

Development of a Valid and Reliable Tool to Measure Skeletal Muscle Spasm in Myofascial Pain Syndrome

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Abstract

Myofascial pain syndrome is a condition that produces local and referred pain occurs due to prolonged overload on the muscle, postural disturbances or due to direct hit to the muscle. Different confirmatory diagnosis have been reported by many researchers to treat the root cause of the pain. But such procedures cannot be routinely used because of the lack of such laboratory settings. This study aims to develop a valid and reliable tool to measure spasm developed due to myofascial pain syndrome. Experts involved in the study evaluated that the tool is easy to administer and can be scored easily and helps in the initial diagnosis of such disorders. The score range of the spasm may vary from 0-14, 15- 39 and 40- 50, resulting into mild, moderate and severe spasm respectively. This developed tool will not only be useful for Physiotherapists only but for frontline Physicians also **dealing** and treating the problems of muscle spasm.

Key words: Myofascial Pain syndrome, muscle pain, muscle spasm, spasm score, validity and reliability of tool

Background

Myofascial pain syndrome (MFPS) is one of the leading causes of chronic musculoskeletal pain caused by myofascial trigger points (MTrP) with

motor, sensory and autonomic symptoms. With a lifetime incidence estimated to be up to 85%. (Fischer et al., 2018) It is characterized by local and

referred pain, weakness, and restricted mobility.(Bron & Dommerholt, 2012; Fischer et al., 2018)The prevalence of MFPS due to MTrPs has been found to be 20–85% in the general population. The etiology behind the development of MTrPs is prolonged overload on the muscle, excessive eccentric work of a muscle or due to direct hit or trauma of the muscle that may result in MFPS resulting in acute or chronic pain.(Fischer et al., 2018; Grieve, Barnett, Coghill, & Cramp, 2013)At microscopic level abnormal endplate activity has been seen due to extensive release of calcium from sarcolemma. Demand of ATP increases due to reuptake of calcium and induces sarcoplasmic reticulum in sarcolemma.(Fischer et al., 2018; Gerwin, 2008)In chronic musculoskeletal pain mitochondrial content is impaired, disturbing aerobic capacity.(Larsson, Björk, Henriksson, Gerdle, & Lindman, 2000)Lack of ATP production develops the contracture, compressing the adjacent capillary circulation causing hypoxia at microscopic level.(Simons, 1998; Simons, Travell, & Simons, 1999)Respirometric studies suggest hypoxia and ischemia can affect mitochondrial function.(Fischer et al., 2018)Inflammatory mediators like calcitonin gene-related peptides, bradykinin, IL-6, IL-1 β , and IL-8, TNF- α , substance P and ILs (interleukins) increase due to inflammatory processes, reported in vivo study in MTrPs in humans.(Larsson et al., 2000)Pyroptosis is hypothesized

to be involved in the inflammatory process in inducing chronic pain in skeletal muscle. Pain may even refer to other area of body when there is no nerve damage induced parasthesia, weakness in muscle but without atrophy autonomic reactions, proprioceptive disturbances with impaired coordination, all can be induced by MTrPs.(Jafri, 2014)Different tools have been used to diagnose myofascial trigger points including electromyography, ultrasound, microdialysis, infrared thermography, and magnetic resonance imaging.(Bourgaize, Newton, Kumbhare, & Srbely, 2018; Bourgaize et al., 2018; Shah & Gilliams, 2008)Ultrasound has been found most suitable of these modalities to identify MTrPs if specific methods are to be used, but there is no precise and cost effective description of a gold standard using these techniques to identify MTrPs and its induced spasm.(Bourgaize et al., 2018, 2018; Shah & Gilliams, 2008)Literature showed a grey area in diagnostic methods which should be easy to implement and low or no cost which subsequently described the need to identify such skeletal muscle pain induced spasm by developing self administered or subjective questionnaire which may prove to be an easy and no cost tool for measurement of muscle spasm.

In order to identify and explore the extent of the muscle spasm, psychometric properties including the validity and reliability of the questionnaire were checked which may

contribute subsequently for assessment of skeletal muscle spasm induced by MTrPs with patient's perspective in lieu of MFPS or other rheumatic conditions. Using SPSS software, the reliability of the questionnaire was checked through cronbach's alpha.

The main aim of the study was to develop a reliable and valid self administered questionnaire which can easily score and address the understanding and point of view of patient's sufferings due to muscle spasm developed because of MFPS. While designing the questionnaire the objectives which were formulated are: to design an intangible structure for a subjective or self administered questionnaire to identify relevant problems related to muscle spasm suffered by patients with musculoskeletal disorders and especially MFPS due to MTrPs. Secondly, to develop a collection of questions based on the suggestions provided by experts and through depth of literature and to design a questionnaire from the item pool preliminarily. Finally, to guarantee the reliability and validity of the finally designed questionnaire addressing the problems of the patients suffering from muscle spasm.

Method

A pilot study was conducted on 48 patients and their pain and stiffness in terms of muscle spasm was calculated. The resultant questionnaire- Muscle Spasm Questionnaire consisted of 18 questions and responses to each item

were based on Likert Scale ranging from never to always. Responses of all forty eight patients to each item of the questionnaire were analyzed in which a higher item score indicated an encouraging approach. Each of 18 items received equal credence when added to enter at a total score.

Therefore the total score can be as low as 0 (least favorable) and as high as 50 (most favorable).

Questionnaire Development

The questionnaire was developed by keeping in mind the preparation of scope and structure first. Secondly, the items of the questionnaire were designed so that a preliminary questionnaire can be constructed. A pilot study was also done for further developing the questionnaire. Then every item of the questionnaire was analyzed and finally the questionnaire was analyzed for reliability.

Step-1 Preparation of scope and framework

Data was collected through exhaustive and extensive in depth google form survey of the patients having pain and stiffness in any part of the body but ensured that pain must be from musculoskeletal by origin. Data was also collected through relatives or guardians of the patients from Delhi and NCR region.

Step- 2 Development of the items of the questionnaire

Based on the available information and questions/ items considering the state of mind of patient of skeletal muscle spasm due to activation of myofascial trigger points caused by MFPS, were identified on Likert Scale which is a scale ranging from never to always by generating a pool of 35 items. But initially that was reduced to 20 items' pool considering only the needed, precise and apparent items. Most importantly it was ensured that the reliability and validity of the questionnaire can be established.

Face validity is supposed to measure the relevant and transparent measurement of the instrument as they come into view to the participant or it can be said it must measure what it is thought to measure. People who stay more time with the target group have been reported to give fair judgement for the face validity.(Haladyna, 2004)

Establishment of content and face validity was the first goal after deciding the item pools. Content validity refers to a methodical evaluation of the test content to verify if the test covers the entire domain which the test is desired to measure along with the assessment of the quality.(Haladyna, 2004; Hendrie, Cox, & Coveney, 2008; Trochim, 2001) The items must cover all the relevant aspect of the patients' problems related to development of spasm.

For ensuring the content and face validity, the item pool of the questionnaire was evaluated by ten experts having extensive experience in the field. The experts were requested to

assess and evaluate the item pool with 35 items and for significance, correctness and suitability or appropriateness, measuring the skeletal muscle spasm of the patient developed due to skeletal muscle disorder.

Step- 3 Analysis of the items for refining the questionnaire (preliminary) through content validity index

This step was included to evaluate the accuracy of every item included in the questionnaire statistically known as content validity.

As per the Content Validity Index, the content is said to be valid if a rating of 3 or 4 is found but must be conceptually compatible also. If 6 out of 10 of the experts rate an item as relevant (4 or 5) the CVI would be $3/5$ i.e. 0.6 but the required level is 0.8 (8/10), now that indicates that the item must be excluded.(DeVon et al., 2007; Parmenter & Wardle, 1999; Streiner, Norman, & Cairney, 2015)

Step- 4 Construction of the preliminary draft of the questionnaire

A subjective or self administered questionnaire was constructed containing 18 items. The initial page of the questionnaire included information about the questionnaire, instructions and demographic details to be filled by the respondent like name, age, gender and occupation. Then in the respective sections, 18 items were distributed randomly to avoid biasing in allocation of the items.

Step- 5 Conducting pilot study

For assessing the accuracy of the developed questionnaire, 48 patients from Delhi, NCR and Haryana responded to each item of the questionnaire through Google form. Their responses as were analyzed for internal consistency quantitatively through SPSS software version 20 and qualitatively also observed if any response would have been received as a comment or remark for any different interpretation, time consumption during response to the questionnaire and any item missed in the questionnaire which might prove important.

Step 6- Reliability of the Questionnaire

Reliability was assessed once the validity procedures were completed and each item analysis was conducted. Reliability is the ability of the tool or questionnaire to measure the stability of a feature and how appropriately that fit and correlate together, theoretically.

6.1 The homogeneity of the questionnaire is described by the internal consistency of all the items which was measured by Cronbach's alpha with SPSS software version 20. The values ranges from 0 to 1 and a 0.7 score or higher is found to be acceptable. That was calculated individually as well as the whole questionnaire having entire scale.

6.2 Internal consistency is measured by Split- Half reliability in which the scale is divided in to two halves where initial

half of the questionnaire versus final half or set of even items versus set of odd items. Scores of the halves on any basis are correlated then. If two sets are found with consistent information that may be indicated by high correlation score that further suggests that scoring high on one item by subject will further be scored higher on second set by the same subject. This reports that the same concept is being measured by the items. Here, in the study this was measured for the questionnaire by using SPSS software version 20.

Results

Face Validity

The experts found 22 items to be appropriate from the item pool of the questionnaire and hence the first draft of the questionnaire with these items was prepared. Pool of 22 items was again evaluated for a second evaluation by the expert panel for selecting satisfactory items further. While reviewing the questionnaire by the experts for the second time the draft was prepared with 20 items after changes in the questionnaire by editing and removal of some more items.

Experts involved in the study found all the questions easy and understandable in terms of lay out, font size and sequence. Length of the questionnaire was also found to be appropriate by most experts.

Content Validity

Two items in the questionnaire had CVI 0.6 and 0.4 and were removed from the questionnaire. The items which were retained and were valid yielded CVIs ranging from 0.8 (8/10) to 0.4 (4/10).

Reliability

Cronbach's alpha reliability coefficient was calculated for total items (N=18) to confirm reliability of questionnaire as

shown in [Table 2 and 3]. The Cronbach alpha value was found to be 0.845 (Table 3) which shows that all the items of the questionnaire are reliable and internally consistent.

Spearman-Brown Coefficient and Guttman Split-Half Coefficient were 0.775 and 0.768 respectively indicating high correlation between two halves of the questionnaire.

Table 1. Case Processing Summary

		N	%
Cases	Valid	48	100.0
	Excluded ^a	0	.0
	Total	48	100.0

Table 2 Item-Total Statistics

Questions (included)	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
1. Over the past one week, have you had any pain?	19.35	69.510	.351	.628	.844
2. Since how long you have been experiencing this pain? (in weeks)	19.00	65.787	.320	.478	.843
3. What is the intensity of this pain?	19.50	63.064	.611	.669	.830
4. Do you feel stiffness/tightness in muscle along with pain?	19.40	69.095	.363	.528	.843

5. Is this stiffness/tightness present most of the time on most of the days?	19.71	67.700	.397	.495	.840
6. Does stiffness/tightness of muscle subside with rest?	18.98	70.957	-.025	.479	.856
7. Does stiffness/tightness of muscle subside with activities?	19.33	67.887	.183	.515	.849
8. Does this stiffness/tightness of muscle aggravate with activities?	19.04	66.594	.279	.644	.844
9. How much have your symptoms interfere with activities of daily living?	19.00	62.638	.635	.775	.829
10. How bad is the stiffness/tightness of muscle with activities?	18.88	62.452	.476	.669	.835
11. How much has it been a problem for you to do physical activities to the level you want because of your muscle symptoms?	19.04	61.275	.625	.687	.828
12. How often have you needed help from others because of your muscle symptoms?	18.92	58.801	.601	.738	.828
13. How often have you had trouble falling asleep?	18.79	59.658	.578	.670	.830

14. How often have you been awakened by pain/stiffness/tightness during the night?	19.08	58.716	.627	.613	.826
15. How often have you been awakened by pain/stiffness/tightness in the morning?	18.83	58.823	.606	.625	.828
16. How much have your joint or muscle symptoms interfered with your social activities and hobbies?	19.23	63.627	.526	.777	.833
17. How much have you felt anxious or low in your mood because of your muscle pain?	18.98	63.000	.489	.521	.835
18. How often do you take medication to relieve pain/stiffness/tightness?	19.54	64.381	.395	.429	.839

Table 3: Cronbach's Alpha Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.845	.847	18

Table 4: Split Half Reliability Statistics

Correlation Between Forms		.733
Spearman-Brown Coefficient	Equal Length	.775
	Unequal Length	.775
Guttman Split-Half Coefficient		.768

Discussion and conclusion

Muscle spasm is one of the sign of MFPS like other skeletal muscle disorders

characterized by involuntary muscle contraction, increased tension and tone after the development of painful nodules or ropes giving hard texture which

spreads to the entire muscle by shortening in the length of muscle.(Cao et al., 2021; Panta, 2017) Currently, researchers have not reached to an agreement on the etiopathology because of lacking in specific laboratory indicators and markers and also the imaging verification, resulting in non integrated diagnostic criteria for MFPS, which easily creates confusion in differentiating it with other conditions.(Cao et al., 2021) In the situation where the condition is misdiagnosed, intervention for the root cause cannot be planned, so subsequent recurrence of the symptoms may be seen. Diagnosis for MFPS can be confirmed by examinations like infrared thermography, electromyography, ultrasound imaging, ultrasound elastography and biomarkers and somewhere biopsy for high resolution respirometry and microdialysis techniques which are required in routine settings.(Bourgaize et al., 2018; Fischer et al., 2018; Gerdle, Ghafouri, Ernberg, & Larsson, 2014) Such techniques are only possible in large and multispecialty settings which are costly and involving some of the invasive procedures also.

In this study, a self-structured questionnaire was developed and was

evaluated for its validity and reliability statistics. The questionnaire was developed with aim to address multiple domains related to muscle spasm and can easily score and address in understanding patient's perception and sufferings caused due to muscular spasm. The total score of the questionnaire can be as low as 0 (least favorable) and as high as 50 (most favorable). Experts evaluated that the patients scoring in the questionnaire ranging from 0 – 14, 15 – 39 and 40 – 50 may hold the spasm as mild, moderate and severe respectively.

It can be concluded from the study that the present questionnaire possesses good face validity and content and an acceptable level of reliability. Being a valid and reliable tool, this questionnaire can be used to analyze different factors that may lead to muscle spasm in patients. This questionnaire lacks in confirming the diagnosis but may be helpful in the initial stages of the condition involving muscle spasm. This developed tool will not only be useful for Physiotherapists only but for frontline Physicians also dealing and treating the problems of muscle spasm.

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