FACET JOINT ANGLE IN LUMBAR DISC HERNIATION

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ABSTRACT :

The geometry of the facet joint has been the focus of several studies. The orientation of the facet joint was studied using CT scan in patients with lumbar disc herniation. There were 20 patients with protruded and 20 patients with extruded disc herniation. The diagnosis was confirmed at surgery in all cases. The facet joint angle was measured according to Grobler's method. Our results revealed an increased facet joint angle in patients with protruded ($p<0.05$) and those with extruded ($p<0.01$) disc herniation, when compared with the control group. The side of increased facet angle was the side of herniated disc in all cases. These results support the possible role of the facet joint on the pathogenesis of disc herniations.

Key Words: *Facet Joint Angle, Lumbar Disc Herniation.*

INTRODUCTION

Several factors have been suggested to play a role in the pathogenesis of lumbar disc herniations. One of these factors is the geometry of the facet joint, including facet joint shape, diameter, depth, and its angle. The relationship between the facet joint angle and the lumbar disc herniation has been investigated by many authors. In 1967, Farfan et al. (9), studied disc pathology and facet joint asymmetry. They found a correlation between the facet joint asymmetry and disc pathology. They postulated that the intervertebral disc is normally protected against axial rotation by the orientation of facet joint. According to them, a more oblique oriented facet joint is associated with a less mechanical resistance against axial rotatory forces. Farfan (10) also applied an axial rotatory load to motion segments and produced a circumferential tears in the annuli similar to thoses found in herniated discs (1). For several years, many studies have focused on the role of facet joint (8, 13–17, 19, 22–24). Several studies have yielded conflicting results concerning the association between facet tropism and intervertebral disc disease.

The aim of this study was to determine the facet joint angle in patients with protruded and extruded L4–L5 disc herniation.

MATERIAL and METHODS

Preoperative computed tomography images of 40 patients with lumbar disc herniation were retrospectively reviewed. There were 28 male and 12 female aged between 22–54 years old (mean 35.6 years). The herniated disc was located at L4–L5 level in all cases. There was no significant sagittal deformity in preoperative radiographs. There were 20 protruded and 20 extruded disc herniations. All the herniated discs were lateral disc herniations, and all the patients had an unilateral disc herniations. There was no central nor far–lateral disc herniation. The diagnosis was performed using MR images and CT scans. All the patients were operated using a hemilaminotomy and open discectomy. So, the diagnosis was confirmed in all cases operatively.

Facet joint angles were measured on axial sections of CT scans according to the method described by Grobler et al (11). By definition, the best CT slices was achieved just inferior and parallel to the superior endplates. A line was drawn to join two points

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determined in the most posterior of the vertebral body. Then, two anterior and posterior points in the inner surface of the facet joint was determined and the joining line was withdrawn to the former coronal line and the angle was measured (Fig. 1).

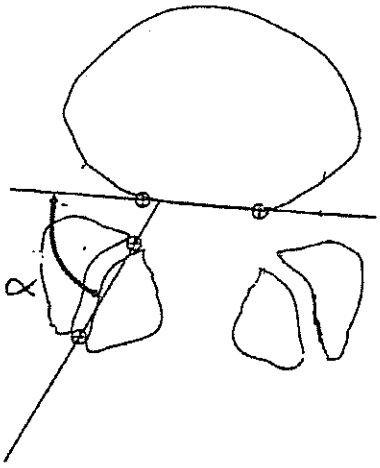

Figure 1. The Facet joint angle measurement technique.

The results were evaluated and compared with the results of a control group without any discogenic problems (aged between 22 to 31 year–old, mean 27.5).

Statistical analysis was performed using unpaired t test, ANOVA, and a Tukey–Kramer multiple comparisons test.

RESULTS

There was no significant difference between age of the patient and control group.

The mean facet joint angle of the control group and patient group were tabled in Table 1, 2, 3 and 4.

Table 1. Mean facet joint angle of the control grup.

Right	Left
44.900±8.634	54.700±12.157

Table 2. Mean facet joint angle of the patients with lumbar disc herniation.

Right	Left
48.5252±11.379	49.200±11.811

Table 3. Mean facet joint angle of the patients with protruded lumbar disc herniation.

Right	Left
55.300±9.015	56.350±8.875

Table 4. Mean facet joint angle of the patients with extruded lumbar disc herniation.

Right	Left
41.750±9.375	42.050±9.997

Figures 2 and 3 illustrates the facet joint angle in a normal case, and in a patient with protruded disc herniation and a patient with extruded disc herniation.

The comparison of facet joint angles in the right side revealed no difference between control group and protruded group; whereas there was a significant difference between facet joint angle of patients with extruded disc herniation and control group ($p<0.01$).

The comparison of facet joint angle in the left side revealed a significant difference between protruded disc herniation and control group ($p<0.05$), and no difference between extruded disc herniations and control group.

The side of increased facet joint angle was identical with the side of disc herniation in all cases.

There was no significant difference between the right and the left facet angles in control group; in patient group; in patients with protruded disc herniation, and in patients with extruded disc herniation ($p>0.05$).

DISCUSSION

This study revealed an increased facet joint angle in cases with protruded and extruded disc herniation. The importance of dorsal spinal structures has been addressed by many authors (1, 2, 5, 6). Yang and King showed that the normal facet joints carry 3 to 25% of compressive loading (25). Adam and Hutton (1) reported that the dorsal structures protect the disc from excessive shear loadings in axial rotation.

There are a variety of studies regarding the relationship between the facet joint orientation and the lumbar disc herniations (6–9, 14–17, 19, 22–24). Asymmetrical facet joints are considered to be of clinical importance as a cause of lumbar disc herniations by some authorities (8, 9, 15–17, 19, 23, 24). In contrast, some authors reported that facet tropism has no clinical relevance (1, 2, 7, 14, 22).

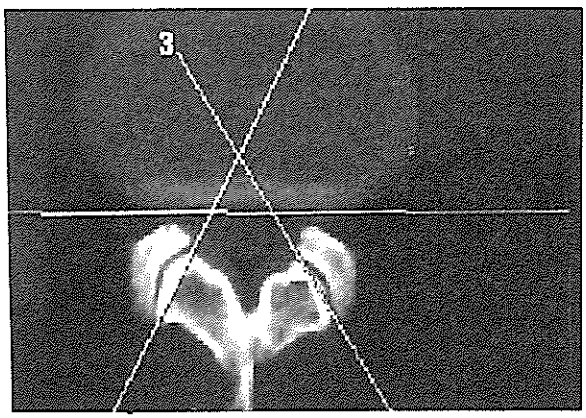

Figure 2. Facet joint angle in a normal case.

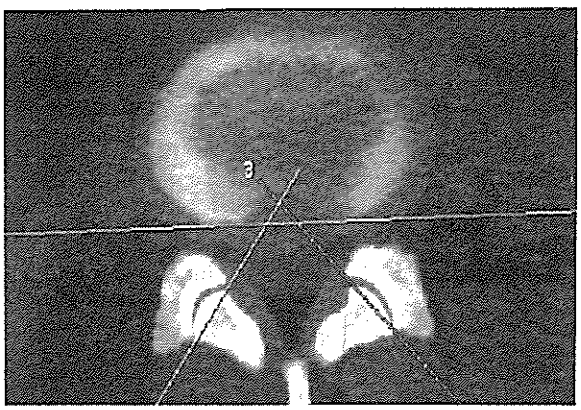

Figure 3. Facet joint angle of a patient with protruded disc herniation.

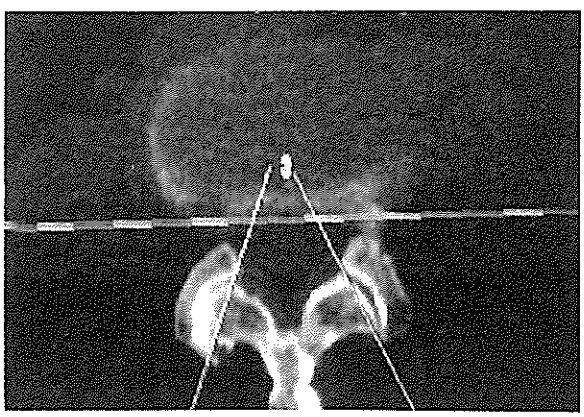

Figure 4. The Facet joint angle of a patient with extruded disc herniation.

The present study was focused only on the facet joint angle in patients with lateral disc herniation at the L4–5 level. This was done so, because of unique biomechanical features of L4–5 level. As reported by Benzel (5), L4–5 level are subjected to axial loads leading to shear forces. Orientation of facet joint was reported to provide a resistance against these shear forces. In other sense, facet joint tropism has been implicated as an aggravating factor or torsional injury of the lumbar spine leading to disc herniation. The occurence of a repetitive shear or a torsional load may have faciliated the occurence of protruded or extruded disc herniations. An increased sagittal facet joint orientation has been shown in patients with degenerative spondylolisthesis (11, 12, 20). The aforementioned features of facet joints led us to investigate facet joint angle only in L4–5 level. Our study showed the presence of facet joint tropism in both patients with protruded and extruded disc herniations.

Van Schaik et al. (23), examined orientation and shape of facet joint in patients with low back pain and found no correlation between side of disc herniation and the facet joint tropism. In our cases, the presence of increased facet joint angle was associated with the presence of ipsilateral disc herniation.

Loback et al., studied facet joint angle and disc herniation (17). They reported an asymmetric facet joint in central disc herniations, and a facet tropism in lateral disc herniations. There was no central disc herniation nor far lateral disc herniation in our series.

The response of motion segment to axial rotation was also investigated. Some authors (4, 18) found an increase in axial rotation of motion segments subjected to axial torque after removal of the facet joints. These findings were substainted in finite element studies by Shirazi–Adl et al (21). On the other hand, Ahmed et al., found no correlation between facet geometry and the axial torque–rotation response (3). They reported that the facets act as a "positive stop" to axial rotation, however, facet joint angle variations did not affect this role. Our study did not address this aspect of the facet joint.

In summary, although this study is limited to lateral herniations of L4–5 level, it revealed an increase in facet joint angle in patients with protruded and extruded lumbar disc herniation. The changes in facet joint orientation of patients with different type of herniation (e.g., central or far–lateral disc herniation) remain to be investigated.

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