



## CASE STUDY

## Disc Desiccation in Low Impact Young Trauma Victims

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### Abstract

**Objective:** To consider evidence that indicates disc desiccation occurs with regularity in young individuals, despite reports to the contrary.

**Clinical Features:** The clinical histories of 168 chiropractic patients under the age of 50 were reviewed in such a manner that individual patients cannot be identified.

**Outcome:** 20 individuals under the age of 50 were found to exhibit disc desiccation, an occurrence of approximately 12%. It was also indicated that disc desiccation appears to occur with slightly greater frequency in women.

**Conclusion:** Disc desiccation is more prevalent in young trauma victims than was previously believed. Concern regarding sample size was discussed, as were suggestions for further research, such as larger sample size, consideration of the direction of impact, the effects of health or obesity upon the occurrence and/or degree of injury.

arthritis of the facet joints have previously been viewed as atypical in patients younger than 50 years [1]. Evidence exists, however, which indicates intervertebral disc desiccation occurs in much younger individuals following the occurrence of low to moderate impact trauma. This phenomenon is further supported by Adams, Freeman, Morrison, Nelson, and Dolan [2], in a study of mechanical initiation of intervertebral disc degeneration. It was hypothesized that minor damage to a vertebral body could lead to progressive disruption of the adjacent intervertebral disc [2]. Their work indicated that minor damage to a vertebral body endplate may lead to progressive structural changes in the adjacent intervertebral discs [2]. Degeneration of intervertebral discs has also been linked with repetitive loading of the lower back [3]. Unlike most other physiology, however, it was found that the intervertebral discs do not grow stronger in response to stress. It is hypothesized that this is due to the low metabolic rate of intervertebral discs, the largest avascular structures in the body [3].

Disc desiccation is frequently one of the first signs of disc degeneration, particularly in the nucleus pulposus. In a study by Boos, Gbedegbegnon, Aebi, and Boesch [4], mean water content in intervertebral discs and in vertebral bodies were significantly ( $P < 0.001$ ) less in the evening than that measured in the morning. A significant ( $P < 0.05$ ) increase between morning and evening measurements in vertebral bodies was also found, with the diurnal variations less pronounced in degenerative discs as compared to normal intervertebral discs [4].

Disc degeneration due to desiccation can be detected reasonably early via MRI because, as the discs dehydrate, the MRI signal decreases on gradient-echo and T2-weighted images. With further degeneration, the

### Introduction/Literature Review

Degeneration of the spine due to either trauma or disease is considered a leading cause of chronic disability in the adult working population and is a primary reason for referral to an MRI center. Although often described as an unavoidable and normal part of aging, degeneration resulting in neck and back pain is also noted to occur in younger individuals, generally in response to trauma. Discomfort may arise from numerous sources, and finding the cause is often problematic for both the patient and the doctor. Most neck and back injuries reportedly respond to conservative treatment, but if the pain is unrelenting, severe, or associated with a radiculopathy or myelopathy, imaging may be necessary in the search for a cause.

Disc extrusion and sequestration, desiccation, nerve root compression, end plate abnormalities, and osteo-

disc collapses, not uncommonly with gas formation and calcification [4]. Consequently, normal axial loading on the spine may stretch and elongate annular fibers, resulting in symmetric bulging of the disc beyond the margins of the vertebral body, encroaching on the ventral spinal canal and inferior portions of the neuroforamina, although not necessarily displacing the nerve roots [4].

A significant correlation between a decrease in MRI signal intensity and age was found, although the signal intensity changed less than 6% in the course of 80 years [5]. This decrease in signal intensity is associated with a decrease in hydration and glycosaminoglycans and an increase in collagen in the disc [5].

Disc degeneration diminishes the stiffness of the intervertebral disc, resulting in abnormal motions of the spine [6]. Therefore, disc degeneration associated with back pain may indicate spinal fusion. Stiffness of normal, undamaged discs exceeded that of discs with transverse, concentric, or radial tears of the annulus fibrosus [6]. Discs with radial tears of the annulus fibrosus had the lowest stiffness [6]. Discs with collapsed disc space and large osteophytes had increased stiffness when compared with radial tears [6].

Vertebral fusion appears to precede calcification, suggesting fusion prevents the normal mechanical stresses within the disc. This may lead to premature degeneration and calcification of the nucleus pulposus [7].

Biochemical and structural changes occur in the intervertebral discs with the onset of age [5]. A significant change is the loss of water-binding capacity, with an average water-content decrease down to approximately 70% [5].

Discoloration and degeneration of the nucleus pulposus, diminishing disc height, and diminishing signal intensity are frequently associated with a radial tear or complete disruption of the annulus fibrosus [8]. Generally, a radial tear in the annulus results in shrinkage and disorganization of fibrocartilage in the nucleus pulposus and replacement of the disc by dense fibrous tissue and cystic spaces [8].

The intervertebral disc is composed of the nucleus pulposus enclosed by the annulus fibrosus. Both the annulus and the nucleus pulposus composed of collagen and proteoglycans. The nucleus has a greater concentration of proteoglycans, resulting in a looser gelatinous texture. It blends into the surrounding annulus without clear anatomic demarcation. The annulus is more collagenous, the collagen becoming progressively more compact and tougher at the periphery. Normally, discs are sufficiently hydrated, the nucleus containing 80 to 85% water and the annulus about 80% [9]. Together with the end plates of the adjacent vertebral bodies, the intervertebral disc provides structural integrity to the interspace and cushions mechanical forces applied to the spine [9].

## Methodology

In this study, subjects were drawn from a group 168 records of 7 chiropractors. 9 males and 11 females, a total of 20, under the age of 50 were found to exhibit significant disc desiccation, representing an 11.90% prevalence rate. Data were collected in such a manner that individual patients cannot be identified.

The data were separated according to gender and according to whether the injury occurred in the cervical or the lumbar region of the spine. In some subjects, injury occurred in more than one intervertebral joint.

Mean age for the entire sample was 37.9 years. Mean age for male subjects was 37.5 years. Mean age for female subjects was 38.5 years. In the female cohort, a total of 2 cervical and 15 lumbar injuries involving intervertebral disc desiccation were reported. In the male cohort, 3 cervical and 10 lumbar injuries involving intervertebral disc desiccation were reported.

In that the data entail comparison of the effects of two variables, gender and location of the disc desiccation, and there are two groups on both variables,  $\chi^2$  (chi square) can be computed.  $\chi^2$  included Yates' correction for continuity, because 2 cells are less than 10, which would, if left uncorrected, result in a  $\chi^2$  computation that would overestimate the true  $\chi^2$  value. Data were arranged in a contingency table, as follows:

Contingency Table

A		B	
C		D	
	n	Cervical Injury	Lumbar Injury
Males	9	3	10
Females	11	2	15
Total (N)	20	5	25

$$\chi^2 = \frac{N[(AD - BC)] - N / 212}{(A + B)(C + D)(A + C)(B + D)}$$

$$= \frac{30[(45 - 20)] - 30 / 212}{(13)(17)(5)(25)}$$

$$= 0.0217$$

$\chi^2 = 0.0217$ , significant at approximately the 0.90 level. This suggests that the difference between genders in the rate and location of disc desiccation would occur approximately 9 out of 10 times by chance, thus gender does not present as a significant influence upon injury in this study; however, these results are based on a small N.

## Discussion

Disc desiccation secondary to low impact trauma appears to occur in nearly 12% of injury victims under the age of 50. In this study, both groups had a mean age in the late 30's. Apparently, there is a slightly greater

occurrence in female victims, although gender does not appear to exhibit a significant influence on the rate or location of disc desiccation. However, these pilot study results are based on a small sample size.

## Summary and Conclusions

Back injury and pain secondary to degenerative and traumatic injury is a major cause of disability, and the source of pain and/or injury may not be obvious. Discs do not regenerate at the same rate as other body parts, largely due to their lack of vascularity. Disc desiccation and degeneration are stated as being facts of growing older. However, disc desiccation, while admittedly unusually in individuals under 50-years-old, does appear to occur in approximately 12% of trauma victims.

## Methodological Concern

A primary methodological concern was the small sample size. With a sufficiently large sample, greater consideration could be given to the question of whether specific intervertebral joints are more commonly injured as a result of impact.

## Considerations for Future Research

In conducting future research on disc desiccation, considerations for a more powerful study are as follows:

- 1 A significant increase sample size.
- 2 Consideration of the angle and direction of impact.
- 3 The effects of muscle tone and/or abdominal pressure on the degree and type of injury.
- 4 A more in depth consideration of the effect of gender upon disc desiccation.
- 5 Inclusion of height to weight ratio, to view the effect of relative health or obesity upon the occurrence and/or degree of injury.

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