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Pressure Algometer: An Effective Diagnostic Tool to Identify Latent Myofascial Trigger Points

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Abstract
A review of the available literature on latent myofascial trigger points is presented in this paper, including their, causes, and diagnosis criteria, and emphasized knowledge about the pressure algometer. A search of multiple databases was used in order to gather review information, including Google scholar, PubMed, ScienceDirect, BMC, Elsevier, and Springer. Myofascial pain syndrome, myofascial trigger points, pressure algometer, and a combination of these terms were searched. The titles and abstracts of all articles were reviewed. Our research included reading the full texts and checking the reference lists of relevant papers. The diagnosis of a latent myofascial trigger point is basically made by using physical examination, ultrasonography, and pressure algometers to determine pain thresholds. From a review of the previous studies, we observed that the pressure algometer is a very useful, reliable, and inexpensive device to identify myofascial trigger points as compared to ultrasonography. Many authors recommend using this device.
***Key Words** – Myofascial Pain Syndrome, Pressure Algometer, Myofascial Trigger Points, Pain Pressure Threshold*

Introduction

'Fascia' is a synonym for "bandage", a word that originates in Latin. Throughout the body, this form of tissue surrounds all organs and tissues and is often referred to as mesenchyme. (Benjamin, 2009; Das & Jhajharia, 2022; Domingo et al., 2011). An organized a body-wide 3D matrixis provided by fascia, the soft connective tissue layer that blankets the human body as noted by the 2007 Fascia Research Congress(Findley et al., 2012). Myofascia (MF) is a connective tissue component of the musculoskeletal system that supports muscles(Martínez Rodríguez & Galán del Río, 2013), mechanical forces are transmitted between muscles by it (Findley et al., 2012; Huijing, 2009). myofascial pain syndrome (MPS) is produced by myofascial trigger points (MTrPs). Waller et.al confirmed in their investigation, Up to 85 percent of the population would encounter my ofascial pain (MFP) at some point during their lives (Weller et al., 2018). The MTrPs definition given by Travell and Simonsas ''Ahyper irritable spot, usually, in a taut band of skeletal muscle or in the muscle fascia, this feels uncomfortable when compressed and can cause referred pain. According to studies, 54 percent of women and 45 percent of men are thought to be affected by MPS, with the most prevalent age group being 27 to 50 years(Cheatham et al., 2018).Clinically, MTrPs is classified as active and latent.(Jiménez-Sánchez et al., 2021; San-Antolín et al., 2020; Wang et al., 2010)MTrPs that do not cause pain is known as latent MTrPs (L-MTrPs).(Cygańska et al., 2022; Ge & Arendt-Nielsen, 2011) L-MTrPs can be accompanied by movement deficiency and reduce muscle strength(Walsh et al., 2019). Further, L-MTrPs increase the risk of patellofemoral pain syndrome and post meniscectomy pain or knee osteoarthritis(Zuil-Escobar et al., 2016), headache, shoulder pain, and mechanical neck pain(Tabatabaiee et al., 2019). The symptoms of an active MTrPs(A-MTrPs) include persistent pain, muscle weakness, decreased muscle elasticity, and referred pain(Ibrahim et al., 2021),despite the fact that L-MTrPs are not responsible for impulsive pain,In addition, they can easily be transformed into A-MTrPs(Ge & Arendt-Nielsen, 2011).There are no unified diagnostic criteria for MPS because there are no specific laboratory or imaging indicators(Cao et al., 2021).Therefore, the aim of this investigation is to provide a general overview of MPS and reliable diagnostics criteria.

Methodology

A search of multiple databases was used in order to gather review information, including Google scholar, PubMed, ScienceDirect, BMC, Elsevier, Spinger. Myofascial pain syndrome, pressure algometer, myofascial trigger points, diagnostic criteria, and a combination of these terms were searched. The titles and abstracts of all articles were reviewed. Our research included reading the full texts and checking the reference lists of relevant papers.

Causative Factors

Researchers noted three well-established theories behind the MPS that are discussed in the following sections based on their detailed observations of previous studies. There are various factors that contribute to chronic and acute myofascial pain, as explained in the book name "MTrPs Comprehensive diagnosis and treatment". Contusion, regularly eccentric muscle strain, Torn muscles, Sprain or dislocation of joints intense isometric muscle contractions, shortening of Myofibers, surge in muscle tension caused by environmental changes, variation in muscle stiffness of psychogenic cause, minor muscular stress due to previous circumstances- these are the reason of acute MFP. Stress, anxiety, and depression are also factors that cause chronic MFP(Irnich, 2013). According to another researcher, long-lasting slight myofibrilsstrain includes bad body position, persistent illness, or soft tissue wound(Bennett, 2007; Hong, 2004). "Integrated hypotheses", given by Mense and Simons, are most commonly credited with developing primary TrPs(2001). An irregular acetylcholine (Ach) release from the axon terminal would be the main malfunction of a TrPs.A non stop proclamation of Ach from the neuromuscular junction occurs when the post junctional membrane depolarizes. In the sarcoplasmic reticulum, calcium ions are continuously released, causing insufficient absorption, leading to a shortening of the sarcomeres. If continuing the problem leads to a vicious cycle, in which hypoxia leads to the construction of vasoactive and algogenic substances, which alert near by nociceptors, causing local hyper sensitivity. Additionally, hypoxia origins a discrepancy in the manufacture of energetic molecules like as ATP, impairing the ability to reabsorb calcium ions into the sarcoplasmic-reticulum (SR), this function needs proper amount of energy , and prolonging the sarcomere obstinate hypoxia,This series is self-sufficient and results in TrPs until it is broken(Bennett, 2007; Spitznagle & McCurdy Robinson, 2014; Weller et al., 2018). There is three crucial characteristics foundation of energy crisis theory (ECT) of contractile myofibers sacs, and it is assumed on this predication that there is an EC in the muscle:1) No other action potentials generated 2) The myofibersac are pain-sensitive locally, 3)On deactivated of TrPs, there is a speedy recovery and reduction in soreness. Contraction that is caused by increased metabolic rate and is chaemically induced hypoxia also takes place without being influenced by the electrical activity of motor neurons. This results from higher energy needs and ongoing maximal activity.The aforementioned pathomechanisms contribute to the dispersion of neuro reactive chemicals in the context of an energy shortage. e.g., bradykinin, serotonin (5-hydroxytryptamine, 5-HT), prostaglandin(Aoki et al., 2010; Bennett, 2007; Weller et al., 2018) the sensitisation of adjacent nociceptors.The ECT claims that this hypoxia leads to oedema and further encourages local is chaemia. It also bases of the release of neuro reactive chemicals and an increase in vasoneuro active messengers. In muscle Ca2þ malfunctions as a result of local hypoxia-induced ATP deficiency. The sarcomeres are still attached to one another and are unable to break free, this accelerates the creation of taut bands and is related to the Cinderella theory. The somatic and autonomic nerve terminal, as well as nociceptors, are irritated by release of neuroactive chemicals. This explains the palpable sensitivity, referred pain, dysfunction of the twitch response, and issues with auto-function (e.g., sweat excretion, temperature of skin). This causes nearby muscle fibres and their sarcomeres to become advanced mechanically, biochemically, and/or electro-physiologically irritated, which makes signs and symptoms tenacious. Persistent strain features favour the continuation of this procedure(Fricton, 2016; Irnich, 2013).

Diagnostics Criteria

In the majority of cases, a precise diagnosis is challenging. One possible cause of these pain feelings is MPS, which is characterised by painful TrPs in the muscles. The first step in providing the appropriate medicine is making an accurate diagnosis. An effective therapy might be unsuccessful if the diagnosis is incorrect. The dependability of the test determines how accurate the diagnosis is. Reliability is the extent to which test results are consistent among examiners when the same test is administered to the same patients (Das & Jhajharia, 2022). According to Gerwin et al., palpation is the only method which can diagnose myofascial pain(Gerwin & Shannon, 2000), but Researchers Lucas and colleagues concluded a study, they reported that physical examinations are currently not reliable tests for diagnosing TrPs.

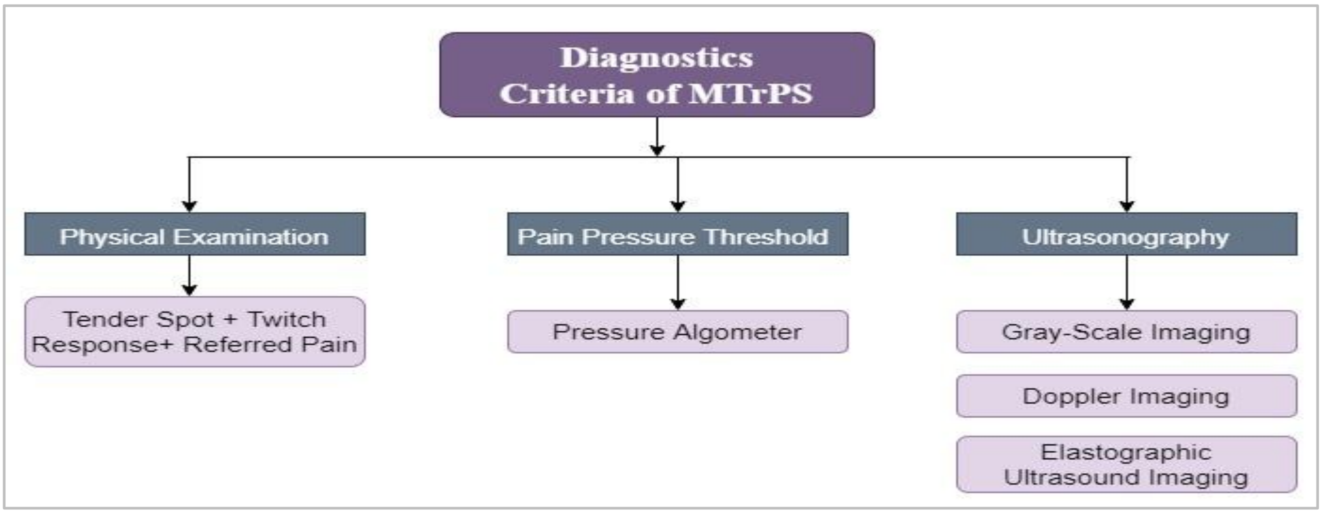

Figure 1 Various Diagnostics Methods Of L-MTrPs and A-MTrPS

Current diagnostic criteria must be validated using high-quality clinical trials in clinically relevant patients in order to determine the reliability of determining the exact location of TrPs(Lucas et al., 2009). In a paper that was published in 2020, researchers discovered that the three most common criteria are—"spot tenderness", "referred pain," and

"local twitch response," as well as the combinations used regularly as a diagnosis criterion. Due to this, specifying evaluative measures alone are inadequate, and more research should elucidate and standardise the required physical tests (Li et al., 2020). According to previous studies, pressure algometers have become a cost-effective, reliable, and clinically feasible tool for enhancing MPS diagnosis and management. In the evaluation of MPS and various musculoskeletal conditions, pressure algometry has been widely used. Patients with MPS were required to meet pressure pain thresholds (PPT), for example, When the PPT on one site of a patient was at least 4lbs/cm^{2}lesserthan the opposing muscle, it considered as abnormal condition. Recent years have seen the adoption of digital pressure algometers being developed(Hong, 1998; Park et al., 2011). In order to diagnose tender spots and assess treatment outcomes, It has been proposed that pressure algometry measurement is an accurate, reliable, and repeatable technique(Aboodarda et al., 2015; Cordeiro et al., 2021). Muscle nodules and tissue layers are often assessed by ultrasound according to their thickness and consistency. Researchers state that a few diagnostic techniques, including magnetic resonance elastography, electromyography, pain pressure threshold, and ultra sonography, have been developed to locate and detect MTrPs as well as to identify and characterise their properties(Taheri et al., 2016). Studies reported that, TrPs were analysed through ultrasound elastography by doppler method whereas a handheld vibrator was used to induce vibrations.There is a decreased vibration amplitude associated with MTrPs, which appear as focal and hypoechoic nodules(Behr et al., 2020; Srbely et al., 2016).The effectiveness of ultra sonography and its many techniques in this area is supported by evidence. As a result, ultra sonography is regarded as a secure, accessible, and affordable imaging technique for impartial detection of MTrPs and assessment for efficacy of therapies (Sikdar et al., 2008). Additionally, recent advancements in ultra sonographic technology provide us additional opportunities to assess the MTrP structure using higher-quality images (Rha et al., 2011). Sikdar and co-workers note in Gray-scale echogenicity and colour variance techniques were used in this investigation to distinguish between A-MTrPs andL-MTrPs and normal MF tissue, blood flow wave-form features were used to distinguish between abnormal and healthy tissues.The initial results demonstrate MTrPs may be distinguished from surrounding tissue using ultrasonography, a practical, accessible, and low-risk technology(Sikdar et al., 2009). Despite of high reliability and accurate diagnosis ultrasound is not cost friendly instrument of large population, and it also a time-consuming procedure and to use ultrasound need expert radiologist. Therefore, as comparison pressure algometer is better in the purpose of diagnosis of L-MTrPs.

Author	Journal	Muscles	Remark
(Dalewski et al., 2021)	*Journal of Clinical Medicine*	Masseter muscle, Temporal muscle, Temporomandibular joint, Sternocleidomastoid muscle	Reliable Instrument
(Pérez-Bellmunt et al., 2021)	*Journal of Manipulative and Physiological Therapeutic*	Gastrocnemius muscles	intraclass correlation coefficient = 0.97
(Castien et al., 2021)	*The Journal of Headache and Pain*	Temporal muscle, C1 Paraspinal muscles, and trapezius muscle	The concurrent validity between the digital and analogue algometer is excellent
(H. Battecha et al., 2021)	*Physiotherapy Quarterly*	Trapezius muscle	High inter-rater reliability in MTrPs assessment
(Ortega-Santiago et al., 2020)	*Brazilian Journal of Physical Therapy*	Upper trapezius, supraspinatus, infraspinatus, teres minor, teres major, latissimus dorsi, subscapularis, pectoralis minor, pectoralis major and deltoid muscles	shown to exhibit high intra- and inter-examiner reliability.
(Samani et al., 2020)	*Journal of Bodywork and Movement Therapies*	Lumbar muscles, Pelvic muscles, Hip muscles	--
(Wang-Price et al., 2019)	*Journal of Manipulative and Physiological Therapeutics*	Middle deltoid, Levator scapulae, Upper trapezius	Useful device for MPS
(Ransone et al., 2019)	*Journal of Bodywork and Movement Therapies*	Upper trapezius	The Cronbach Alpha reliability 0.94 - 0.99
(Walsh et al., 2019)	*Journal of Bodywork and Movement Therapies,*	Quadriceps Muscle Group	--
(Moraska et al., 2017)	*American Journal of Physical Medicine & Rehabilitation*	vastus lateralis vastus medialis	--
(Gordon et al., 2016)	*Journal of Bodywork and Movement Therapies*	Shoulder Muscles	--
(Celik & Mutlu, 2013)	*Current Pain and Headache Reports*		intraclass correlation coefficient=0.91 (95 % confidence interval (CI), 0.82–0.97)

Table2Use of Pressure Algometer by Various authors to diagnosis of MPS

Discussion

From the table no 1 we observed that pressure algometer is very reliable device and useful in the diagnosis of MTrPS. These portable devices contain a maximum hold feature that shows the highest pressure that was achieved during any given application. The algometer has been used in several clinical settings, including the assessment of fibrositis (Moldofsky et al., 1975) and fibromyalgia(Tunks et al., 1988), identification of TrPs(Fischer, 1988), quantification of joint tenderness in arthritis conditions(McCarty et al., 1965; Moldofsky & Chester, 1970), evaluation of pain sensitivity(Fischer, 1987; Keele, 1954) abdominal pain(Yamagata et al., 1976), and in psychological studies (Merskey et al., 1962). Additionally, pressure monitoring has been demonstrated to be useful for assessing the effects of pain reducing techniques such anaesthetic blocks, heat management, and anti-inflammatories as well as demonstrating the treatment's long-standing efficacy. (Fischer, 1987; Kinser et al., 2009). Algometry is a reliable and reproducible method for objectively documenting the degree of pain for use in medical and legal proceedings (Andrew A., 1986).

Conclusion

In both healthy subjects and MPS patients, the concurrent validity of the digital and analogue algometers ranges from fair to outstanding. In medical treatment and research, for both cross-sectional and longitudinal usage, studies recommended medical practitioner and scientific researchers to use algometer. The algometer is a reliable, user-friendly, and affordable tool for determining mechanical sensitivity in both healthy volunteers and MPS patients.

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Abbreviation

Myofascial Pain Syndrome (MPS)
Myofascial Trigger Points (MTrPs)
Active Myofascial Trigger Points (A-MTrPs)

Latent Myofascial Trigger Points (L-MTrPs)

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