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Secondary degenerative changes in the intervertebral disc due to zygapophyseal (para-vertebral) facet joint lesions.

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6.0 CONCLUSION

A summary of the findings show that 48% of the specimen show a correlation between ipsilateral annular fibrosus indentation/ and or degeneration by the nucleus pulposus with accompanying facet joint degeneration.

Of the remaining 52%, 32% showed the opposite and the remaining 20% showed mixed results. The mixed results are considered with the positive findings, as there is correlation. This then gives a positive correlation of 68%.

The outcome of this study therefore supports the hypothesis that there is a degree of correlation between ipsilateral articular facet joint surface degeneration and degeneration of the anulus fibrosus. In all cases of the disc degeneration, facet joint degeneration was also noted. But, there were 9 cases (36%) were facet joint degeneration was present without disc degeneration, indicating that disc degeneration has not yet occurred. This finding was also reported by Cramer (2004)

It was shown in the literature that the articulating facet surface undergoes degenerative changes before discal degeneration is observed. This shows that the anulus fibrosus maintains its viscosity and integrity, pending movement, allowed to it by the functionality of the facet joints. Restriction in facet joint movement caused degenerative changes to the joint surface which in turn affects discal movement resulting in physiological narrowing and eventual degeneration in the anulus fibrosus.

The altered dynamics of the movement in the articulating facet joints can therefore be seen to act as a precursor to ipsilateral annular narrowing and degeneration.

This finding has a significant contribution in the management and procedural consideration of mechanical low back pain. Assuming that not all disc narrowing is not also disc degeneration, restoration of function to the facet joints would lead to improved discal nourishment. Should this not occur the disc could well be in a state of disrepair. Just as primary facet joint lesions may be more responsive to

manipulation and exercise, primary discal lesions would be more responsive to surgical intervention.

The disc can be seen as a fibro cartilaginous structure that maintains its viscosity by the process of imbibing and osmosis. ”To live it needs to move”. The degree and range of motion that can be allotted to the disc is governed by the apophyseal joints and the adjacent ligaments. These ligaments also need end range motion to maintain elasticity and this brings the focus back to the apophyseal joints. Maintaining function in these diarthrodial joints, maintaining the visco elastic properties of the adjacent ligaments, stimulates the nourishment of the intracapsular facet structures, lubricates the surfaces and last but not least maintains the fluid viscosity in the intervertebral disc.

The finding in this current study suggests that there is a correlation between annular degenerative changes and ipsilateral facet degeneration. Whether altered apophyseal function precedes disc narrowing and in time degeneration, remains an enigma. The statistical percentages in this study however show that there is a high prevalence of facet degeneration with lesser discal degeneration.

Bio physiologically, the author is of the opinion that evidence suggests that the disc is at the receiving end of apophyseal function and that it is dysfunction in motion that proceeds disc narrowing. The work of Adams and Hutton (1980) and Cramer et al (2004) supports this hypothesis. This view supports the view of the author of this thesis.

The matter of disc narrowing and discal degeneration needs further clarification. Disc narrowing should be reversible whereas degeneration not. For the sake of clarity, the terms should be used appropriately.(See annexure)

7.0 Annexure

Two interesting phenomena which arose from this study that bears mention and further investigation.

1) The reference “Disc Degeneration” and “Disc Disease”
2) The method of herniation of the nucleus pulposus.

1 (Disc) Degeneration

----“a change from a higher to a lower form; especially change of tissue to a lower or less functionally active form.

a) True degenerations – when there is chemical change in the tissue itself
b) Infiltration – when the change consists in the deposit of abnormal matter in the tissue. “(Dorland’s 1965)

(Disc) Disease

----“a definite morbid process having a characteristic train of symptoms; it may affect the whole body or any of its parts and its aetiology; pathology and prognosis may be known or unknown” (Dorlands 1965)

Both the terms “degeneration” and “disease” are used loosely in reference to a state of the intervertebral disc. It does not describe the matter of *discal narrowing*. The author is of the opinion that disc narrowing is initially a physiological state. As was seen from the literature review, the intervertebral disc is a dynamic structure in that it is supposed to change in height pending activity or lack thereof. A narrow disc might therefore only be narrow due to lack of function. It does not conform to the definition of true degeneration or infiltration, nor is it a disease.

Should a state of “physiological narrowing” be maintained, degeneration may result leading up to a disease.

Although it may be difficult to diagnose, the author proposes that discal narrowing must be described as either physiological or pathological.

Physiological would indicate that there is a mechanical error in the motion segment and that the disc may be intact. Pathological narrowing would imply a change of state of the tissue as with discitis or herniation.

The current terminology around the use of the term disc degeneration is confusing. The author suggests that a task team needs to study the definition in relation to motion segments, specifically the intervertebral disc, as this misunderstanding may also have legal implication

2. The Method of Herniation of the Nucleus Pulposus

The purpose of this study was to examine the correlation between facet degeneration and fissuring of the nucleus pulposus into the anulus fibrosus.

In the methodology of dye infiltration into the nucleus pulposus and subsequent X-Ray studies, it became evident that dye migrations also takes place on the end plate, as can be seen in figures 4.15, 4.16, 4.17, 4.21, 4.26, 4.27.

It was also observed that at times the dye might be located superior or inferior and even both. At times, the dye would be central.

The author was not able to find clarification for this phenomenon in the literature. In professional discussion it was mentioned, that Dr Harris Jackson, located in Johannesburg, had noticed this phenomenon in the 1950's when injecting radio - opaque dye into patients nucleus pulposus for discogram X Rays and had made mention that the nucleus pulposus may appear in two halves.

With this as background, the author observed in MRI studies, that this statement might be justified. (Figure 7.1)

This correlates well with what was observed in the dye infiltration models.



Figure 7.1: The herniation is visible on the superior aspect of the anulus fibrosis where it attaches to the end plate. Also shown is the “double nucleus” phenomenon. (authors own terminology and from authors patient records)

What may be the significance of this?

Firstly, by being aware of this phenomenon, it would lead to a more accurate diagnosis making the procedural repair more focused with a better out come.

Secondly, as regards this study, the true relation of annular fissuring may have been missed by slicing/dividing the disc at the wrong level. Fortunately, the outcome of the study supported the hypothesis, but it could very easily have shown the opposite, figure 7.2.

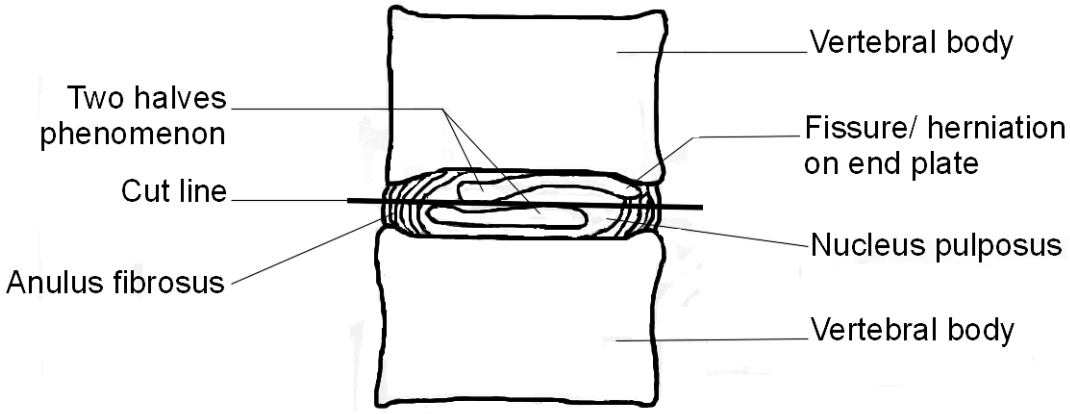


Figure 7.2: Schematic diagram, illustrating the “double nucleus appearance” in the vertebral disc

This “double nucleus appearance” needs further investigation, as does a detailed study of the migration of nucleus pulposus. It may also account for the variations in speculation regarding physiological and pathological intervertebral disc activity.

White and Punjabi (1978) summarize experimental work by various authors and state that with central compressive loading, the disc bulges in the horizontal plane but not in any particular direction. This implies that for the disc to be herniated posterior laterally as seen in the clinical situation, is not inherent to the structure of the disc, but must depend upon certain loading situations other than compression. (Again, it is assumed that the structure of the anulus was not in a state of degeneration or disrepair – Author)

Akeson (1977) and Smith et al (1988), in studies of axial compression of the vertebral column, showed that failure occurred into the vertebral body and adjacent to the anulus fibrosus, before the anulus failed. It is assumed that the anulus fibrosus was in a “healthy” anatomical state.

The process of degeneration makes the disc less visco elastic. This implies that as the disc degenerates, it loses the capability to attenuate shock and to distribute load uniformly over the entire end plate White and Punjabi (1978).

The fore going discussion explores the behaviour of the normal disc and compares it to a degenerate disc on the assumption that a degenerate disc is one that has lost viscosity in the nucleus pulposus and is exhibiting loss of visco elasticity in the anulus fibrosus.

The author proposes that the state of mechanical/ physiological disc narrowing is not necessarily also disc degeneration.