack was applied on the upper trapezius with a trigger point for 20 minutes. Hot Pack was wrapped in 2 layers of towels in order not to burn the patient. A Compex device was used to provide conventional TENS by using a modulated TENS program, which is one of the pain modulators. It was applied for 20 minutes, with the negative electrode placed on the trigger point and the positive electrode located on the insertion of the acromial tendon of the trapezius. Massage was applied on the upper trapezius for 10 minutes, with the use of the stroking technique and trigger point massage technique. Exercises, in turn, were described to the patient and we confirmed at each session that the participants were actually performing the exercises. The subjects were requested to repeat the exercises 10 times for 10 seconds once per day. A total of 4 exercises were taught to the patients – the upper trapezius stretching exercise, pectoralis muscle stretching exercise, and 2 posture exercises. The classic therapy sessions were administered 3 times per week for a total of 10 sessions.

Classic therapy plus dry needling group

In this group, besides classic therapy, dry needling was applied. Dry needling was carried out by first identifying the trigger point or points in the trapezius muscle, then cleaning the skin surface with a suitable antiseptic agent, and injecting 0.25 × 25 mm sterile acupuncture needles. Sterile, disposable, and stainless steel needles in a plastic cylindrical guide were used. For the patients in group 2, deep dry needling was performed with the aim of keeping the tip of the needle in the trigger point by immobilizing this trigger point between the thumb and index finger. The needle and the guide were placed perpendicularly to the skin and the patient was given a certain amount of pressure on the skin of the trigger point and the guide tube in order to minimize the pain upon first entry of the needle (having developed tolerance); then, the skin was rapidly passed and the needle was placed in the trigger point. To remove the needle, the muscle was expected to relax and the needle was released after a while. A total of 5 sessions of dry needling were applied. One session included only classic therapy, while the consecutive session involved classic therapy followed by dry needling. As such, the patients were treated 3 times a week for a total of 10 sessions.

Classic therapy plus Kinesio taping group

Kinesio taping was applied together with classic therapy in this group of patients using the inhibition method among muscle techniques in order to inhibit the upper trapezius muscle as follows: application position – flexion/rotation to the related side; material – an 'I' strip; beginning – the lateral 1/3 of the clavicle; ending – *linea nuchae*. In total, 5 sessions of Kinesio taping were performed. One session included only classic therapy and one session involved classic therapy followed by Kinesio taping. The patients were treated 3 times per week, with 10 sessions in total. The participants were asked not to remove their tapes until they came to the next session unless irritation occurred.

Clinical evaluation

Clinical evaluation of all the patients included in the study was performed at baseline and after the treatment. VAS was used for pain assessment, while the SF-36 quality of life scale served for functional assessment. For VAS, the meanings of the scores from 0 to 10 on a 10-cm line were explained to the patients: 0 stood for no pain at all, 10 for the most severe pain in life, and 5 for moderate pain. In accordance with these explanations, the subjects were asked to mark their pain during rest, activity, and night-time on the 10-cm line. For SF-36 evaluation, the individuals were asked to answer 36 questions designed to score the physical function, physical role, emotional state, social function, general state of health, mental health, pain, and life.

Statistical methods

The SPSS 22.0 software was used for the analyses. Descriptive statistics were expressed in median (min–max) values. The Kruskal-Wallis test was applied for abnormally distributed data. Subgroup analyses in the dependent groups were performed with the Wilcoxon test. The percentage of categorical variables among the independent groups were evaluated by using the chi-square test. The value of $p < 0.05$ was considered statistically significant.

Ethical approval

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and was approved on December 22, 2016 by the Acibadem University Medical Research Review Board, with board meeting number 2016/20 and resolution number 2016-20/20.

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

Data analysis was performed with 3 groups. Table 1 presents the demographic data of all groups. Age, gender, and educational background distribution did not differ significantly between the groups (classic group, dry needling group, Kinesio taping group; $p > 0.05$). The rate of single patients in the dry needling group was significantly higher ($p < 0.05$) than in the classic and Kinesio taping groups. There was no significant difference between the classic group and the Kinesio taping group in terms of marital status distribution ($p > 0.05$).

Pre-treatment and post-treatment VAS night/resting/activity scores did not differ significantly between the classic, dry needling, or Kinesio taping group ($p > 0.05$). In addition,

there was a statistically significant decrease in the post-treatment VAS night/resting/activity score compared with baseline in all groups ($p < 0.05$; Table 2).

Table 3 displays SF-36 scores of all the groups measured at baseline and at the end of the study. When all groups were compared with one another in all the items of SF-36 (physical function, physical role, pain, general state of health, vitality, social function, emotional role, mental health), the pre- and post-treatment scores did not differ significantly ($p > 0.05$).

In the classic physical therapy group, the physical function, physical role, pain, and general state of health items of SF-36 were significantly improved when compared with baseline ($p < 0.05$; Table 3). In the dry needling group, the SF-36 sub-parameters of physical function, physical role, and pain improved statistically significantly compared with pre-treatment values ($p < 0.05$; Table 3). In the Kinesio taping group, the physical function, physical role, pain, general state of health, and social function improved significantly compared with baseline ($p < 0.05$; Table 3).

Discussion

The present study aimed to compare the efficacy of classic physical therapy, dry needling, and Kinesio taping in the trapezius muscle of MPS patients. All the therapies applied to MPS participants were associated with a statistically sig-

Table 1. Comparison of demographic characteristics of the patients

Variable	Classic group		Dry needling group		Kinesio taping group		p
	Mean ± SD n (%)	Median	Mean ± SD n (%)	Median	Mean ± SD n (%)	Median	
Age	35.5 ± 6.7	36.5	31.0 ± 8.2	29.5	34.1 ± 6.8	31.5	0.648 ^K
Gender	Female	6 (60)	9 (90)		6 (60)		0.240 ^C
	Male	4 (40)	1 (10)		4 (40)		
Marital status	Married	8 (80)	0 (0)		9 (90)		0.000 ^{C*}
	Single	2 (20)	10 (100)		1 (10)		
Education	Two-year degree	1 (10)	0 (0)		0 (0)		> 0.05 ^C
	Undergraduate	9 (90)	10 (100)		10 (100)		

^K Kruskal-Wallis test, ^C chi-square test, * significant value

Table 2. Comparison of VAS scores

Variable	Classic group		Dry needling group		Kinesio taping group		p
	Mean ± SD n (%)	Median	Mean ± SD n (%)	Median	Mean ± SD n (%)	Median	
VAS night before treatment	3.7 ± 2.2	3.0	3.2 ± 2.2	3.0	5.2 ± 2.0	5.5	0.144 ^K
VAS night after treatment	1.7 ± 1.8	1.0	1.9 ± 1.0	2.0	1.6 ± 0.8	2.0	0.697 ^K
p for intergroup change	0.016 ^{W*}		0.046 ^{W*}		0.005 ^{W*}		
VAS resting before treatment	2.7 ± 1.6	2.5	4.1 ± 2.5	4.5	4.3 ± 1.6	5.0	0.053 ^K
VAS resting after treatment	1.0 ± 0.8	1.0	1.7 ± 1.7	1.5	0.9 ± 0.7	1.0	0.776 ^K
p for intergroup change	0.011 ^{W*}		0.007 ^{W*}		0.005 ^{W*}		
VAS activity before treatment	4.8 ± 2.2	4.5	5.1 ± 1.9	5.5	6.6 ± 1.6	7.0	0.057 ^K
VAS activity after treatment	2.1 ± 1.6	1.5	2.2 ± 0.9	2.5	2.3 ± 1.2	2.5	0.368 ^K
p for intergroup change	0.007 ^{W*}		0.005 ^{W*}		0.005 ^{W*}		

VAS – visual analogue scale

^W Wilcoxon test, ^K Kruskal-Wallis test, * significant values

Table 3. Comparison of SF-36 scores

Variable	Classic group		Dry needling group		Kinesio taping group		p
	Mean ± SD n (%)	Median	Mean ± SD n (%)	Median	Mean ± SD n (%)	Median	
Physical function before treatment	85.0 ± 11.8	87.5	86.0 ± 14.5	87.5	78.5 ± 14.0	80.0	0.268 ^K
Physical function after treatment	93.0 ± 7.9	95.0	91.5 ± 9.1	92.5	85.0 ± 9.1	85.0	0.054 ^K
p for intergroup change	0.011 ^{W*}		0.026 ^{W*}		0.031 ^{W*}		
Physical role before treatment	52.5 ± 41.6	50.0	52.5 ± 36.2	50.0	50.0 ± 42.5	50.0	0.906 ^K
Physical role after treatment	82.5 ± 26.5	100.0	85.0 ± 21.1	100.0	90.1 ± 21.1	100.0	0.400 ^K
p for intergroup change	0.016 ^{W*}		0.009 ^{W*}		0.016 ^{W*}		
Pain before treatment	52.2 ± 16.2	57.5	48.8 ± 20.6	45.0	41.8 ± 10.6	45.0	0.091 ^K
Pain after treatment	73.8 ± 5.4	77.5	68.8 ± 18.9	62.5	74.3 ± 10.6	72.5	0.968 ^K
p for intergroup change	0.007 ^{W*}		0.018 ^{W*}		0.005 ^{W*}		
General state of health before treatment	50.0 ± 11.9	52.5	45.5 ± 10.4	45.0	46.5 ± 9.1	50.0	0.400 ^K
General state of health after treatment	58.0 ± 9.8	60.0	46.5 ± 15.8	45.0	52.5 ± 13.2	50.0	0.358 ^K
p for intergroup change	0.040 ^{W*}		0.364 ^W		0.027 ^{W*}		
Vitality before treatment	62.0 ± 4.8	62.5	55.5 ± 12.2	55.0	62.0 ± 5.9	60.0	0.968 ^K
Vitality after treatment	59.5 ± 5.5	60.0	55.5 ± 10.7	55.0	59.5 ± 5.5	57.5	0.843 ^K
p for intergroup change	0.102 ^W		1.000 ^W		0.272 ^W		
Social function before treatment	87.5 ± 15.6	87.5	76.3 ± 21.6	87.5	75.0 ± 15.6	75.0	0.066 ^K
Social function after treatment	90.0 ± 17.5	93.8	81.3 ± 17.9	81.3	93.8 ± 14.7	87.5	0.845 ^K
p for intergroup change	0.480 ^W		0.305 ^W		0.017 ^{W*}		
Emotional role before treatment	63.3 ± 24.6	66.7	53.3 ± 42.2	66.7	60.0 ± 26.3	66.7	0.744 ^K
Emotional role after treatment	73.3 ± 21.1	66.7	66.7 ± 27.2	66.7	66.7 ± 27.2	66.7	0.654 ^K
p for intergroup change	0.083 ^W		0.102 ^W		0.480 ^W		
Mental health before treatment	56.8 ± 8.4	56.0	47.6 ± 8.3	48.0	49.2 ± 8.2	52.0	0.072 ^K
Mental health after treatment	59.2 ± 9.4	62.0	52.0 ± 10.2	50.0	53.2 ± 7.8	54.0	0.125 ^K
p for intergroup change	0.366 ^W		0.084 ^W		0.132 ^W		

^W Wilcoxon test, ^K Kruskal-Wallis test, * significant values

nificant improvement of pain and quality of life assessed by VAS and SF-36, respectively, in the short term of up to 4-week follow-up.

The current use of the term ‘MPS’ implies a specific condition which is distinguished from other soft tissue pain disorders, such as fibromyalgia, tendonitis, or bursitis. It presents as regional pain, sometimes with referred pain, often accompanied by increased tension and decreased flexibility [11].

For MPS, there is a limited number of studies that compare one intervention plus another intervention in the experimental design [12, 13]. We aimed to find the most effective intervention method in trapezius MPS by applying classic physical therapy and dry needling or Kinesio taping, and we observed that all the 3 therapies were equally effective ($p < 0.05$ when compared with baseline) by VAS and SF-36 scores. This finding suggests that the trapezius muscle in MPS patients can be treated by either of the interventions within the bounds of possibility.

In our study, the mean age of participants was 35.5 ± 6.7 years in the classic group, 31.0 ± 8.2 years in the dry needling group, and 34.1 ± 6.8 years in the Kinesio taping group. These rates were in line with the literature as MPS is most

frequently observed in sedentary subjects aged 27.5–50 years [14].

Previous studies on dry needling and Kinesio taping have yielded different conclusions concerning effectiveness. Cerezo-Téllez et al. [15] compared the efficacy of deep dry needling with passive stretching applied to participants with chronic non-specific neck pain attributed to MPS. They suggested that dry needling was associated with better and clinically meaningful results for pain and other clinical findings in the short term and at 6 months of follow-up. Onat et al. [16] investigated the effect of Kinesio taping on posterior cervical spine and dry needling into posterior paracervical muscles. They concluded that both methods were effective for pain, mood, and quality of life, and Kinesio taping was found to be superior to dry needling in terms of increasing the range of motion and decreasing disability. In a review by Dommerholt et al. [17], dry needling turned out to be effective in the treatment of MPS, although there was not sufficient evidence. In our study, classic physical therapy alone or in combination with dry needling or Kinesio taping was observed as an efficient method for improving pain and quality of life.

For MPS, Hayta and Umdü [18] compared different man-

agement techniques, dry needling and Kinesio taping, and evaluated these techniques by VAS, Neck Disability Index, and Nottingham Health Profile for up to 12 weeks. They demonstrated that dry needling and Kinesio taping comparably reduced VAS scores measured at weeks 4 and 12 and their efficacies were more remarkable at week 12. According to their findings, these interventions significantly reduced the Neck Disability Index and Nottingham Health Profile scores and the effects were also more remarkable at week 12; however, dry needling was found more effective. The results of our study, overall, are consistent with the above-mentioned observations when the VAS score is taken into account at week 4. On the contrary, in our research, similar positive effects were obtained in the dry needling and Kinesio taping groups.

Since the most common complaint of MPS patients is pain, VAS monitoring during treatment is crucial. Ziaefar et al. [19] found dry needling to cause a significant decrease in pain scores measured via VAS. Rayegani et al. [20] compared dry needling and classic therapy (Hot Pack, TENS, upper trapezius stretching exercises), observing a significant decrease in both groups' VAS values in the post-treatment 1st week and 1st month. Ay et al. [21] analysed 80 patients diagnosed with MPS and applied dry needling and lidocaine injection. They found in the 4th and 12th week assessments that both treatments provided a significant decrease in VAS scores. The results of our clinical study are in accordance with the aforementioned observations when considering improvement in VAS score between the pre-treatment and post-treatment status.

Limitations

There are some limitations to this study. One of them is that the results need to be confirmed by other studies comparing the effect in different regions of the body, excluding trapezius. Moreover, in the present study, there was a limited number of MPS patients and no long-term follow-up. We believe that there are no statistically significant between-group differences due to the small sample size. In this regard, studies with a larger number of cases would provide a more effective and rapid improvement in groups with Kinesio taping and dry needling applied in addition to classic therapy.

Conclusions

Overall, in the current clinical settings, Kinesio taping and dry needling applied with classic physical therapy provided health benefits in MPS patients by improving VAS and SF-36 scores in short term up to 4 weeks. These results constitute preliminary evidence and future controlled studies are needed to investigate long-term efficacy.

Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

References

- Robinson JP, Arendt-Nielsen L. Muscle pain syndromes. In: Braddom RL (ed.), *Physical medicine and rehabilitation*, 4th ed. Philadelphia: Elsevier; 2010; 971–1001.
- Lavelle ED, Lavelle W, Smith HS. Myofascial trigger points. *Anesthesiol Clin*. 2007;25(4):841–851; doi: 10.1016/j.anclin.2007.07.003.
- Kadi F, Waling K, Ahlgren C, Sundelin G, Holmner S, Butler-Browne GS, et al. Pathological mechanisms implicated in localized female trapezius myalgia. *Pain*. 1998; 78(3):191–196; doi: 10.1016/S0304-3959(98)00126-2.
- Lin Y-C, Kuan T-S, Hsieh P-C, Yen W-J, Chang W-C, Chen S-M. Therapeutic effects of lidocaine patch on myofascial pain syndrome of the upper trapezius: a randomized, double-blind, placebo-controlled study. *Am J Phys Med Rehabil*. 2012;91(10):871–882; doi: 10.1097/PHM.0b013e3182645d30.
- Srbely JZ. New trends in the treatment and management of myofascial pain syndrome. *Curr Pain Headache Rep*. 2010;14(5):346–352; doi: 10.1007/s11916-010-0128-4.
- Scott NA, Guo B, Barton PM, Gerwin RD. Trigger point injections for chronic non-malignant musculoskeletal pain: a systematic review. *Pain Med*. 2009;10(1):54–69; doi: 10.1111/j.1526-4637.2008.00526.x.
- Baldry P. Management of myofascial trigger point pain. *Acupunct Med*. 2002;20(1):2–10; doi: 10.1136/aim.20.1.2.
- García-Muro F, Rodríguez-Fernández AL, Herrero-de-Lucas A. Treatment of myofascial pain in the shoulder with Kinesio taping. A case report. *Man Ther*. 2010;15(3): 292–295; doi: 10.1016/j.math.2009.09.002.
- Kalichman L, Vulfsons S. Dry needling in the management of musculoskeletal pain. *J Am Board Fam Med*. 2010; 23(5):640–646; doi: 10.3122/jabfm.2010.05.090296.
- Salehi S, Shadmehr A, Olyaei G, Tajali SB, Mir SM. Effectiveness of dry needling for the management of plantar fasciitis: a review study. *J Mod Rehabil*. 2019;13(1): 1–10; doi: 10.32598/JMR.13.1.1.
- Shah JP, Thaker N, Heimur J, Aredo JV, Sikdar S, Gerber L. Myofascial trigger points then and now: a historical and scientific perspective. *PM R*. 2015;7(7):746–761; doi: 10.1016/j.pmrj.2015.01.024.
- Funk MF, Frisina-Deyo AJ. Dry needling for spine related disorders: a scoping review. *Chiropr Man Therap*. 2020; 28(1):23; doi: 10.1186/s12998-020-00310-z.
- Aksu O, Doğan YP, Çağlar NS, Şener BM. Comparison of the efficacy of dry needling and trigger point injections with exercise in temporomandibular myofascial pain treatment. *Turk J Phys Med Rehabil*. 2019;65(3):228–235; doi: 10.5606/tftrd.2019.1802.
- Tantanatip A, Chang K-V. Myofascial pain syndrome (MPS) [Updated 2020 Jun 2]. Treasure Island: StatPearls Publishing; 2020. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499882/>.
- Cerezo-Téllez E, Torres-Lacomba M, Fuentes-Gallardo I, Perez-Muñoz M, Mayoral-Del-Moral O, Lluch-Girbés E, et al. Effectiveness of dry needling for chronic non-specific neck pain: a randomized, single-blinded, clinical trial. *Pain*. 2016;157(9):1905–1917; doi: 10.1097/j.pain.0000000000000591.
- Onat SS, Polat CS, Bicer S, Sahin Z, Tasoglu O. Effect of dry needling injection and Kinesiotaping on pain and quality of life in patients with mechanical neck pain. *Pain Physician*. 2019;22(6):583–589.
- Dommerholt J, Grieve R, Layton M, Hooks T. An evidence-informed review of the current myofascial pain literature – January 2015. *J Bodyw Mov Ther*. 2015;19(1): 126–137; doi: 10.1016/j.jbmt.2014.11.006.
- Hayta E, Umdu NM. A randomized trial to study the comparison of trigger point dry needling versus Kinesio taping technique in myofascial pain syndrome during 3-month follow-up. *Int J Physiother*. 2016;3(5):490–496; doi: 10.15621/ijphy/2016/v3i5/117436.

19. Ziaefar 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(2):298–305; doi: 10.1016/j.jbmt.2013.11.004.
20. Rayegani SM, Bayat M, Bahrami MH, Raeissadat SA, Kargozar E. Comparison of dry needling and physiotherapy in treatment of myofascial pain syndrome. *Clin Rheumatol.* 2014;33(6):859–864; doi: 10.1007/s10067-013-2448-3.
21. Ay S, Evcik D, Tur BS. Comparison of injection methods in myofascial pain syndrome: a randomized controlled trial. *Clin Rheumatol.* 2010;29(1):19–23; doi: 10.1007/s10067-009-1307-8.