OBJECTIVIZATION OF A PATIENT'S STATE WITH MYOFASCIAL PAIN SYNDROME IN PHYSIOTHERAPY PRACTICE

M. Wytrążek[1], M. Chochowska[2], J. Huber[3]

[1] *Laboratory of Manual Therapy and Massage, College of Education and Therapy in Poznan*

[2] *College of Education and Therapy in Poznan*

[3]*Department of Pathophysiology of Locomotor Organs, Poznan University of Medical Sciences*

Abstract

Myofascial pain syndrome (MPS) with myofascial trigger points (TrPs) diagnosed in patients is a very common musculoskeletal disorder. Beside pain symptoms MPS is concerned with many other symptoms like muscle weakness, decreased range of motion or muscle stiffness. Although many researches indicate objective changes in the area of trigger points, in clinical practice subjective methods of patients state assessment are still used. This article presents an objective diagnostic methods enhancing reliability of trigger point examination. Apart from palpation, examination of pressure pain threshold using algometry and bioelectrical activity of muscles using electromyography will be presented. Trigger points are characterised by a lower pressure pain threshold, different depending on their irritability. Needle electromyography examination provides an opportunity to obtain characteristic spontaneous electrical activity recordings, while surface electromyography examination gives an opportunity to obtain increased muscle tension recordings at the resting state and decreased muscle motor units efficiency during maximal voluntary contraction.

Key words: myofascial pain syndrome, trigger points, palpation examination, algometry, electromyography

Streszczenie

Zespół bólu mięśniowo-powięziowego (ZBMP), w którym u pacjenta rozpoznawane są mięśniowo-powięziowe punkty spustowe (MPPS) jest powszechnym zaburzeniem w obrębie układu mięśniowo-szkieletowego. Oprócz objawów bólowych w zespole tym może występować wiele innych objawów, takich jak osłabienie siły mięśniowej, ograniczenie zakresów ruchu w stawach czy uczucie sztywności mięśni. Chociaż wiele badań wskazuje na obecność obiektywnych zmian w punktach spustowych, to nadal w praktyce klinicznej wykorzystywane są głównie subiektywne metody oceny stanu chorego. Artykuł ten

przedstawia metody diagnostyczne zwiększające wiarygodność badania punktów spustowych. Obok badania palpacyjnego zostaną przedstawione obiektywne metody pomiaru wrażliwości uciskowej tkanek z wykorzystaniem algometru oraz badanie czynności bioelektrycznej mięśni z wykorzystaniem elektromiografii. Punkty spustowe mają niższy próg wrażliwości uciskowej tkanek, zależny od stopnia ich wrażliwości. Elektromiografia igłowa daje możliwość zarejestrowania charakterystycznej spontanicznej czynności bioelektrycznej natomiast elektromiografia powierzchniowa daje możliwość zarejestrowania zwiększonego napięcia mięśnia w warunkach spoczynkowych i obniżonej sprawności jednostek ruchowych mięśnia w warunkach wysiłkowych.
Słowa kluczowe: zespół bólu mięśniowo-powięziowego, badanie palpacyjne, algometria, elektromiografia

Myofascial pain syndrome

Myofascial pain syndrome (MPS) is a complex neuromuscular dysfunction consisting of motor and sensory abnormalities involving both the peripheral and central nervous systems [1, 2, 3]. It is characterised by the presence of tender points, called trigger points (TrPs), located within palpable taut bands of muscle fibres, which give the symptoms of referred pain [2, 4, 5]. The syndrome may accompany many conditions, including radiculopathies, disk pathology, tendonitis, carpal tunnel syndrome, tension type headaches, migraines, dysfunction of joints, including temporo-mandibular joint [6]. Apart from pain symptoms, myofascial pain syndrome is not life-threatening, it may however result in lowering of life quality. Moreover, the syndrome is associated with many other symptoms such as muscle weakness, limited range of motion in joint or muscle stiffness, in particular after a long period of immobility [2, 7].

Pathophysiology of the myofascial pain syndrome is not entirely known. Currently it is mainly explained on the basis of integrated hypothesis combining the theory of “energy crisis” with the theory of “neuromuscular connection” (“theory of motor plate”) and “reflex disorders” [8, 9, 10].

There are many studies which indicate objective changes within trigger points, which was proved in electromyographic assessment (recording of spontaneous bioelectric activity within TrPs) and biochemical assessment (a higher level of chemical substances obtained in a microdialysis of the TrPs area) [11,12, 13, 14, 15, 16].

Myofascial pain syndrome should be considered in all patients for whom the etiology of pain cannot be clearly defined [17]. Epidemiological data indicate frequent incidence of the syndrome. The studies of patients treated by specialists in internal medicine showed that in approx. 30% of patients with pain symptoms active trigger points can be found [18]. Fishbain et al. [19] noted trigger points in 85% of patients they examined. According to Wheeler [20] myofascial pain relates to 85% of patients with post-traumatic pain and more than 90% of patients coming to a doctor due to pain in the course of other disease. Gerwin is of a similar opinion [21], as according to him in as many as 95% of people requesting doctor's advice due to pain, a myofascial component can be found. Fricton et al. [22] believe that it may be found in 55% of patients suffering from head and neck pain. Drewes and Jennum [1995] report that myofascial pain syndrome is diagnosed in 37% of men and 60% of women aged 30-60 years [23]. High estimated numbers are also indicated by Magni [1993] according to whom the syndrome affects 44 million Americans [24]. Latent trigger points are found even in the population of young healthy people [25].

However, as reported by Bennett [2007] and Dommerholt [2006] in spite of such a common incidence MPS remains undiagnosed and thus untreated in case of many chronic diseases of the motor organ [17, 26]. According to Travell and Simons [1999] the diagnosis of MPS should be taken into consideration in all cases where the cause of pain cannot be established clearly and without any doubt, because the only marker of the changes are unspecific complaints reported by patients [2]. Bennett [2007] indicates here: **joint osteoarthritis**, bursitis and tendonitis and inflammation of tendon attachments and nonspecific back pain syndrome [17]. Many studies confirm the occurrence of myofascial component in case of very different pain syndromes including tension type headaches [27], pain in the temporomandibular joint [28], complaints concerning forearm and hand [29] as well as in back pain syndromes – both in the cervical spine [30] and lumbosacral spine [31].

Moreover, it is thought that even in patients in whom the cause of the complaints has been clearly defined (e.g. rheumatoid arthritis), the myofascial pain syndrome may be an unrecognised component of the pain [17, 26]. The "main" diagnosis does not exclude the associated MPS.

Most authors distinguish active and latent trigger points, depending on their level of activity [2, 5, 7, 26]. Active trigger points are the cause of referred pain, but also other symptoms such as sensation of tingling, numbness, burning or other paraesthesias. On the other hand, patients are not aware of the presence of latent trigger points – as they do not cause spontaneous pain. However, latent trigger points may cause limited range of motion, muscle weakness or change in body posture [2, 5, 7, 32]. Chaitow [2006] distinguishes also embryonic trigger points, which he calls points of increased sensitivity within soft tissues, but not causing referred or radiating pain [32]. According to this author, as a result of various factors they may change into latent or active trigger points. They may correspond to latent not referring trigger points distinguished by Lew et al. [33].

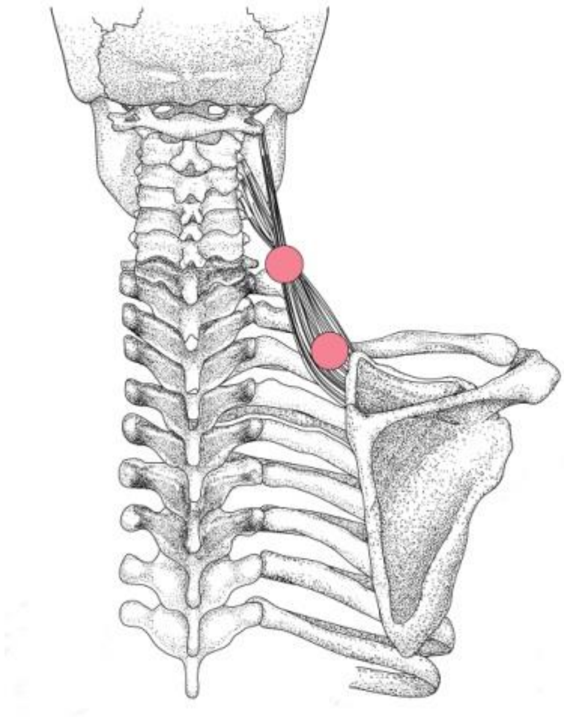

Figure 1. Examples of trigger point location in the levator scapulae muscle (figure by J. Wytrążek, published with the author's consent).

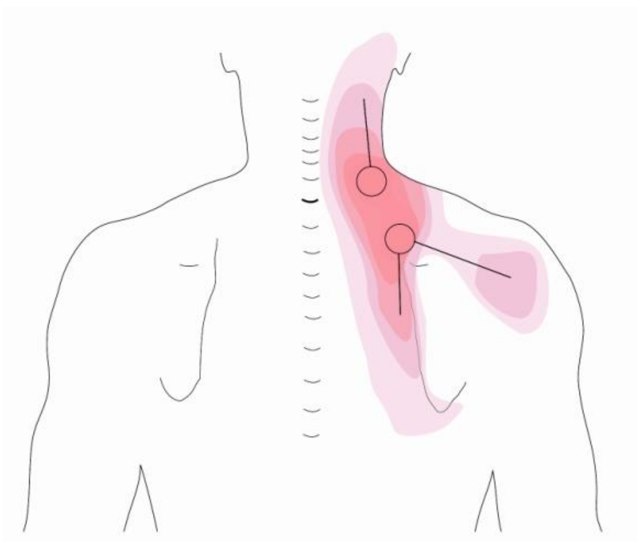

Figure 2. Diagram of pain referred from trigger points in the levator scapulae muscle (figure by J. Wytrążek, published with the consent of the author).

The diagnostics of the myofascial pain syndrome should include a detailed analysis of a patient's pain history with a clinical examination [34]. The examination should include precise noting of pain areas (indicted by the patient) combined with a palpation, which allows for establishing the patterns of pain radiating from individual muscles. Information helpful in diagnostics may be pain caused during palpation (recognised by the patient), tender point felt within the taut band of muscle fibres, local twitch response, "jump sign", weakening of muscular strength, restricted range of motion and pain resulting from stretching the muscle [2].

For Kostopoulos et Rizopoulos [2001] the main diagnostic criteria are finding a taut band of muscle fibres and locating a tender, "nodular" area in it, the pressing of which may result in referred pain, recognising the pain by the patient as "experienced earlier" and pain which appears in the last phase of stretching the muscle [7]. The complementary criteria are, according to the authors, the presence of local twitch response caused by pressure across the taut band of muscle fibres or as a result of irritating with a needle, presence of patterns of referred pain – characteristic for individual muscles and a spontaneous electromyographic activity.

Palpation

The first stage of palpation of trigger points is locating the taut band of muscle fibres. The examiner should place his or her fingertips above the examined muscle and then, slowly increasing the pressure, sink them into the tissues. At this stage the examination should not cause pain or any discomfort [32]. Without moving the fingers on the skin the examiner should start making movements across the fibres, trying to locate taut fibres. The knowledge of muscle topography and anatomy of its fibres is important. Taut fibres are often described as a structure which resembles "a thick string", "rope" or "pencil" underneath the layer of skin. In many muscles at least a few fibres can be found which fit the above description. Then the examiner must assess which of the fibres of this type is most taut. Another stage is making provoking movements across the selected fibre (like on a string of a guitar), which makes it possible to assess in which area this fibre is most sensitive or painful (usually it is a small area). To avoid missing a part of a muscle the fibre should be checked throughout its length – from the starting attachment to the end attachment. When the small area of highest sensitivity is located gradual vertical pressure should be applied. The angle of pressure should be gradually changed, as very often a slight change of angle causes the right place to be pressed, the provoking of which gives the symptom of referred pain. During the examination many examiners concentrate on feeling a thickness described sometimes by some authors, which is defined as “a pea”, “nodule” or “tubercle”. Indeed, it is often possible to feel the thickness within the taut band of muscle, however very often it is difficult to distinguish the area called “a lump” within the examined structure, which does not mean that the trigger point is not there. Therapists who concentrate during palpation on finding the described “nodule” may in many cases obtain a false negative result. It should be remembered that a trigger point is a part of a muscle in which there are microscopic groups of contracted sarcomeres, which may constitute an area too small to feel like a separate structure [35]. The key strategy in this case is locating a tender area, which provokes radiating pain. To a certain respect the name itself may be to blame for this common misunderstanding. The “trigger” component seems appropriate, as after pressing the pain appears in a distant place, as if released after pulling a gun trigger. However, the “point” component suggests to many therapists they should search for a point, not a small tender area as described above.

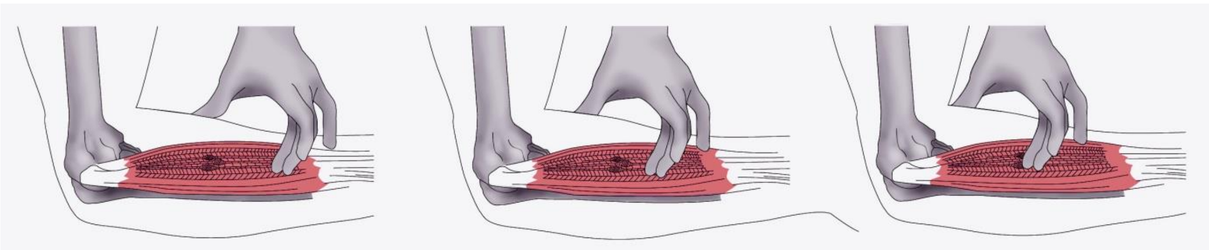

Figure 3. A diagram of palpation of a trigger point in the extensor muscle of fingers. The examination across a taut band of muscle fibres along its whole length is presented (figure by J. Wytrążek, published with the author’s permission).

Examination of TrPs requires patience and inquisitiveness. Each movement must be calm, slow and gentle, and the area must be examined millimetre by millimetre. This is significant as in the early days of practicing many therapists start pressing the muscle quickly and chaotically and if they cannot find TrPs within several seconds most of them agree that it is not there. Of course, if the trigger point cannot be found after a while, the examination has to be stopped. However, as we said above, trigger points occur often (even in people without pain complaints) and it is worthwhile to make “a false positive” assumption that a trigger point is located in the examined muscle and spend more time locating it.

In order to diagnose the myofascial pain syndrome it is necessary to have a good ability of palpation. Observations of Fisher [1998] show that very often the presence of trigger points remains unnoticed due to the lack of proper training [36]. According to this author, therapists without appropriate preparation may fail to locate more than 70% of trigger points present in a patient. Besides, in the initial period of practice therapists can recognise only about 40-50%, and after a six-month practice 60-70% of trigger points in a patient [36]. Bennett [2007] notes that most physicians are not taught the ability of palpation of trigger points [17].

The studies of Njoo and Van der Does [1994] showed the reliability of the assessment of local sensitivity, the “jump sign” and pain recognition by the patient [as] they had a high kappa coefficient [37]. Nice et al. [1992] showed a low reliability in location of trigger points in the same patients by different examiners [38]. This may be caused by inappropriate training of the examiners, four of whom were students. Lew et al. showed a high consistency between raters [1997] [33].

Gerwin et al. [1997] demonstrated a high reliability of trigger point examination between four well-trained testers [39]. In their study, the kappa coefficient was 0.74 (which means “substantial” according to Landis and Koch interpretation, quoted after: Jarosz-Nowak, 2007) [40]. Other studies with a double blind test demonstrated that four clinicians are able to locate latent trigger points in a trapezius muscle and carry out an algometric test obtaining similar results [41]. The reliability of palpation of trigger points on the basis of examination of muscles of the shoulder girdle is confirmed also by Bron et al. [42].

Other authors, on the other hand, indicate that precise location of trigger points in bellies of muscles is difficult and requires a lot of experience. Andrzejewski et al. [2009] believe that an easier method for a therapist is the assessment of pressure sensitivity in places of attachments [43]. It is particularly significant that these authors showed correlation between the values of pressure on the length of the muscles in trigger points and on attachments.

Also, Chaitow et Fritz [2006] present various aspects of palpation of trigger points [32]. They note that the presence of trigger points may be related to changes on the surface of the skin above a trigger point. It may be local swelling of tissues, the “orange skin” or “goose bumps” symptom, as well as increased sympathetic activity, expressed as increased perspiration. The authors also note that the presence of trigger points is related to the change in warmth and elasticity of tissues. These elements seem however to be highly subjective and require significant experience of a therapist.

Examination of tissue sensitivity to pressure

A measurement which is helpful in diagnostics of myofascial trigger points is algometry [17]. The assessment of pressure sensitivity of tissues is an easy method, more objective that palpation, and it can be successfully used in planning treatment and the assessment of its effectiveness [43, 44].

An algometer developed by Fisher [1986] is a simple device used to measure sensitivity to pressure [45]. It is used to determine the pressure pain threshold, that is the smallest force which causes pain, the pressure is measured in kilograms per square centimetre. Algometry is a reliable measuring method which can objectively support diagnosis of trigger points in myofascial pain syndrome [37, 46, 47, 48, 49]. Algometry is also characterised by high reproducibility [44]. Algometric measurements are reliable even in case of taking them for three days in a row [50]. However, Chesterton et al. [2007] suggest that the highest reliability can be achieved by deriving a mean of three measurements [51]. Studies indicate that the pressure pain threshold is lower in latent trigger points, compared to tissues without a dysfunction, and that it is statistically lower in active trigger points, compared to latent trigger points [52].

Andrzejewski et al. [2009] note that during the study the value of the measurement should be only visible to the person performing the measurement, however it is good when both the patient and the tester do not see the face of the device until the patient reports that the pressure is perceived as painful [43]. At best, the patient should signal the moment when it happens, for example by saying “stop”. The pressure should be applied at the angle of 90 degrees to the tissues with a speed of 1 $kg/cm^2/s$ [53].

In the algometric examination a higher pressure pain threshold can be noted in men compared to women as well as a varied pressure pain threshold can be noted for individual muscles [53]. The differences between pressure pain threshold in men and women are confirmed by many studies [44, 54, 55, 56, 57].

Individual body areas are characterised by various pressure pain thresholds [44]. The tissues of the cervical spine are more sensitive than those of lower spine [44, 45]. Vanderween [1996] notes that the pressure pain threshold of shoulder girdle and arm tissues is lower than that of more distal tissues of lower arm and hand [44]. According to Fisher [1986] a significant result of the measurement is the difference in pressure pain threshold of tissues on both sides of the body larger than 2 kg/cm^2, which may be a proof of an ongoing disease process within them [58]. However, this author considers values below 3 kg/cm^2, as abnormally low [59]. In case of healthy muscles without trigger points the pressure pain threshold may be higher than 10 kg/cm^2, however applying such a large pressure may lead to microtraumas and bruising, according to some authors [50].

Electromyographic test

The first reports about the possibility of recording characteristic bioelectric activity in trigger points date back to the early second half of the 20th century [60]. A needle electromyography test provides an opportunity to confirm the presence of myofascial trigger points thanks to registering bioelectric activity, not registered outside the trigger point [11, 13, 14, 61]. In the test an asynchronous recording of spontaneous high-amplitude discharges (up to 2000 μV) with low-amplitude background (of several dozens μV) is observed. According to Ge et al. [2001] needle electromyography is the only electrophysiological method which can confirm the presence of trigger points [62]. On the other hand, other researchers were unable to register this type of activity [63].

In surface electromyography test the recording of spontaneous activity is also observed, but less often and with a lower amplitude [14]. It is assumed that these discharges may be related to the excessive release of acetylcholine [9]. Electromyographic tests are the basis for the so called “integrated hypothesis” which attempts to explain the phenomenon of origin of trigger points [26].

Few studies have explored the use of less invasive surface electromyography, using which changes in bioelectric activity in the area above the trigger points can be registered [14, 64]. Research shows that changes in bioelectric activity in patients with myofascial pain syndrome may be observed both under resting conditions and in exercise tests [14]. It should be emphasised that it is difficult to perform a needle electromyographic test without interfering with the activity of the trigger point, as mere inserting of the needle may affect it [65]. Donaldson [1994] using surface electromyography in people with headaches noted that muscles where trigger points were present had increased bioelectric activity compared to muscles in which no trigger points were located [66]. Gemmell and Bagust [2009] noted lowered bioelectric activity recorded in exercise tests in trapezius muscle in people with trigger points [64]. Although they noted a higher activity in latent trigger points, they did not note a statistically significant difference between recordings from active and latent trigger points. The study of Kuan et al. [2007] shows a high relation between low values in the examination of the pressure pain threshold and increased amplitude of spontaneous bioelectric activity of a muscle registered in trigger points [67].

The methods which can confirm the dysfunction resulting from the presence of trigger points are also microdialysis, elastography with the use of magnetic resonance and ultrasonic imaging [68, 69].

Summary:

Although in clinical practice the diagnostics of trigger points is based mainly on palpation, more and more diagnostic methods are available which enable a quick, non-invasive and more objective forms of evaluation of a patient with myofascial pain syndrome. This is particularly important in case of a search for the most effective therapeutic methods used in therapy of this pain syndrome. Both algometry and surface electromyography enable more precise evaluation of the condition of a patient with myofascial pain syndrome which may be significant at the stage of diagnosis, planning and assessing the effectiveness of a therapy.

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