

A New Approach to Evaluate of Musculoskeletal Pain

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ABSTRACT

Musculoskeletal Disorders (MSDs) and pains are one of the most common and costly types of injuries that disrupt the function of the involved tissue/tissues, and the function of the affected person. Failure to pay proper attention to pain assessment can have an adverse effect on the patient, disease process, and treatment steps. In order to properly assess pain, one should have a selective and comprehensive perspective, including history taking, disease history, attention to clinical and paraclinical findings, the use of multidimensional quantitative and qualitative structured tools (to assess pain intensity, physical, emotional and social functions), and the use of health-related Quality of Life (QoL) measurement tools. The purpose of this article is to present a new and brief approach to evaluate of musculoskeletal pain and related cases.

Keywords: Evaluation, Musculoskeletal Pain, New Approach.

Introduction

Musculoskeletal Disorders (MSDs) include any damage to soft tissues such as muscles, ligaments, tendons, and nerves, which causes impaired function of the injured tissue/tissues. The most common MSDs include: osteoarthritis (OA), autoimmune inflammatory arthritis, such as rheumatoid arthritis (RA), crystal-induced inflammatory arthritis such as gout, and fibromyalgia. In this category of problems, chronic pain and the discomforts resulting from it are the main and dominant complaints of affected people in the health systems of all countries [1-2]. Musculoskeletal disorders and pains are considered as one of the most common and costly types of injuries in the whole world (these problems make up one third of work-related injuries every year). [3-4]. The prevalence of chronic musculoskeletal pain in developed and developing countries is one out of four

people (25%) [5]. Research has shown that feeling pain and discomfort in different parts of the musculoskeletal system is one of the major problems and the reason for the absence of personnel from the work environment [6]. The etiology of musculoskeletal problems and pains, like other chronic pain conditions, is multifactorial in all societies. [5, 7].

Some of the background and key factors affecting musculoskeletal pain are: existence of comorbid health problems [8-9], social support [10-11], gender [12], education and health literacy, income, personality, pain tolerance and threshold [12-13], access to and use of health care, low socioeconomic status, untreated/incompletely treated childhood or adolescent problems, negative emotional symptoms and some other factors [5]. These reasons explain why people with arthritis with similar radiographs may experience very different levels of pain or

other symptoms ^[14]. These problems and resulting pains can be localized, regional or widespread. The mentioned disorders and the resulting pains affect the affected people individually and on the society at any age, sex, social background, and demographics characteristics. Musculoskeletal disorders are one of the major factors of long-term disability, reduced productivity, and reduced quality of life ^[5]. New evidence indicates that one should not look at pains and musculoskeletal problems only from the perspective of physical problems, but also from a biopsychosocial perspective and the influence of family factors. Because children with a family history have a higher chance (58%) of experiencing musculoskeletal pain and problems (especially when both parents report problems and pain) ^[15].

Successful Logic in the Treatment of Musculoskeletal Pain

Adequate and appropriate initial evaluation is the basis of successful treatment of musculoskeletal pain. Fortunately, there are various tools in this field such as: standard questionnaires, modern imaging methods such as computerized tomography, magnetic resonance imaging and musculoskeletal ultrasound or electrophysiology. According to these methods, it is usually done that the pathology caused by pain can be done in a targeted way. But none of these techniques allow adequate judgment about the obtained findings. Therefore, additional tests should be performed (complete history and disease history) and its results should be compared and interpreted with clinical findings. These two axes are still the cornerstone of the evaluation of painful musculoskeletal disorders ^[16].

Valid and Reliable Assessment of Pain

Pain is a primary symptom in musculoskeletal disorders. The coordinates of pain experience (such as pain intensity) is one of the key considerations in clinical

decisions and as a result of trials and interventions, so it is necessary to have a proper pain assessment result ^[17]. Chronic pain is defined as persistent pain that can be continuous or frequent, has sufficient length and intensity, and affects the well-being, level of functioning, and Quality of Life (QoL) of the patient ^[18]. Proper pain assessment has an effective and fundamental role for clinical trials and for pain management and treatment. Due to the nature of pain, which makes it impossible to objectively measure it, the assessment of chronic musculoskeletal pain and its impact on physical, emotional and social functions requires multi-dimensional qualitative tools and the use of Health-Related Quality of Life (HRQOL) tools ^[19]. In other words, the evaluation should include the use of structured tools to determine the intensity, the impact of psycho-social factors, and performance because sensory, emotional and cognitive factors play a role in the persistence of pain ^[18]. On the other hand, since measuring the result of the pain test is useful for performing normal evaluations, therefore, the evaluation should include things such as: pain, fatigue, sleep disorder, physical function, emotional function, global rating of patient satisfaction and QOL. Despite the growing availability of instruments and theoretical material related to the measurement of various aspects of chronic pain, there is still no good quantitative agreement and no single approach has been devised. Therefore, there is still a significant need to develop a set of measurement tools and response criteria, as well as a need to develop and modify related tools, standard assessment training, and adaptation between health status assessment questionnaires ^[19]. Regarding some commonly used pain measurement scales, we can refer to the Visual Analogue Scale (VAS), McGill Pain Questionnaire. Special and general questionnaires should

also be used to assess disability at the individual level. In any case, proper diagnosis of chronic pain is the first step for successful treatment ^[18].

Structural and Biomechanical Evaluation of Pain in the Musculoskeletal System

Maintaining the health of the musculoskeletal system increases QOL. Healthy muscles and bones increase human vitality and dynamism. While the defective musculoskeletal system affects all vital and main activities of the body. Recent studies have shown that the cause of the increase in the incidence of diseases such as chronic fatigue, arthrosis, varicose veins, heel deviation, flat feet, heel spurs, and spine problems is the lack of compliance in the biomechanics of the body. These disorders can be caused by various causes (hereditary and acquired), which are among the most common causes of pain and joint problems. Working conditions and individual positions during daily activities can also be effective in the occurrence of these disorders. According to the approach of structural and biomechanical assessment of pain, most of the structural disorders of the body originate from the foot. After causing problems in the arch of the foot and heel deviation, the alignment of the spine, leg and thigh bones, wrist, knee, hip, and even shoulder joints undergo disproportionate changes and asymmetry. Therefore, the first step for the structural and biomechanical assessment of pain in the musculoskeletal system is a detailed examination of the structure and function of the foot. Of course, other structures must also be examined in addition to the assessment of the foot. Appearance, joint range of motion, movement pattern, muscle strength, etc. are among the items that should be considered in structural and biomechanical examinations. Structural and biomechanical assessment also includes analyzing the body for its alignment and functioning ^[20]. In this

evaluation, the relevant experts use different skills such as listening skills, knowledge of anatomy, physiology, physics and mechanical engineering as part of this evaluation. This method of evaluation is important in two ways: firstly, it allows us to identify the way the body moves and its effect on other parts of the body, and secondly, we can use it to prevent further damage and discomfort ^[21].

The Concept of the the "Pain Cascade" and its Role in Musculoskeletal Pain

Pain cascade is a concept that talks about the effect of pain-intensifying factors that reinforce and intensify each other's effects in a chain. This concept is widely used in identifying and evaluating pain especially in musculoskeletal pain, which is generally multifactorial.

Depression is very common in people with chronic painful musculoskeletal disease. Chronic musculoskeletal pain can also lead to depressed mood by affecting fatigue and disability ^[22]. This depression not only helps to create and intensify pain, but also can have a bad effect on the process of therapeutic and medical interventions and their effectiveness ^[23]. On the other hand, the effect of musculoskeletal pain on fatigue is at least partially due to its effect on the sleep of the affected person (24-27). Low quality of sleep is common among people with chronic musculoskeletal pain. Chronic pain can aggravate the disturbance in the structure of sleep and sleep deprivation, reduce the pain threshold, and increase the discomfort of affected people ^[28]. These effects over time can lead to worsening of pain and disability and increased risk for sensitization of the central pain pathways (central sensitization) ^[22, 29-32]. In fact, paying attention to the concept of pain cascade shows the relationship between the factors affecting the occurrence and intensity of pain and also shows its role and importance in the evaluation of musculoskeletal pain.

Using the Biopsychosocial Perspective to Evaluate Musculoskeletal Pain

A complete assessment of the patient's pain experience is the first important step to ensure optimal clinical management of musculoskeletal problems. Such an approach can determine the decision of the patient and the doctor about the most appropriate treatment approach. For example, a patient with chronic musculoskeletal pain who has sleep apnea (temporary cessation of breathing, especially during sleep), may experience improvement in their pain through treatment of the associated sleep disorder. Additionally, treating depression with musculoskeletal problems may increase the response to musculoskeletal pain treatments. Finally, patients' description of their pain may be useful in identifying individuals with pain sensitization. A comprehensive assessment of musculoskeletal pain ensures access to a biopsychosocial perspective [33], which includes pain and its downstream effects as well as key contextual factors such as social, cultural and personal (34- 35). Therefore, it is recommended to pay attention to reliable and effective symptoms that are reported through Patient-Report

Outcome Measures (PROMs). Patient-Report Outcome Measures are widely available to assess musculoskeletal pain characteristics such as pain intensity, pain predictability, pain frequency, pain quality (burning, stabbing, etc.), sleep quality, mood including depression and anxiety, fatigue, activity limitations (activities a person must do such as bathing), participation limitations (activities a person wants to do such as work or travel) (36, 37) and key contextual factors. Therefore, using a conceptual framework that shows mutual relationships to researchers and doctors may be useful and affect patients' pain experiences. Therefore, it should be used formally or informally in

assessments. The framework that is often used in the World Health Organization (WHO) to evaluate musculoskeletal problems is known as the International Classification of Functioning (ICF) model [38], which is based on the assessment of function, disability and health.

The Role of Clinical Examination in the Assessment of Musculoskeletal Pain

The physical examination actually complements the evaluation of the symptoms expressed by the questionnaire through the patient. Local physical examination is useful for determining the location of the patient's pain (joints, muscles, etc.), evaluating the presence of signs of inflammation (erythema, joint effusion, or soft tissue swelling), sensitivity to touch, pain during movement, joint instability, and incorrect alignment. body (malalignment).

Some Mechanisms and Tools for Evaluating Pain in Local and Widespread Musculoskeletal Problems

The mechanism of hyperalgesia can be explained by increasing pain sensitivity in pain receptors located deep in the tissue (peripheral sensitivity) or by increasing the responses of posterior horn neurons (central sensitivity). The spread of pain and sensitivity can also be explained by increasing synaptic activity in central neurons and supraspinal centers. Quantitative sensory testing provides the possibility to evaluate the manifestations and mechanisms of pain. Manifestations related to different aspects of sensitivity can be evaluated using quantitative sensory tests (such as pressure algometry (quantitative touch) and quantitative cuff algometry). Repeated pressure stimulation can assess the sum of time (which is a proxy for the level of central sensitivity) while the muscle pain is widespread. Since the transformation of acute localized musculoskeletal pain into chronic widespread pain is related to the development of peripheral and central sensitivity, it should

be evaluated by adequate and appropriate pain biomarkers. Early intervention strategy and new hyperalgesia compounds should be used to prevent pain ^[39-40].

Quality of Life in Chronic Musculoskeletal Pain

Chronic musculoskeletal pain directly/indirectly has a negative effect on the QOL and health of patients ^[41]. These people often report limitations in daily functioning (due to pain) ^[42]. In addition to physical health problems, chronic musculoskeletal pain can have a profound negative impact on emotional and social status (such as lethargy, slouching, depression, reduced desire to move and be active, etc.) affected people. In these diseases, pain is actually the factor that leads affected people to receive medical care ^[43], use non-steroidal anti-inflammatory drugs ^[44] and perform joint replacement surgery ^[45]. Although the efforts of the health sector are obviously vital in the treatment of chronic musculoskeletal pain, we should not underestimate and forget the role and high level of patient and community participation to reduce the burden of these diseases (because their role is key) ^[41]. Therefore, recently, the WHO has recommended in the International Classification of Functioning, Disability and Health (ICFDH) that instead of focusing on limitations, emphasis should be placed on the remaining abilities and facilities of patients in functioning. In patients with musculoskeletal pain, this means that the focus should be on the person's "level of daily activity" instead of his "level of disability". Currently, there is no specific agreement on how to measure physical activity in the daily life of patients with these pains ^[42]. In this regard, patients should actively participate in solving this problem with health care professionals, and the patient's family members should encourage their patients to be as independent as possible. The employer of a person with chronic musculoskeletal

pain has an important role in returning him to work (as soon as possible). By empathizing and removing all obstacles and using preventive and therapeutic services, the burden of musculoskeletal pain on patients and society can be reduced ^[41].

Clinical Messages:

- 1- Musculoskeletal disorders disrupt the function of the involved tissue/tissues, and the function of the affected person.
- 2- These problems and resulting pains can be localized, regional or widespread.
- 3- New evidence indicates that pains and musculoskeletal problems should be looked at both from the perspective of physical and biopsychosocial perspective.
- 4- Adequate and proper initial evaluation is the basis of successful treatment of musculoskeletal pain.
- 5- Structural and biomechanical assessment of e pain, showed that the most structural disorders of the body originate from the foot and then involve other parts of the body.
- 6- To properly assess pain in musculoskeletal problems, a selective and comprehensive perspective (including history, disease history, attention to clinical and paraclinical findings, use of multi-dimensional quantitative and qualitative structured tools, should be considered.

Conclusion

In short, for the proper assessment of pain in musculoskeletal problems, one must have a comprehensive perspective, and multi-dimensional quantitative and qualitative structured tools. Therefore, in their evaluation, special attention should be paid to things such as intensity and type of pain, level of fatigue, presence/absence of sleep disorder, physical function, emotional and mental function, social function, family status, global ranking of patients' satisfaction, and QOL. In other words, pains and musculoskeletal problems should be looked

at biopsychosocial perspective.

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References:

1. Motaqi M, Ghanjal A. Musculoskeletal Disorders: Definition, Causes, Risk Factors, and Prevention. *International Journal of Musculoskeletal Pain Prevention*. 2019; 4(1): 127-131.
2. Motaqi M, Afran M, Ghanjal A. Care and Management of Pain in Patients with Musculoskeletal Pain during the Covid-19 Epidemic. *International Journal of Musculoskeletal Pain Prevention*. 2022; 7(1): 626-622.
3. Feye AM, Herbison P. The role of physical and psychological factors in occupational low back pain: A prospective cohort study. *Occupat Environ Med* 2000;57:116-20.
4. Meier E. Ergonomic standard and implication for nursing. *Nurs Econom* 2001; 19:31-2.
5. Shahrjerdi S. Prevalence and Associated Factors of Musculoskeletal Pain in Students of Engineering and Humanities Faculties of Arak University in 2018-2019. *J Arak Uni Med Sci*. 2021; 24 (4) :482-495.
6. Victoria P Weale , Yvonne Wells , Jodi Oakman. Self-reported musculoskeletal disorder pain: The role of job hazards and work-life interaction. *Am J Ind Med*. 2018;61(2):130-139. doi: 10.1002/ajim.22793. Epub 2017 Nov 9.
7. Anna Huguet , Michelle E Tougas , Jill Hayden , Patrick J McGrath , Jennifer N Stinson , Christine T Chambers .Systematic review with meta-analysis of childhood and adolescent risk and prognostic factors for musculoskeletal pain. *Pain*. 2016 ;157(12):2640-2656. doi: 10.1097/j.pain.0000000000000685.
8. van Dijk GM, Veenhof C, Schellevis F ,et al.: Comorbidity, limitations in activities and pain in patients with osteoarthritis of the hip or knee. *BMC Musculoskelet Disord* 2008; 9: 95-96.
9. Reeuwijk KG, de Rooij M, van Dijk GM, Veenhof C, Steultjens MP, Dekker J: Osteoarthritis of the hip or knee: which co-existing disorders are disabling? *Clin Rheumatol* 2010; 29: 739-47.
10. Ethgen O, Vanparijs P, Delhalle S, Rosant S, Bruyere O, Reginster JY: Social support and health-related quality of life in hip and knee osteoarthritis. *Qual Life Res* 2004; 13: 321-30.
11. Ferreira VM, Sherman AM: The relationship of optimism, pain and social support to well-being in older adults with osteoarthritis. *Aging Ment Health* 2007; 11: 89-98.
12. Keefe FJ, Lefebvre JC, Egert JR, Affleck G, Sullivan MJ, Caldwell DS: The relationship of gender to pain, pain behavior, and disability in osteoarthritis patients: the role of catastrophizing. *Pain* 2000; 87: 325-34.
13. Sullivan MJ, Thorn B, Haythornthwaite JA et al.: Theoretical perspectives on the relation between catastrophizing and pain. *Clin J Pain* 2001; 17: 52-64.
14. Lachance L, Sowers M, Jamadar D, Jannausch M, Hochberg M, Crutchfield M: The experience of pain and emergent osteoarthritis of the knee. *Osteoarthritis Cartilage* 2001; 9: 527-32.
15. Amabile B Dario , Steven J Kamper , Mary O'Keeffe , Joshua Zadro , Hopin Lee , Luke Wolfenden , Christopher M Williams. Family history of pain and risk of musculoskeletal pain in children and adolescents: a systematic review and meta-analysis. *Pain*. 2019;160(11):2430-2439. doi: 10.1097/j.pain.0000000000001639.
16. Hans Rudolf Ziswiler , Gion Caliezi, Peter M Villiger. Assessment of musculoskeletal pain. *Ther Umsch*. 2011;68(9):487-94. doi: 10.1024/0040-5930/a000200.
17. Fiona MacKichan , Vikki Wylde, Paul Dieppe. The assessment of musculoskeletal pain in the clinical setting. *Rheum Dis Clin North Am*. 2008;34(2):311-30. doi: 10.1016/j.rdc.2008.03.002.
18. Durdica Babić-Naglić. The diagnostics of chronic musculoskeletal pain. *Reumatizam*. 2007;54(2):32-6.
19. F Salaffi , A Ciapetti, M Carotti. Pain assessment strategies in patients with musculoskeletal conditions. *Reumatismo*. 2012;64(4):216-29. doi: 10.4081/reumatismo.2012.216.
20. Marco Barbero , Alessandro Schneebeli , Eva Koetsier, Paolo Maino. Myofascial pain syndrome and trigger points: evaluation and treatment in patients with musculoskeletal pain. *Curr Opin Support Palliat Care*. 2019 ;13(3):270-276. doi: 10.1097/SPC.0000000000000445.
21. Mojtaba Mirakhoro , Mahmood Reza Azghani , Sedighe Kahrizi. Validation of a musculoskeletal model of lifting and its application for

- biomechanical evaluation of lifting techniques. *Res Health Sci*. 2014 ;14(1):23-8.
22. Hawker GA, Gignac MA, Badley et al.: A longitudinal study to explain the pain-depression link in older adults with osteoarthritis. *Arthritis Care Res (Hoboken)* 2011; 63: 1382-90.
 23. Dimatteo MR, Lepper HS, Croghan TW: Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and depression on patient adherence. *Arch Intern Med* 2000; 160: 2101-7.
 24. Hawker GA, French MR, Waugh EJ, Gignac MA, Cheung C, Murray BJ: The multidimensionality of sleep quality and its relationship to fatigue in older adults with painful osteoarthritis. *Osteoarthritis Cartilage* 2010; 18: 1365-71.
 25. Lavigne GJ: Effect of sleep restriction on pain perception: towards greater attention! *Pain* 2010; 148: 6-7.
 26. Lavigne GJ, Nashed A, Manzini C, Carra MC: Does sleep differ among patients with common musculoskeletal pain disorders? *Curr Rheumatol Rep* 2011; 13: 535-42.
 27. Asih S, Neblett R, Mayer TG, Brede E, Gatchel RJ: Insomnia in a chronic musculoskeletal pain with disability population is independent of pain and depression. *Spine J* 2014; 14: 2000-7.
 28. Rzewuska M, Mallen CD, Strauss VY, Belcher J, Peat G: One-year trajectories of depression and anxiety symptoms in older patients presenting in general practice with musculoskeletal pain: A latent class growth analysis. *J Psychosom Res* 2015; 79: 195-201.
 29. Adam P Goode , Xiaoyan A Shi, Richard H Gracely, Jordan B Renner, Joanne M Jordan. Associations between pressure-pain threshold, symptoms, and radiographic knee and hip osteoarthritis. *Arthritis Care Res (Hoboken)*. 2014;66(10):1513-9. doi: 10.1002/acr.22321.
 30. Nurgül Arinci Incel , H Rana Erdem, Salih Ozgocmen, Sema Atalay Catal, Z Rezan Yorgancioglu. Pain pressure threshold values in ankylosing spondylitis. *Rheumatol Int*. 2002;22(4):148-50. doi: 10.1007/s00296-002-0211-1. Epub 2002 Jun 19.
 31. Rohini Kuner. Central mechanisms of pathological pain. *Nat Med*. 2010;16(11):1258-66. doi: 10.1038/nm.2231. Epub 2010 Oct 14.
 32. Ahn H, Weaver M, Lyon D, Choi E, Fillingim RB: Depression and pain in Asian and white Americans with knee osteoarthritis. *J Pain*. 2017;18(10):1229-1236. doi: 10.1016/j.jpain.2017.05.007.
 33. Hawker GA: Experiencing painful osteoarthritis: what have we learned from listening? *Curr Opin Rheumatol* 2009; 21: 507-12.
 34. Hunt MA, Birmingham TB, Skarakisdoyale E, Vandervoort AA: Towards a biopsychosocial framework of osteoarthritis of the knee. *Disabil Rehabil* 2008; 30: 54-61.
 35. Somers TJ, Keefe FJ, Godiwala N, Hoyler GH: Psychosocial factors and the pain experience of osteoarthritis patients: new findings and new directions. *Curr Opin Rheumatol* 2009; 21: 501-6.
 36. McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). *Arthritis Care Res (Hoboken)* 2011; 63: S240-52.
 37. Hawker GA, Mian S, Kendzerska T, French M: Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). *Arthritis Care Res (Hoboken)* 2011; 63: S240-52.
 38. World Health Organization. International classification of functioning, disability and health (ICF). Geneva: World Health Organization; 2001.
 39. Thomas Graven-Nielsen , Lars Arendt-Nielsen. Assessment of mechanisms in localized and widespread musculoskeletal pain. *Nat Rev Rheumatol*. 2010;6(10):599-606. doi: 10.1038/nrrheum.2010.107. Epub 2010 Jul 27.
 40. Thomas Graven-Nielsen , Lars Arendt-Nielsen, Pascal Madeleine, Peter Svensson. Pain mechanisms in chronic musculoskeletal conditions. *Ugeskr Laeger*. 2010;172(24):1824-7.
 41. Emine Handan Tüzün. Quality of life in chronic musculoskeletal pain. *Best Pract Res Clin Rheumatol*. 2007 ;21(3):567-79. doi: 10.1016/j.berh.2007.03.001.
 42. Jeanine A Verbunt , Ivan P J Huijnen, Albere Köke. Assessment of physical activity in daily life in patients with musculoskeletal pain. *Eur J Pain*. 2009;13(3):231-42. doi: 10.1016/j.ejpain.2008.04.006. Epub 2008 Jun 10.
 43. Hawker GA, Badley EM, Croxford R et al.: A population-based nested case-control study of the costs of hip and knee replacement surgery. *Med Care* 2009; 47: 732-41.
 44. Bidaut-Russell M, Gabriel SE: Adverse gastrointestinal effects of NSAIDs: consequences and costs. *Best Pract Res Clin Gastroenterol* 2001; 15: 739-53.
 45. Hawker GA, Wright JG, Coyte PC et al.: Differences between men and women in the rate of use of hip and knee arthroplasty. *N Engl J Med* 2000; 342: 1016-22.