Original Research

The Interexaminer Reproducibility and Prevalence of Lumbar and Gluteal Myofascial Trigger Points in Patients With Radiating Low Back Pain

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Abstract *Objective:* To determine the interexaminer reproducibility for judging the presence, number, and location of leg-pain referring myofascial trigger points, and their prevalence in patients with low back pain with and without concomitant leg pain referral.
Design: An interexaminer reproducibility study.
Setting: An outpatient public Hospital Spine Centre in Southern Denmark.
Participants: Examiners: experienced examiners (N=2), a chiropractor and a physiotherapist, respectively. *Subjects:* a case mix of patients with low back pain (N=32) with and without leg pain referral.
Interventions: A standardized palpation examination protocol of 4 bilateral lumbosacral muscles performed by each examiner.

Main Outcome Measures: Reproducibility on presence (measured in Cohen's κ), number (difference and limits of agreement), location (distance between matching marks placed by examiners), and prevalence of myofascial trigger points.

Results: Kappa values of the examined muscles were as follows: quadratus lumborum (κ=0.42), gluteus medius (κ=0.83), gluteus minimus (κ=0.74), and piriformis (κ=0.62), with a mean of all examined muscles of kappa=0.66, assessed as substantial agreement. The mean difference in number of trigger points was 0.8, with limits of agreement ranging from −6.4 to 4.9. Mean distance between trigger point locations was 12.9 mm, with 57% only being identified by a single examiner. The prevalence of trigger points was 82.7%, highest in the gluteal region of the painful side.

Conclusions: Inadequate standardization and multiple trigger point sites complicate interexaminer reproducibility on location and number of patients with low back pain and leg pain referral. Nevertheless, substantial interexaminer reproducibility for the trigger point presence appears achievable. Implemented routinely, this relatively simple clinical evaluation procedure could meaningfully enhance diagnostic triage and eventual management.

More than 60% of patients who present with low back pain (LBP) report concomitant leg pain referral (cLPR) to the leg.[1] This high prevalence appears to be clinically relevant, because the reporting of both LBP and leg pain indicate poorer recovery outcomes.[2] Furthermore, neuropathic and nociceptive pain-producing clinical entities appear to co-occur commonly in this subgroup of patients. A notable example being lumbosacral radiculopathy and lumbopelvic myofascial trigger points (MFTrPs), in which 1 in every 2 cases presents comorbidly,[3-5] and where patients are thought to suffer from an average of 3 pain-producing MFTrPs spread across the region.[3,6]

When the leg pain is found to be radicular, some patients may benefit from decompressive surgery.[7] However, decompressive surgery carries risk and is costly. Traditional recommendations suggest that comorbid sources of pain that worsen the overall symptom pictures should be identified,[8] and in an effort to narrow down the list of differential diagnoses,[9] removed through low-risk conservative interventions.[4] This may especially be true in cases of doubt of the source of the patient's radiating pain, due to the insensitivity and inspecificity of diagnostic tests for lumbar radiculopathy[10,11] and the high correlation with myofascial pain. The latter which may in certain cases be a comorbid separate condition and respond better to conservative care than radiculopathy.[8,9,12,13] However, uncertainties surrounding the presence and prevalence of MFTrPs remain, especially as newer evidence does not suggest that trigger points in the presence of radiculopathy represent a separate condition.[14,15] As a result, the credibility of the myofascial pain syndrome (MPS) diagnosis, which encompasses the presence of at least 1 MFTrP, in the context of radiculopathy is still under debate.[5]

Currently, palpatory evaluation remains the benchmark for determining the diagnostic relevance of a MFTrPs.[16] MFTrP evaluation is difficult to reproduce consistently because it is a sophisticated psychomotor task during which the clinician builds an index of suspicion regarding clinical relevance by simultaneously interpreting palpation, observational and verbal feedback in real time.[17] The process is made even more complex when multiple MFTrP locations and muscle groups are investigated.[16] As a consequence, generally low to moderate interexaminer reproducibility outcomes (most often measured in κ, indicating agreement, adjusted for chance) have been observed in relation to standardized MFTrP evaluation.[18] This is particularly evident in the lumbopelvic region (m. gluteus medius κ=0.30-0.49 and m. quadratus lumborum κ=0.36-0.50).[16] This issue creates uncertainty as to whether MFTrPs are in fact present and by extension the credibility of MPS diagnosis.[19] In this regard, further refinement of MFTrP evaluation to robustly demonstrates MPS as a comorbid diagnosis alongside lumbar radiculopathy, separate entity or not, is needed.

In the context of LBP patients in which lumbar radiculopathy is suspected as a comorbid diagnosis, this study aimed to determine the prevalence and interexaminer reproducibility of MFTrPs in persons with LBP with and without lower limb pain using a pragmatic interexaminer protocol to assess the presence, location, and number of MFTrPs in 4 lumbar and gluteal muscles.

Method

Design and participants

An interexaminer reproducibility study was conducted based on the Guidelines for Reporting Reliability and Agreement Studies.[20] Over a 4-week period (March-May 2018), a convenience sample of patients with LBP or LBP with cLPR were recruited from a public sector Hospital Spine Centre. All patients complained of persistent symptoms after conservative management and were recruited from either the medical or surgical department they were visiting. No explicit exclusion criteria were set with respect to patient sex, age, specific symptoms, or comorbidities,

but asymptomatic patients and those incapable of lying prone for 20 minutes were excluded.

Examiners and standard operating procedures

Two female clinicians (a chiropractor and a physiotherapist) with, respectively, 12 and 9 years of diagnostic triage experience acted as examiners. The first author (A.H.J.) acted as study coordinator.

A prestudy 2-part standardization procedure was carried out, entailing first establishing trigger point criteria consensus and second psychomotor standardization of clinical evaluation.[21,22] The examiners evaluated MFTrPs using tenderness, altered soft tissue consistency, and distal trigger point-mediated leg pain referral during palpatory pressure described by the patient as pain, soreness, tingling, heaviness, or pressure.[17] If the patient already had cLPR to their LBP, the sensation either had to change in nature or worsen on palpation pressure of the MFTrP and return to normal after release. A MFTrP was marked if either criterion 1 or 2 was present in addition to criterion 3.

Participant preparation and blinding

After agreeing to participate in the study, written consent was obtained—the scientific committee of the region of Southern Denmark granted ethical clearance for the project (ref. no.: S-20172000-170). Participants completed a standard information sheet, including whether cLPR was absent, unilateral, or bilateral. The patient was instructed to lie prone and to reveal information about the examination procedure only. A.H.J. then marked the outline of quadratus lumborum, gluteus medius, gluteus minimus, and piriformis muscles using known anatomical landmarks bilaterally.[23]

The examiners were only present in the examination rooms during their turn to do the MFTrP evaluation and did not engage in dialogue with the patient beyond questions related to the evaluation. Examiners used customized markers (denoting an "A" or "B"), visible only under ultraviolet light, to blind skin marking, and an infrared lamp disguised skin erythema from previous examination. An independent assessor (A.H.J.) recorded the examiners' markings after the last examination.

Data capture

After completion of the evaluations, A.H.J. recorded the following: (1) Whether the examiners agreed on the presence of ≥1 MFTrPs in the 4 evaluated muscle pairs. The muscles were divided into 2 categories: a side with cLPR and a side without cLPR, accounting for patients with no cLPR at all and patients with bilateral cLPR. A pair of examiner marks <50 mm from each other on opposite side of a muscle outline was noted as present in the same muscle. (2) The number of MFTrPs identified in all 8 muscles by each examiner. (3) The distance between markings put by both examiners, measured by a band. (4) In which of 3 categories MFTrPs were to be distributed: MFTrPs identified only by a single examiner (no partner match within 50 mm), MFTrPs with a matching mark within 20-50 mm, and MFTrPs

with matching mark within <20 mm. After A.H.J. noted these findings, the patient's participation in the study was over and they left.

Analysis

Presence

Overall agreement (%) and Cohen's kappa coefficients with 95% confidence intervals (95% CIs) were calculated across all observations to estimate the interexaminer reproducibility of the presence of MFTrPs.[24] To interpret the factors of prevalence of MFTrPs and examiners bias (such as difference in experience or tactile skills), prevalence-adjusted bias-adjusted kappa was calculated.[24] To note any sex difference, overall agreement and kappa, both with 95% CI, were calculated across all observations in both female and male participants.

Number

The mean absolute and relative differences with 95% CI in number of MFTrPs per patient between examiners were calculated. No differentiation between muscles or sides was made regarding the number of MFTrPs. The limits of agreement of the differences were calculated.[25] The observed differences were tested for normality of distribution with Shapiro-Wilk test.

Location

The percentage distribution of the 3 categories of MFTrPs was calculated. The average distance with 95% CI between matching marks was calculated.

Prevalence

The prevalence (%) of at least a single MFTrP with 95% CI was calculated in the same categories as in the kappa analysis. Because disagreement of MFTrP presence between examiners was expected, the prevalence was estimated to be the prevalence in patients, in which the examiners agreed on the presence of MFTrPs, plus the average of patients in which the examiners disagreed.

Results

Thirty-two patients were evaluated, 15 (47%) were women and a mean age of 52 years (SD 15). Twenty-seven patients (84%) exhibited cLPR, and 17 of these (53%) were diagnosed with lumbar radiculopathy by a clinician during their visit to the Spine Centre, not by specific criteria set by this study. Mean duration of symptoms was 12 months (SD 19). No participants dropped out of the study after agreeing to participate.

In total, 256 muscle examinations (8 muscles in 32 patients) were completed by each examiner. Overall agreement on MFTrP presence or absence was 84% and kappa was substantial (0.66). Results are presented in table 1.

Table 1 Prevalence and reproducibility of the presence of MFTrPs

Does the Following Contain at Least 1 Trigger Point? Yes/No	Prevalence of MFTrPs (%) With 95% CI	Overall Agreement Between Examiners (%)	κ With 95% CI	Prevalence-Adjusted Bias-Adjusted κ
Quadratus lumborum (n=64)	30%	75%	0.42 (0.17-0.67)	0.50
Gluteus medius (n=64)	35%	92%	0.83 (0.69-0.97)	0.84
Gluteus minimus (n=64)	42%	88%	0.74 (0.58-0.91)	0.75
Piriformis (n=64)	42%	81%	0.62 (0.43-0.81)	0.63
Mean (all muscles) (n=256)	37%	84%	0.66 (0.56-0.75)	0.68
With cLPR only (n=108)	49%	82%	0.65 (0.50-0.79)	0.65
No. of cLPR only (n=148)	31%	85%	0.65 (0.52-0.79)	0.70
Mean (women) (n=120)	48%	85%	0.70 (0.57-0.83)	0.70
Mean (men) (n=136)	28%	83%	0.58 (0.43-0.74)	0.66

Across all patients, examiner A identified 133 MFTrPs and examiner B 158 MFTrPs, averaging 4.2 and 4.9 MFTrPs per patient. Results are presented in table 2. The Shapiro-Wilk test demonstrated that both the absolute and relative differences had a low probability ($P<.05$) of being normally distributed.

A total of 200 MFTrPs were identified, with 6.3 different MFTrPs per patient, counting both examiners' markings. Seventy MFTrPs (35%) had a matching mark within <20 mm, 22 MFTrPs (11%) had a matching mark within 20-50 mm, and 108 MFTrPs (54%) had no partner match within 50 mm. The mean distance between the MFTrPs with corresponding partner mark was 12.9 mm (95% CI, 9.2-16.6 mm).

The prevalence of at least a single MFTrPs in a patient was 82.7% (95% CI, 63.6-92.8). The remaining results are presented in table 1.

Discussion

Presence of trigger points

The established cutoff point of acceptable reproducibility in palpation-driven diagnosis is a kappa value of 0.4.[26] Considering the mean of all examined muscles, this protocol demonstrated substantial reproducibility (κ>0.6) for the presence of MFTrPs.[24] The observed reproducibility varied between the different muscles, as well as with and without cLPR. The kappa of the mean of all examined muscles best represents the overall reproducibility of the protocol, with kappa of single muscles representing the utility of the protocol in these specific sites.

We expected the kappa coefficients to be reduced due to an expected prevalence of MFTrPs higher than 50% and due to differing examiner propensity to identify MFTrPs.

Both effects were observed but were minor. This is represented by a small difference between kappa and the prevalence-adjusted bias-adjusted kappa value in most cases. Incidentally, the occurrences of prevalence or bias were sufficiently evenly distributed that when calculating the mean of all examined muscles, the kappa coefficient was unaffected. This indicates that the protocol is limited in reproducibility due to standardization, not preexisting factors such as MFTrPs prevalence, examiner experience, or tactile skills.

Reproducibility was anticipated to be higher in instances with cLPR as noted in earlier studies.[27] This expectation was however not confirmed by the results, because the differences were found to be evenly distributed in the examined muscles, resulting in almost identical reproducibility when calculating the mean kappa of all muscles in the side with cLPR and the side without cLPR.

Two previous studies have investigated interexaminer reproducibility in similar muscles as this study. Hsieh et al[28] observed poor reproducibility in the same 4 muscles by identifying 3 different MFTrP criteria, following Landis and Koch's categorization for taut band and twitch responses, and moderate reproducibility for pain referral.[29] Rozenfeld et al[30] investigated reproducibility of identifying latent or active MFTrPs in 3 zones of the gluteus medius muscle. Their MFTrP criteria were identical to those in this study. These authors identified kappa values ranging from 0.26 to 0.54 for latent MFTrPs and 0.42-0.69 for active MFTrPs.[30] Our study did not differentiate between latent and active MFTrPs, but rather used the criteria of leg pain referring MFTrP. Nevertheless, it would appear that pain referral is a reliable finding.

It seems that identifying MFTrPs based on a summation of criteria instead of focusing on a singular criterion produces better reproducibility, as originally pointed out by

Table 2 Reproducibility of number of MFTrPs

Measurement	Absolute Value (MFTrPs Per Patient) With CI	Relative Value (% of Mean) With CI
Mean	4.55	
Difference	0.8 (−0.3 to 1.8)	12.9% (−21.8% to 47.5%)
Lower limits of agreement	−6.4 (−9.5 to 3.4)	−174% (−233% to −116%)
Upper limits of agreement	4.9 (1.8-7.9)	200% (142%-259%)

Myburgh et al.[16] Indeed, 4 studies in the last decade have focused on a global assessment of different MFTrP criteria into a single categorical judgment with mean kappa ranging from 0.51 to 0.81.[17,27,30,31] Our study gives further credence to this perspective.

An interesting finding in the study was the difference in reproducibility depending on the participant's sex. To our knowledge, no earlier study has reported such difference. The authors suspect that the strictly limited questions in the examination may have contributed to this difference, though unclear to what extent, because the examiners frequently reported to the main author about unclear communication with the male patients. Other sex-related anatomical factors, such as differing depth and density of the lumbosacral soft tissue, may have been an issue as well. Only 3 earlier studies have reported a standardization of questions asked to their patients, but neither of these identified any sex-related issues with this.[17,32,33] Future research into this may be relevant.

Number of trigger points

Analysis of interexaminer agreement on the number of MFTrPs indicated 2 novel findings. First, the absolute and relative differences in the identified number of MFTrPs between the examiners were low (less than a single MFTrP per patient), rendering the differences statistically insignificant (see table 2). Second, however, the wide range between the limits of agreement indicates a risk of disagreement between the examiners when assessing a single patient. This indicates that when calculating the overall agreement of the number of MFTrPs between all 32 patients, the examiners seemed to agree. However, when assessing a single patient, the probability of disagreeing by a relatively large number of MFTrPs was large. This brings into question the utility of the examination protocol in the clinical setting, because clinicians do not prescribe treatment for populations, but individual patients. The fact that normal distribution of the differences between examiners was not observed seems irrelevant to our results, because our method of calculating the limits of agreement calculated was probably more reliable than other suggested methods and would not have a great effect on the results.[34]

Location of trigger points

A previous study by Mora-Relucio et al[27] in which 72%-86% of the MFTrPs identified 2 forearm muscles were <15 mm. We were unable to reproduce these findings, because a significant number of MFTrPs had no partner match. The size of the region examined, differences in muscle characteristics, and differences in MFTrP criteria employed could have contributed to the trigger point locations being more difficult to pinpoint. This result is, however, tempered by the relatively small average distance (<15 mm) between the MFTrPs with a corresponding partner.

Prevalence of trigger points

The prevalence of MFTrPs was high in the patients of this study, especially in the gluteal region in the ipsilateral side of the cLPR. This observation correlates well with the results of earlier studies investigating the association between lumbosacral radiculopathy and gluteal MFTrPs.[9,15,35]

Study limitations

As is the case with all agreement studies, we established an artificial setting of examination, as well as a number of steps to optimize reproducibility, notably the training period with palpatory pressure standardization and the marking of the examined muscles. In an everyday clinical setting, the interexaminer reproducibility is likely lower than presented here.

This study did not attempt to demonstrate that MPS and lumbar radiculopathy are either linked or separate entities, and the protocol cannot be used for this.

Despite the intuitively clinically relevant leg pain referring nature of the identified MFTrPs, the study did not contain a control group, leaving doubt of the clinical relevance of the identified MFTrPs. Because clinically relevant trigger points can technically be either active or latent, the prevalence data in the present study could be systematically inflated.[36,37] Future studies investigating the treatment of these MFTrPs including a control group are needed to establish the true clinical relevance.

Conclusions

Inadequate standardization and multiple MFTrP sites complicate interexaminer reproducibility on location and number in this challenging subgroup of patients. Substantial interexaminer reproducibility for the trigger point presence appears achievable; however, lower reproducibility in the clinical setting is expected. Clinical evaluation criteria require further refinement before trigger point targeted management can be considered. The authors suggest future studies focus on mimicking the clinical setting and standardization of criteria for number and location of trigger points.

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