Magnetic Resonance Study of Lumbar Disks in Female Dancers

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Background: Previous imaging studies have shown that degenerative disk disease is more common in the competitive female gymnast than in asymptomatic nonathletic people of the same age training to any degree. However, results of exposure-discordant monozygotic and classic twin studies suggest that physical loading specific to occupation and sport has a relatively minor role in disk degeneration, beyond that of upright postures and routine activities of daily living.

Hypothesis: Intensive, regular, and prolonged dancing causes strain on the lumbar spine and can trigger or accelerate the development of degenerative diskopathy.

Study Design: Cross-sectional study; Level of evidence, 3.

Methods: Forty volunteer female dancers (20 ballet and 20 flamenco) aged between 18 and 31 years (mean = 24.2) underwent magnetic resonance imaging of the lumbar spine. They were compared against a control group of 20 women of the same age. A descriptive analysis was done, and the 2 groups were compared by contingency table analysis using the Pearson chi-square test complemented by an analysis of residuals.

Results: Nine of the 20 women (45%) in the control group had disk degeneration compared with 13 of the 40 (32.5%) women in the dancer group, with a chi-square of 0.897 (not significant). There were 12 degenerated disks of the 100 explored (12%) in the control group compared with 21 of the 200 explored (10.5%) in the dancer group (chi-square = 0.153; not significant).

Conclusion: Dancing cannot be considered a risk factor for lumbar disk degeneration in women.

Clinical Relevance: The present study indicates that dancing has no negative effect on the development of degenerative diskopathy.

Keywords: intervertebral lumbar disk; spine; magnetic resonance; ballet dancers
Dancing affects the morphological characteristics and functionality of the spine, and a high prevalence of lesions has been reported among dancers. Thus, intense training and repetitive lumbar hyperextension are believed to increase the risk of low back injuries, but leanness, muscle strength, and flexibility, which are typical of rhythmic gymnastics, should be protective.

Powell et al studied 111 female dancers aged between 21 and 30 years; 32% had at least 1 degenerated disk. Boden et al studied 35 subjects of both sexes, aged between 20 and 39 years; 34% had at least 1 degenerated disk. Jensen et al, studying 20 subjects of both sexes aged between 20 and 29 years, found that 35% (20% according to another observer) had at least 1 degenerated disk.

Magnetic resonance imaging (MRI) is the best diagnostic imaging method for studying degenerative diskopathy (DD), because it is a reliable, sensitive, and harmless technique, ideal for research studies in young people.

Our hypothesis is that intensive, regular, and prolonged dancing causes strain on the lumbar spine and can trigger or accelerate the development of DD.

The aim of this study is to show a relationship, if possible, between dancing and the development of degenerative lumbar diskopathy by using MRI studies to establish that there is a greater incidence of disk alterations in female dancers than in the general population of the same age.

MATERIALS AND METHODS

Magnetic resonance imaging of the lumbar spine was carried out in 60 female volunteers aged between 18 and 31 years. The study was approved by the local ethics committee, and all subjects signed a consent form after reading the information and after the procedure was explained to them.

Forty of the subjects were dancers, aged between 18 and 31 years (mean, 24.17 years; range, 22.92-25.42), either advanced students at higher schools of dance or professional dancers. Twenty performed ballet and 20 flamenco. They had all been dancing for more than 8 years (mean, 10.25) and practiced for more than 12 hours per week (mean, 16.65).

The 20 women in the control group, aged between 19 and 28 years (mean, 22.3 years; range, 20.95-23.64), had not systematically practiced any form of dance and did varying degrees of physical exercise, without regular sport activities.

The exclusion criteria for both groups were history of lumbar surgery, sciatic pain or severe lumbago of more than 2 weeks’ duration or more than 3 episodes, and moderate or severe scoliosis.

MRI Examination of the Lumbar Spine

Magnetic resonance imaging was done in all cases with a Signa Horizon 1.5 (General Electric, Fairfield, Connecticut) and included 3 sequences:

1. T1-weighted spin-echo (SE) sequence in the sagittal plane, including at least from D11 to S1, with repetition time (TR) 300, echo time (TE) 15, thickness 4 mm, matrix 512 x 224 x 3 number of excitations (NEX), and field of view (FOV) 28 cm
2. T2-weighted SE sequence in the sagittal plane, with TR 4500, TE 108, and the same thickness, matrix, and FOV as before
3. T1-weighted SE sequence of the lumbar disks in the axial plane, with TR 500, TE 15, FOV 15 cm, thickness 4 mm, and matrix 256 x 160 x 3 NEX

In the MRI studies we analyzed the lumbar disks looking for signs of DD and assigning to each disk a degeneration grade from 0 to 4 according to the following scale based on the morphological model: grade I, signal loss of the L5-S1 disk (Figure 1); grade II, decreased height of the L4-5 disk. The extension of the posterior disk contour beyond the interspace, depending on the shape of the disk contour on the axial image, can be classified as bulging (grade II) (Figure 2), protrusion (grade III) (Figure 3), or extrusion (grade IV).

Intra-observer error was obtained by taking a second reading of 30 MRI studies done at random a month later and with no knowledge of the results of the first reading (blind study).

To determine interobserver error, 2 radiologists took the reading of these same 30 studies independently and blindly.
A descriptive analysis was done of the 2 samples. The 2 groups (dancers and controls) were compared by contingency table analysis with Pearson's chi-square test and an analysis of residuals to determine trends.

**RESULTS**

Twelve degenerated disks were detected in the control group: 2 grade I (16.6%), 4 grade II (33.3%), and 6 grade III (50%). This means that of the 100 disks examined 12% had signs of DD, with an incidence at the lumbar level increasing caudally (Table 1). Nine of the 20 women (45%) had at least 1 degenerated disk.

In the dancer group, 21 degenerated disks were detected: 4 grade I, 8 grade II, and 9 grade III. This means that 10.5% of the 200 lumbar disks examined had signs of DD, with an incidence at the lumbar level increasing caudally (Table 1). Thirteen of the 40 dancers (32%) had at least 1 degenerated disk.

There was a greater tendency for disk degeneration in the control group (9/20; 45%) than in the dancer group (13/40; 32.5%), with chi-square = 0.897 (not significant).

There were 12 degenerated disks of the 100 examined (12%) in the control group compared with 21 degenerated disks of the 200 explored (10.5%) in the dancer group, with chi-square = 0.153 (not significant).

When the 2 groups were compared according to grade of disk degeneration, a slightly higher percentage of grade III was noted in the control group, whereas for grades I and II (lower degree of involvement) the percentage was the same in both groups (Table 1).

**Reproducibility and Reliability Study**

When the 2 readings taken by the main observer were compared, there was a coincident analysis in 25 (83.3%) of
the subjects. Three subjects (10%) showed a discrepancy in discrimination between classifications of normal and degenerated in at least 1 disk. Another 2 subjects (6.6%) showed a discrepancy when grade of degeneration was determined.

We found discrepancies in 5 of the 150 disks examined (3.33%); in 3 the difference was between classifications of normal and pathological. Reliability was 0.869.

In the interobserver reproducibility study, we had a coincident analysis in 24 (80%) of the lumbar spines analyzed. In 3 (10%), the discrepancy was between classifications of normal and degenerated in at least 1 disk. In 3 (10%), the discrepancy was determining the grade of degeneration.

In 7 of the 150 disks explored (4.6%) we found a discrepant reading: in 3 disks the difference was between classifications of normal and pathological. Reliability was 0.859.

**DISCUSSION**

The incidence of DD in the dancer group was slightly but not significantly lower than that in the control group, even though the mean age of the controls was a little lower. There was an increased incidence of DD cranio-caudally, as was to be expected, with no statistically significant differences encountered between the control and dancer groups. If we compare the intensity of the degenerative changes, the control group had a slight although not significantly lower than that in the dancer group (Table 2) when compared using contingency table analysis (Pearson’s chi-square test). It is worth noting the coincidence with Powell’s series (chi-square = 0.000006).

The relationship between disk degeneration and physical overexertion in work or sport has been shown previously, and some types of sport have been found to put the lumbar spine at high risk. Disk degeneration has
also been shown to be a prognostic factor for the appearance of low back pain and disk herniation. 8

Tertti et al 25 found no major incidence of DD in young competition gymnasts who perform forceful rotations and flexions of the spinal column. For these athletes, the disk resists well or recovers without sequelae from the strain of flexion or compression providing there is no bone lesion (spondylosisys or Schmorl’s nodule), because these lesions lead to DD. Ong et al 26 found that top athletes have a greater prevalence and higher grade of disk degeneration than the normal population. However, the lack of control of the previous back injury or a history of back pain might explain the difference.

Dancing alters the morphologic characteristics and functionality of the spine. Lumbar disks withstand an excessive strain from the rotational force they undergo when the hips are raised during hyperextension of the column. 11 Several authors have reported a high prevalence of lesions to the spine in ballet. 1, 12, 24, 30, 35

The results of this study contradict our hypothesis, because the frequency of DD in the dancer group was generally similar to that found in the publications mentioned previously and slightly less than that encountered in the control group. Our study indicates that intensive dancing cannot be considered a risk factor for the development of DD.

Assessment of sport technique and correction by means of an educational program help reduce the mechanical errors that lead to back lesions and decrease the incidence and/or progression of lumbar disk degeneration. 9, 25 Besides maintaining good physical condition, a dancer should devote a major part of practice time to strengthening and stretching the back and abdomen and should pay a great deal of attention to avoiding the technical deficiencies that are often the cause of lesions due to overuse. 1 We believe that by following a proper training program, dancers may help prevent the disk degeneration that can be associated with physical overexertion while at the same time benefit from the health aspects of the program itself.

The present study indicates that dancing has no negative effect on the development of DD. The repeated rotations and flexions associated with ballet apparently do not have the negative effect on the lumbar disks that might be expected, providing bad habits and harmful movements are avoided. These findings warrant confirmation in further investigations. According to the results of this study, dancing cannot be considered a risk factor in women for accelerating or triggering lumbar disk degeneration.

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REFERENCES


