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The Relationship of Facet Tropism with Disc Degeneration at L5-S1 Level

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Abstract

Introduction: Facet joints play an important role in spinal stability. In the lumbar spine, the range of movements at the same segment is defined by the orientation of facet joint. In the upper lumbar spine, facet joints are more sagittally oriented, whereas at the lower levels, they are more coronally oriented to facilitate increased movements. Facet tropism is defined as asymmetry between left and right facet joints. It is important because of thought that facet tropism increases sharing force on intervertebral disc and causes early degeneration. Despite previous authors investigated whether facet orientation and tropism influence the risk of lumbar disc herniation, the results remain controversial. For this reason, the association between Facet Tropism (FT) and Disc Degeneration (DD) at the L5-S1 level was investigated.

Material and Methods: 50 patients (25 female and 25 male), whose average age was 49.48 was studied in this article. Magnetic resonance imaging scans of 50 patients with L5-S1 level were analyzed. Left and right facet joint angles of L5-S1 level were measured on axial sections. The FT was determined by calculating the differences between the left and right facet joint angles. DD were identified using the Pfirrmann grading system. Pearson correlation analyze was used to determine the association between facet tropism and disc degeneration.

Results: Mean FT degree was 7.18 ± 0.88 and mean Pfirrmann degeneration degree was 3.22 ± 0.14. Disc degeneration grades were statistically higher in patients which has high FT level (p=0.00).

Conclusion: Facet tropism is associated with increased risk of L5-S1 intervertebral disc degeneration.

Keywords: Facet tropism; Disc degeneration; MRI

Introduction

Facet Tropism (FT) is described as differences of the left and right facet joint angles of one lumbar spinal unit [1]. FT is seen in 14% to 28% of the lumbar region and increase shearing force. Therefore causes spinal disorders such as spondylolisthesis, facet arthritis and disc herniation [2-3]. First, Farfan and Sullivan asserted the correlation between facet tropism and lumbar disc herniation [4]. They suggested that rotation of facet joint cause's additional shearing force on the intervertebral discs and this situation cause's early degeneration. Masharawi et al. signified that if asymmetry of facet joints occurs in lumbar vertebrae, it may be connected with pathological conditions [5]. The role of FT in Disc Degeneration (DD) is still uncertain. The aim of this study was to determine the relationship of FT with DD. Further, we measured the relationship between the side of DD and that of the FT.

Materials and Methods

Magnetic resonance imaging scans of 50 patients that mean age was 49.48 and 50 pairs of facet joint with L5-S1 level were analyzed retrospectively. T1 and T2 MRI was performed using 1.5 T (Magnetom EAREA; Siemens Healthcare, Erlangen, Germany) while the patients were in the supine position. In the axial plane, the slices were parallel to the end plates with 4-mm thickness, enabling us to exactly assess the intervertebral discs and facet joints. Left and right facet joint angles of L5-S1 level were measured on axial sections.

Facet joint angles were measured according to Noren et al. method [6]. Axial sections of T2 weighted MRI that equally bisected the intervertebral disc space were used to measure each facet angle. The facet angle corresponds to the angle between the reference line that passes through the center of the disc and the base of the spinous process and the facet line that connects the anteromedial and posterolateral margins of the superior articular facet (Figure 1). The FT was determined by

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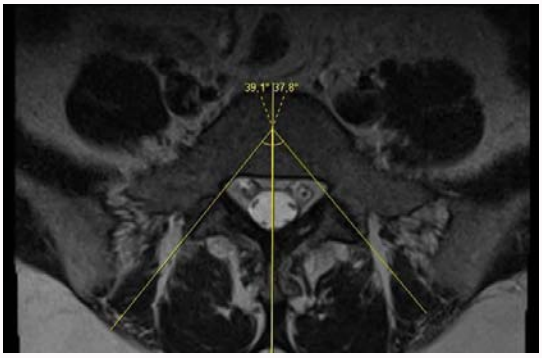

Figure 1: Facet angle measurement method according to Noren et al. Both right and left facet angles at L5-S1 was measured as the angle between the reference line that passes through the disc center as well as the base of the spinous process and the facet line connecting the anteromedial and posterolateral margins of the superior articular facet.

Grade	Structure	Distinction of nucleus and annulus	Signal Intensity	Height of intervertebral disc
I	Homogenous, bright white	Clear	Hyperintense, isointense to cerebrospinal fluid	Normal
II	Inhomogenous with or without horizontal bands	Clear	Hyperintense, isointense to cerebrospinal fluid	Normal
III	Inhomogenous, grey	Unclear	Intermediate	Normal to slightly decreased
IV	Inhomogenous, grey to black	Lost	Intermediate to hypointense	Normal to moderately decreased
V	Inhomogenous, black	Lost	Hypointense	Collapsed disc space

*Adapted from Pfirrmann et al. (2001) (8)

Figure 2: Pfirrmann disc degeneration grading system.

calculating the differences between the left and right facet joint angles.

DD were identified using the Pfirrmann grading system [7]. Pfirrmann disc degeneration grade used the signal intensity on T2-weighted MR images to evaluate water content with morphological parameters on a scale from I to V. With reference to grading system; Grade 1, the nucleus pulposus is homogeneous and translucent, with a clear boundary from the annulus fibrosus, and the height of the intervertebral disc is normal. Grade 2, the nucleus pulposus is not fully homogeneous, with a clear boundary from the annulus fibrosus, and the height of the intervertebral disc is normal. Grade 3, the nucleus pulposus is moderately darkened, with an unclear boundary from the annulus fibrosus, and the height of the intervertebral disc is normal or slightly lowered. Grade 4, a black disc is observed, there is no boundary between the nucleus pulposus and the annulus fibrous, and the height of the intervertebral disc is less than normal. Grade 5, a black disc is observed, there is no boundary between the nucleus pulposus and the annulus fibrous, and the intervertebral space has collapsed (Figure 2).

Pearson correlation analyze was used to determine the association between facet tropism and disc degeneration.

Results

The mean value of facet tropism was 7.18 ± 0.88 and mean Pfirrmann degeneration degree was 3.22 ± 0.14. The maximum facet angle was 71.60 and minimum facet angle was 24.90 on the left side.

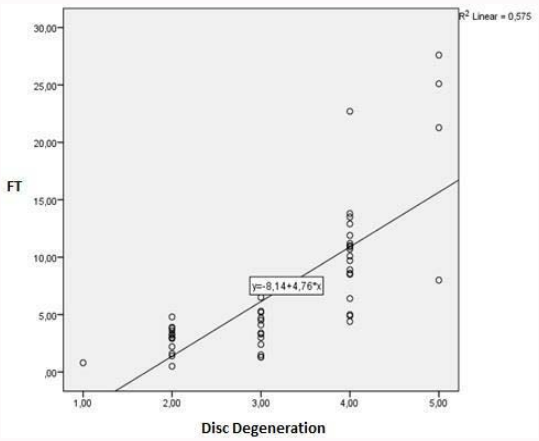

Figure 3: Pearson correlation coefficient demonstrated a significant positive correlation between facet tropism and disc degeneration (P=0.00).

The maximum facet angle was 81.30 and minimum facet angle was 27.10 on the right side. Mean facet angle degree was 45.64 ± 1.42 on the left side and 47.02 ± 1.57 on the right side. Age and gender did not show any significant relationship with FT and DD. Positive correlation was determined between the facet tropism and disc degeneration degree (p=0.00) (Figure 3).

Discussion

Facet joint is important for spinal stability. Facet joint provide stability against axial loading [8]. Asymmetry of facets which is in the same spinal unit causes change on the biomechanics of lumbar spinal movements and accelerate early degenerative changes in the adjacent intervertebral discs subscribe to back pain [9]. Brailsford defined facet tropism in 1928 as asymmetry between the left and right vertebral facet joint angles [10]. Facet tropism is most common at L5-S1, followed by L4-L5 [11]. Therefore, we researched the relationship between the FT and disc degeneration at the L5-S1 level. Facet tropism is defined as an absolute difference of more than 7° between the right and left facet angles [12]. We found the mean value of facet tropism was 7.18 ± 0.88 in our study group. It is known that a facet tropism can lead to early osteoarthrosis of facet joint and degenerative spondylolisthesis; however, it is uncertain whether an asymmetry in joint by itself can cause disc degeneration [13,14]. Some author suggests that facet joints are important cause of lumbar disc herniation while others report that facet tropism has no relation [4-15]. Our study showed that there are association facet tropism and disc degeneration. Facet tropism statistically increased risk of L5-S1 intervertebral disc degeneration (p=0.00). Kim et al. stated that FT did not increase disc stress or facet joint stress but that FT could make the spinal unit more undefended to external movements or anterior shear force (2). Grobler et al. indicated that increasing sagittal orientation of the facet joint causes disc degeneration [16]. Cyron and Hutton submitted that FT could lead to segmental instability that causes increased rotational strain on the annulus fibrosus [17]. Van Schaik et al. measured facet asymmetry in 100 patients with low back pain or sciatica or both. In cases where there was less than 11° of asymmetry, there was an equal distribution of herniation. There was correlation on asymmetry of facet angle with the incidence of disc herniation [18]. Our findings are in accordance with their study.

Conclusion

Our study has some limitations such as it is retrospective case

control study and study group is narrow. For all that our study demonstrated a significant association between FT and DD.

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