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THE RELATIONSHIP BETWEEN FACET JOINT OSTEOARTHRITIS AND MULTIFIDUS FATTY ATROPHY IN SPINAL OSTEOARTHRITIS: RETROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Objective: Facet joint osteoarthritis (FJO) is a prominent condition among the degenerative spinal pathologies and is recognized as one of the key causes of chronic low back pain (LBP). Multifidus fatty atrophy (MFA) occurs as an effect of muscle degeneration, with the muscle tissue being replaced by the formation of surrounding adipose tissue. The aim of this study is to investigate the association between FJO and MFA. The study aims to demonstrate that FJO is more than just a cartilage-related issue in the facet joint, which suggests more extensive clinical implications.

Materials and Methods: A retrospective study was conducted based on the review of magnetic resonance imaging (MRI) scans collected between April 2021 and September 2021 in a population of 79 patients experiencing chronic LBP FJO and MFA parameters were evaluated at the L4-L5 level using MRI. T2-weighted high-resolution axial images were acquired. Two experienced clinicians examined image sets individually.

Results: The relationship between FJO and MFA was assessed using the Kappa coefficient. The statistical analysis confirmed a moderate yet significant association between the two conditions ($p<0.05$, Kappa=0.234).

Conclusion: The findings indicate that analysis of the multifidus muscle should not be ignored in the diagnosis of facet joint disease. A broader approach to diagnosis that includes both FJO and MFA will provide more accurate and improved therapeutic outcomes in patients with chronic LBP.

Keywords: Facet joint, multifidus, spine, osteoarthritis, low back pain

INTRODUCTION

Facet joint osteoarthritis (FJO) is a common form of degenerative spinal disease and contributes notably to the development of chronic low back pain (LBP)[1]. The facet joints located in the back of the spine are crucial in allowing spinal movement[2]. A characteristic feature of FJO is cartilage degradation in the facet joints with a decrease in joint space; it has been found to contribute 15-45% to chronic LBP[3,4]. Magnetic resonance imaging (MRI) is most often utilized in FJO diagnosis owing to its improved ability to visualize soft tissue and bone structures[5]. The multifidus muscle is essential in the provision of spinal stabilization and is located near the facet joints[6]. Degeneration of the multifidus muscle leads to multifidus fatty atrophy (MFA), where muscle is replaced by adipose tissue[7]. MFA is a common finding in patients with chronic LBP and compromises spinal stabilization by reducing the functional ability of the multifidus muscle[8]. Due to their association in spinal degeneration, it is believed that MFA is correlated with FJO[9].

The aim of this research is to prove that FJO not only involves the cartilage surrounding the joint but also affects the surrounding muscular tissues[10]. It is argued that the

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surrounding anatomical tissues are vital in the assessment of spinal degenerative diseases[11].

MATERIALS AND METHODS

During this retrospective study, MRI evaluations of 79 patients with chronic LBP collected between April 2021 and September 2021 were analyzed. Criteria for inclusion in the study included the absence of spinal infections, spinal cord injuries, spinal tumors, fractures, deformities, previous lumbosacral surgery, and certain comorbidities (cerebrovascular events, muscle diseases, etc.). These criterias were established to ensure a homogeneous patient group for the study. Informed consent was obtained from each participants, and the study was approved by the Institutional Ethics Committee İstanbul Yeni Yüzyıl University (decision number: 2025/06-1603, date: 17.06.2025).

FJO and MFA at the L4-L5 level were examined using MRI. The imaging was performed with high-resolution axial T2-weighted sections. All images were independently evaluated by two experienced spine surgeons.

The classification of FJA used was that of Grogan et al.[3], which consists of four stages:

- **Stage 1:** The entire joint surface is overlaid with thick cartilage, and an intercartilaginous band of low-signal-intensity is continuous between the plates of cartilage.
- **Stage 2:** The joint surface is entirely covered with cartilage but with patches of erosion and irregularity.
- **Stage 3:** The joint surface is only partly overlaid with cartilage, while bone is present within the joint.
- **Stage 4:** The cartilage is nearly lost with fragments of cartilage being apparent.

The visual staging of MFA was classified according to Kjaer et al.[7] into three categories (Figure 1):

- **Normal:** Contains 0-10% fat.
- **Mild:** Contains 10-50% fat.
- **Severe:** Contains >50% fat.

Statistical Analysis

Data was analyzed using SPSS software version 22.0. To measure the agreement the levels of FJO and MFA, the Kappa statistic was used, and the statistical significance was based on a p-value of less than 0.05.

RESULTS

This study retrospectively evaluated the relationship between FJO and MFA at the L4-L5 level in 79 patients with chronic LBP. The demographic data and clinical findings of the patients are described in detail below.

The average age of the 79 participants was 39.5 [(standard deviation ±10.6) range, (min. age 24)-(max. age 47)], and the cohort consisted of 45 males (57%) and 34 females (43%).

FJO and MFA were evaluated using MRI, and the criteria for classification were outlined below:

FJO degrees

- **Stage 1:** 18 patients (22.8%)
- **Stage 2:** 38 patients (48.1%)
- **Stage 3:** 16 patients (20.3%)
- **Stage 4:** 7 patients (8.9%)

MFA degrees

- **Normal** (0-10% body fat): 12 (15.2%)
- **Mild** (10-50% fat): 33 patients (41.8%)
- **Severe** (>50% fat): 34 (43.0%)

FJO degrees in patients with normal MFA: stage 1 in 7 patients, stage 2 in 2 patients, stage 3 in 1 patient, stage 4 in 2 patients.

FJO degrees in patients with mild MFA: stage 1 in 4 patients, stage 2 in 22 patients, stage 3 in 6 patients, stage 4 in 1 patient.

FJO degrees in patients with severe MFA: stage 1 in 7 patients, stage 2 in 14 patients, stage 3 in 9 patients, stage 4 in 4 patients.

The correlation between the levels of MFA and FJO was evaluated using the Kappa statistic. A statistically significant correlation ($p<0.05$, Kappa: 0.234) was found between the levels of FJO and MFA.

DISCUSSION

This study thoroughly examined the relationship between FJO and MFA. Our findings demonstrated a statistically significant relationship between FJO and MFA. These results are consistent with some studies in the literature and highlight the need to consider spinal degenerative diseases from a broader perspective[1,6,8,11]. The study by Guven et al. [12] directly investigates the relationship between FJO and lumbar

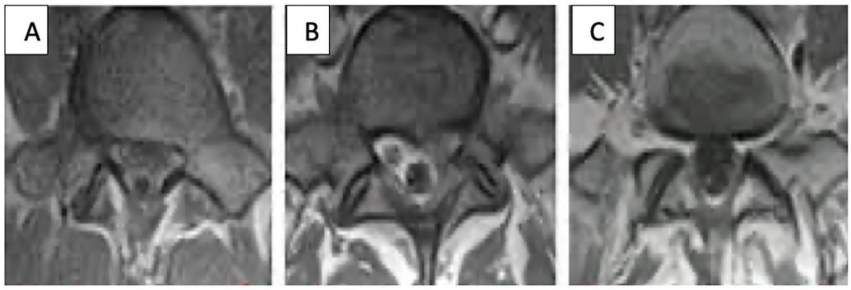

Figure 1. The visual staging of multifidus muscle fatty atrophy was classified into three categories[7]: A) normal, contains 0-10% fat, B) mild, contains 10-50% fat, C) severe, contains >50% fat

paraspinal muscle atrophy. The results showed a significant relationship between the extent of fatty infiltration in the functional cross-sectional area of the multifidus muscle and the FJO, but none for the erector spinae or the psoas muscle.

The current study showed a statistically significant, yet relatively weak ($p<0.05$, Kappa: 0.234) relationship between the severity of FJO and the degree of MFA. This finding suggests that muscle tissue degenerative changes can occur in patients who have FJO. A study by Fujiwara et al.[11] compared the association of FJO and the degeneration of the intervertebral disc. Their study concluded that FJO is associated with degenerative changes in adjacent anatomical structures beyond disc degeneration. The present study adds to the literature by illuminating the association of MFA and FJO. The study by Faur et al.[13] further support the clinical relevance of MFA in LBP and its association with disc degeneration. Lower multifidus muscle cross-sectional area has been associated with several degenerative conditions of the lumbar spine, including disc degeneration, Modic changes, endplate defects, facet arthrosis, and disc herniations, and may show a dose-response relationship as the number of pathologies increases. These findings are suggestive that multifidus atrophy and spinal degenerative change may be the result of related underlying mechanisms or that they are part of related degenerative processes[14].

The multifidus muscle is important for spinal stabilization, and degeneration can intensify LBP[6]. Danneels et al.[8] reported cases of MFA among patients suffering from chronic LBP, which contributed to diminished spinal stability. In addition, our study revealed an association for MFA and FJO, and it suggests that FJO may affect the function of the multifidus muscle. Our finding is consistent with the current literature for the importance of the multifidus muscle in maintaining spinal stability.

Perolat et al.[1] state that FJO is often seen as one causative factor underlying the onset of chronic LBP. Our study suggests that FJO should be considered in the paradigm of myofascial pain syndrome and that combined consideration of both conditions can optimize the efficacy of therapeutic and diagnostic procedures. As such, it is recognized that FJO involves more than just cartilage degeneration in the joint, as it affects the surrounding muscular structures as well.

Literature on the relationship between FJO and MFA is somewhat scant. However, certain studies have focused on the relationship between degenerative changes in the multifidus muscle and spinal disorders. Kjaer et al.[7] demonstrated that the prevalence of fatty degeneration in the multifidus muscle is related to LBP and negatively affects spinal stability. This study adds to the literature by clarifying the relationship between FJO and MFA.

The study of Chua et al.[15] investigated the association of the morphological characteristics of facet joint arthropathy with multifidus muscle atrophy in patients suffering from degenerative lumbar spinal stenosis. The results showed that strong correlations occurred among excessive facet overhang and high-grade atrophy and fatty infiltration of the deep part of the multifidus, but not with the other morphological parameters.

Yu et al.[16] demonstrated that FJO is strongly associated with MFA, characterized by decreased cross-sectional area, increased muscle-fat ratio. These findings support that FJO should not be understood only as cartilage degeneration of the localized cartilage, but should be considered as a whole-joint complex dysfunction involving the paraspinal musculature[16].

Our findings are in keeping with the existing literature and highlight an association between facet osteoarthritis and the multifidus muscle. Nevertheless, this retrospective nature of our study, coupled with this small sample size, introduces certain limitations. Larger population prospective studies would potentially be able to provide more information about this association.

CONCLUSION

This study clarifies the association of FJO and MFA, highlighting the need to consider fatty atrophy of the multifidus muscle in the evaluation of degenerative spinal disorders. Concurrent consideration of FJO and MFA in the clinical context could lead to better management of LBP.

Ethics

Ethics Committee Approval: The study was obtained from each participants, and the study was approved by the Institutional Ethics Committee İstanbul Yeni Yüzyıl University (decision number: 2025/06-1603, date: 17.06.2025).

Informed Consent: Informed consent was obtained from all participants. All participants gave both verbal and written informed consent.

Footnotes

Authorship Contributions

Surgical and Medical Practices: C.M.A., S.K., Y.K., M.N.E., R.G.U., M.T., Concept: C.M.A., S.K., M.N.E., M.T., Design: C.M.A., Y.K., R.G.U., M.T., Data Collection or Processing: C.M.A., S.K., Y.K., M.N.E., R.G.U., M.T., Analysis or Interpretation: C.M.A., S.K., Y.K., M.N.E., R.G.U., M.T., Literature Search: C.M.A., S.K., M.N.E., M.T., Writing: C.M.A., S.K., Y.K., M.N.E., M.T.

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