ALGORITHM FOR FUNCTIONAL ASSESSMENT IN PATIENTS WITH MYOFASCIAL PAIN SYNDROME

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Abstract. Myofascial pain syndrome (MFPS) is a common clinical problem, arising from the muscles and produces sensory, motor and autonomic symptoms which are caused by myofascial trigger points that are focal areas of tenderness caused by hypercontracted muscle tissue. Chronic condition affects the fascia covering the muscles, characterized by the local and reflected pain may occur at any age, as well as in rheumatic and in many other diseases as a manifestation of inflammatory and / or degenerative-dystrophic process. A significant role in the development of MFPS play inherent characteristics of the musculoskeletal system: developmental abnormalities, Sacralisation and lumbarizatsiya spine spondiloliza, svrahmobilnost of joint deformities and others. Myofascial pain is a topical interdisciplinary problem and currently occupies a leading position among major pain syndromes in general medical practice. MFPS is one of the most common causes of back pain, neck and limbs. Treating MFPS usually involves a combination of medication and physiotherapy - special exercises, techniques for myofascial release using special balls and rollers, manual therapy and massage. Functional evaluation and monitoring of the dynamics of recovery is needed to make analytical selection of functional and performance tests corresponding to the dysfunction of the musculoskeletal system. **Purpose**: The purpose of this study is to develop and justify a test battery for functional assessment in patients with myofacial pain syndrome, based on comprehensive research. **Research methodology:** To achieve the goal of the research, the following methods are applied: Analysis of literature sources in theoretical aspect, related to the problem of MFPS; Expert evaluation. **Results:** Establishing the status of various aspects of the repair process in MFPS, after analysis of the literature and expert evaluation of the test battery for functional assessment include: History, Somatoscopy (examination), Palpation, Centimetry - a method for measuring the length and circumference of the limbs in centimeters. Functional examination (stiffness, muscular hypotrophy, etc.), skin examination, connective tissue examination, periosteal examination. Functional tests: - To assess the dynamic pain, or pain when moving - Test by the method of Merle O. Dobine; Visual-analog scale (VAS) for pain. Functional tests for examining the range of movement; Methods for assessing muscle strength and endurance. Assessment of the patient's psycho-functional condition through the SAN test before and after treatment. **Conclusion:** For functional assessment and monitoring of the dynamics of recovery in individuals with MFPS, an analytical selection was made and an algorithm for functional assessment of the musculoskeletal system was prepared.
Keywords: myofascial pain syndrome, fascia, kinesitherapy, test

1. INTRODUCTION

The International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage", can be acute (acute) and short-term or chronic and long-lasting. Muscle pain attracts the attention of doctors of various specialties - orthopedists, neurologists, rheumatologists and others. This is mainly due to the high incidence of chronic pain syndrome leading to long-term disability, mainly in young and middle-aged people (Stoyanov et al., 2020; Nenova, 2016).
The nature of myofascial pain, despite the long-standing interest of researchers in this problem, remains unclear. Nerve structures, skin, muscles, fascia, periosteum, joints and vessels are involved in the formation of pain. Many authors point out that pain is always based on an imbalance of proprioception, and local changes are crucial. (Mitova et al., 2020; Avramova, 2020; Nenova, et al, 2016). Trigger points (TP), trigger zones (TZ) are described, which can be a source of myofascial pain syndromes in various pathological conditions of the musculoskeletal system and internal organs (Safonicheva, 1999). Myofascial TP is a hyper-irritant region in the condensed skeletal muscle and localized in the muscle tissue and / or fascia. When pressed, this point is painful and can reflect pain and autonomic manifestations in certain parts of the body (Travel, Simons, 1989). Myofascial pain syndrome is associated with muscle pain and inflammation in the soft tissues of the body (Gramatikova, 2015; Valchev, 2019).
The chronic condition affects the fascia - the connective tissue that covers the muscles. The criteria for the diagnosis of myofascial pain syndrome are: painful spasmodic muscles, painful muscle seals, active trigger points with the formation of an area of reflected pain. It is essential that in order to diagnose myofascial pain syndrome, it is necessary to reproduce the pain that the patients complains of by processing a trigger point. Usually the patient

remembers exactly which movement or action caused the pain. Pain reproducibility is one of the necessary conditions for the diagnosis of myofascial syndrome (Alekseev, 2008; Podchufarova, 2005).

Myofascial pain may be due to muscle trauma or overuse of a particular muscle, muscle group or tendon, or due to: damage to the intervertebral disc; state of fatigue and exhaustion; repetitive movements; medical condition, including heart attack, stomach problems; lack of activity due to a broken leg or arm. The main symptom of myofascial pain syndrome is momentary or prolonged muscle pain in areas such as the lower back, neck, shoulders, chest. Other symptoms of myofascial pain include: a touch-sensitive muscle; muscle pain that is felt when pressing on a sensitive area; pain associated with a burning sensation or stabbing; pain in the affected area when moving; feeling of weakness in the affected muscle (Shostak, et al., 2014).

According to the literature, myofascial pain syndrome is much more common than diagnosed. In the general population, almost everyone experiences myofascial pain throughout their lives. According to various authors, 30 to 80% of the population of different age groups constantly suffer from varying degrees of severity of myofascial pain syndrome (Ivanichev, 2002; Travell et al. 2004; Glushkova, et al., 2014).

A major contribution to the development of MFPS theory was made by Travel, who proposed the term "myofascial trigger point" (MFTP) and, together with Simons, published a two-volume guide to myofascial pain, summarizing decades of observation and research. In the model of myofascial pain proposed by Travel and Simmons, the concept of MFTP occupies a central place (Shah et al, 2015).

Several hypotheses have been put forward for the emergence of MFPS and MFTP. It is believed that their development is associated with muscle strain. MFTP can be formed as a result of overload of the neck and postural muscles, which are in a state of prolonged tension to maintain a certain position of the body (postural load), the so-called static muscles (Podchufarova et al., 2014). It has been proven that non-intense but prolonged muscle contractions in office workers during 30 minutes of writing cause the formation of MFTP.

According to Cinderella's hypothesis, the mechanism of development of the MFTP is explained by Hennemann's "principle of magnitude": during prolonged non-intensive exercise, type I muscle fibers contract first, but they are the last to relax. (Treaster, et al., 2006; Hagg, 1991). As a result, these fibers are constantly activated and metabolically overloaded (including a change in calcium channels). They are more damaged and are considered a key factor in the formation of MFTP, in contrast to the larger phasic muscle fibers, which are involved only during dynamic loading (Shah et al. 2008).

Intramuscular perfusion is thought to decrease with prolonged low intensity. As a result, ischemia, hypoxia and insufficient synthesis of ATP develop in the fibers of motor units of type I, which can lead to an increase in the concentration of hydrogen ions, accumulation of calcium ions, subsequent reduction of sarcomeres. With long-term contraction of the sarcomeres, an even greater decrease in intramuscular perfusion is observed with the formation of a vicious circle, which leads to the formation and maintenance of MFTP (Shah et al, 2015).

According to Stecco's (2011) hypothesis, displacement of adjacent layers of the muscular contractile apparatus due to overload or trauma causes increased formation of hyaluronic acid, which accumulates in the interfascial spaces and increases friction in them, leading to thickening of the fascia and slippage. in muscle fibers. In addition, friction causes neural hyperstimulation, leading to sensitization of mechanoreceptors and pain receptors located in the thickened fascia. In addition, the severity of the sensitization phenomenon correlates with the duration of pain, the development of allodynia, paresthesias, impaired proprioception, and random movements (Stecco, et al. 2011).

Some authors do not support the hypothesis of the leading role of the MFTP in the formation of the MPS. The development of MFPS and MFTP is thought to be secondary in nature to the underlying disease. The MFTP phenomenon, which is considered to be the most important component of MFPS, is considered only as an area of secondary hyperalgesia associated with damage to peripheral nerve fibers. According to these concepts, MFPS is a complex form of neuromuscular dysfunction that is accompanied by soft tissue damage and the development of peripheral and central sensitization due to neurogenic inflammation and affecting the structures of the limbic system (Quintner, 1994; Butler, 2006).

2. MATERIALS AND METHODS

The aim of the present study is to develop and substantiate a test battery for functional assessment in patients with myofascial pain syndrome based on a comprehensive scientific study. To achieve this goal we apply the methods: Analysis of literature sources in theoretical terms related to the problem of MFPS; Expert evaluation. The study includes: **Functional examination** - based on general principles accepted in medicine. The clinical examination of the patient reveals not only gross anatomical abnormalities, but also subtle, insignificant external manifestations and injuries (stiffness, muscular hypotrophy, etc.).

History, Somatoscopy, Palpation, Centimetry, Examination of the skin, Examination of the connective tissue, Examination of the periosteum, Point of pressure on the periosteum, Kibler test, Test for the assessment of dynamic pain by the method of Merl d'Aubigne, Borg scale, Visual -Analog Pain Scale (VAS), Facial Expression Pain Assessment, Kiel Muscle Strength Test, *Ott* TEST, *Schober* TEST, Patient Psycho-Functional Assessment Using the SAN Test Before and After treatment. Ten-minute Hendler screening test for patients with chronic pain.

3. RESULTS

To establish the state of various aspects of the recovery process at MFPS, after analysis of literature sources and expert assessment in the **test battery** for functional assessment include:

Functional examination: - History - a thorough history of the patient is taken - name, age, dominant arm, anthropometric data, routine motor activities, physical activity, motor behavior, presence or past illness. **Somatoscopy** (examination) - a general examination of the patient's posture is performed, followed by a local examination of the lesion and other parts of the body (detailed examination). We perform the examination in the initial position standing and moving. The load axis passes from the anterior-superior femoral spine (spina iliaca anterior superior), through the middle of the cap to the I interdigital space. Hypotrophies of muscle groups or individual muscles are sought. **Palpation -** to track and identify abnormalities, palpate on both sides with your thumb and forefinger. Palpation is performed with warm hands, from a painless to a painful area, without causing severe pain on examination. Palpation determines the tone and presence of muscle malnutrition, as well as the appearance of pain in the examined muscle. **Centimeter -** we measure the lengths and circumferences of the limbs in centimeters. The examination is performed with the help of a centimeter tape in the initial position standing and occipital position. **Skin examination -** Changes in the normal condition of the skin (areas in the dermatome). Increased skin irritation can manifest itself in the form of: • superficial hyperesthesia - a condition characterized by increased tactile sensitivity. The pain can be caused by displacement of the skin - when stroking the skin, attention should be paid to the pain; • superficial hyperalgesia is a sensation of pain in limited areas of the skin without any tactile irritation - the patient is worried about a burning sensation; • Excessive skin surface tension - a condition in which the skin is difficult to lift (peel off the skin). **Connective tissue examination -** Palpation of the skin is performed near the fascia always in two symmetrical places, without pressure and without a feeling of cutting. In order to identify the differences between the parties, it is necessary to conduct a two-handed study. The skin moves at right angles to the edge of the bone. **Examination of the periosteum** - Changes in the periosteum can be caused by mechanical changes (for example: a sharp contraction of a muscle). Point of pressure on the periosteum - The therapist performs a strong irritation of the bone located directly under the skin with the pads of two fingers.

To determine the mobility of the skin fold we use - Kibler Skin-Rolling test - The patient's starting position is lying down. The upper limbs are relaxed and lie along the body. A skin fold gathers between the thumb and forefinger and "rolls" over the body or limbs, moving the skin roller perpendicular to the direction of the dermatomes. This test assesses regional variations in how easily the skin can be lifted, the consistency of the skin fold (rubber or edematous) and the lack of mobility in the skin. Palpation can detect regional tension in the superficial and deep muscles, as well as autonomic dysfunction (such as local warming or increased sweating). In areas of hypoalgesia, the skin is less pliable, more difficult to lift and resists rolling. The patient reported pain (Buckup, 2008).

To determine the extent and nature of pain, we use a test by the method of Merl d'Aubigne - to assess the dynamic pain, or pain when moving. The strength of the pain is determined in 6 degrees with the numbers from 0 to 5, where at 0 - there is no pain, and at degree 5 there is strong pain at the beginning of the movement, blocking it, weak effect of analgesics.

To determine the degree and nature of static pain, we use the Borg Scale - The strength of pain is determined in 12 degrees with the numbers from 0 to 10, where at 0 - no pain, and at degree 10 the pain is maximum. This scale registers the subjective perception of patients for static back pain, as well as the strength of its irradiation.

Visual-analog scale (VAS) for pain - subjective reading of the degree of pain. The VAS is a scale for assessing pain perception with a length of 100 mm. The left end of the scale reflects the level of "no pain" and the right - "very strong pain". The patient indicates on the scale this point, which according to him reflects the strength of his pain perception at the time of measurement. The intensity of the pain is recorded as the length in millimeters, measured from the left end of the scale to the point indicated by the patient.

Assessment of pain by facial expression - For this purpose we use a scale (Table 1), monitor the patient's reaction and report facial expression

. Table 1. Scale for pain assessment by facial expression

0	***2***	***4***	***6***	***8***	***10***
Without pain	***Minimal pain***	***Mild pain***	***Moderate pain***	***Strong pain***	***Unbearable pain***

Kiel muscle strength endurance test - including three test movements to examine the strength endurance of the back, abdominal and buttock muscles.

The first test movement includes a study of - the strength endurance of the abdominal muscles. The face is in the initial position of the occipital position, with outstretched lower limbs, with the arms folded in front of the chest. The person raises his body to 45 degrees flexion of the torso and holds in this position (static part). The examiner fixes the lower limbs, not allowing the knee joints to bend. The position of the head is important, which should be an extension of the spine (flexion is not allowed).

The second test movement includes a study of - strength endurance of the back muscles. The person is in the starting position lying down, with the upper part of his body outside the narrow side of the couch. The hands are behind the nape. The body is raised to a horizontal plane, then held in this position (static part). The lower limbs are fixed by the examiner to the couch.

The third test movement includes a study of - the strength endurance of the gluteal muscles. The starting position is lying down. The lower limbs are off the couch. For better support, make the person hold hands on both sides of the couch. Raise the lower limbs to a horizontal position and hold in this position (static part). It is considered to be muscle weakness if the test cannot be performed on its own or if the static part of the test cannot be held for at least 20 seconds. With test results between 20 and 30 seconds, there is considered to be muscle weakness (quoted in Debruner, Hep, 1999).

Manual muscle testing - we measure the muscle strength (weakness) of the extensors of the hip joint (m. Gluteus maximus, m. Semitendinosus, m. Semimembranosus, m. Biceps femoris), back muscles (m. Errector spinae, m. Iliocostalis, m. Longisimus dorsi , m. spinalis, m. quadratus lumborum), abdominal muscles (m. rectus abdominis, m. obliquus externus et internus abdominis, evaluated according to generally accepted criteria (Bankov, 1976). We use the evaluation criteria introduced by R. Lovett: 0 - no activity; 1 - visible contraction without visible effect; 2 - movement in full range with eliminated gravity; 3 - movement in full range against the force of gravity; 4 - movement against manual resistance; 5 - normal movement. Grades can also be given in percentages: 0-0%; 1-5%; 2-30%; 3-50%; 4-80%; 5-100%. Grades 5, 4 and 3 are considered functional.

Spinal range of motion tests - Ott TEST - we examine the patient from the II main posture. We measure a distance of 30 cm from the processus spinosus of TH1 caudally. We note the upper and lower vertebrae. We force the patient to perform full flexion, and in this position we measure the same distance again. Normally, at full range of this movement, the distance between the marked points increases by about 3.5 - 5 cm. In the case of limited mobility of the chest, flexion is reduced, and in some cases may be completely absent. **Schober TEST** - we use it to measure the range of movement in the lumbar spine. The patient is in a standing position. From L5, measure 10 cm in the cranial direction. Again, mark the distance with a demographic pencil. The patient bends forward and down. At full range of motion, the distance between the two points increases by about 3.5 - 4 cm, when there is limited mobility, the distance increases by 1 - 2 cm or does not change in more serious pathology (Buckup, 2008).

Assessment of the patient's psycho-functional condition through the SAN test (self-esteem, activity, mood) before and after treatment. The methodology was developed at the St. Petersburg Military Medical Academy (Leonova, 1984). It is a system of rating scales based on the principle of rating bipolarization (from +3 to -3). Three indicators (scales) are evaluated: self-confidence, activity, mood. On each scale, a total indicator divided by 30 is obtained, giving a score in the range from +1 to -1. A general indicator can also be calculated as the arithmetic mean of the three private indicators. Subjects are asked to assess their condition at the time of the inspection. The results obtained from each category are divided by 10. The average score on the scale is 4. Scores greater than 4 indicate a favorable condition of the respondents. Ratings less than 4 indicate an unfavorable condition. Grades in the range of 5.0 - 5.5 are an indicator of normal condition.

Ten-minute Hendler screening test for patients with chronic pain - The test contains 15 test questions with one correct answer. Each answer carries a certain number of points. The results are interpreted as a score of 18 points or less suggesting that the patient suffers from chronic pain which he defines quite objectively. A score of 15-20 points suggests that the patient generally has an objective feeling of his chronic pain, but slightly exaggerated. A score of 19-31 points suggests that the patient has a tendency to exaggerate the sensation of pain. Score of 32 points - these patients tend to greatly exaggerate the sensation of pain and suffering and usually report many problems before the pain and show significant difficulty in coping with the chronic pain they are currently experiencing (Hendler, Baker, 2008).

4. DISCUSSION

Myofascial pain syndrome is a chronic condition that causes pain in the musculoskeletal system. Future clinical trials should focus on identifying the mechanisms responsible for the pathogenesis of myofascial pain syndrome. Successful treatment depends on identifying and targeting these mechanisms and addressing the supporting factors that support this common pain syndrome. Treatment should be based on the removal of the root cause and begin conservatively with manual therapy. Patients with myofascial pain should be examined periodically until all symptoms have resolved.

5. CONCLUSION

Myofascial pain syndrome is an extremely common cause of chronic musculoskeletal pain. For functional assessment and monitoring of the dynamics of recovery in individuals with MFPS, an analytical selection was made and an algorithm for functional assessment of the musculoskeletal system was prepared. The presented test battery is effective for monitoring the dynamics of complex therapy in persons with myofascial pain syndrome.

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