Introduction: The facet joints, the only synovial joints of the spine, allow articulation between vertebrae, and provide stability, control, and shock absorption for the back. They are specifically designed to block rotation in the axial plane along with forward sliding of the lumbar vertebrae (Adams et al.). Although it has been suggested that pathology of the facet joint affects up to 40% of patients with low back pain, the actual percentage may be even greater and thus the contribution of this joint to back pain as well as its relationship to intervertebral disk (IVD) degeneration warrants further investigation. Other studies that have examined entire surfaces of facet joints were either in elderly populations (Tischer et al.) or at just the upper lumbar level (Swanepoel et al.). Here we examine the degeneration of the lumbar facet joints of a younger sample and compare them to magnetic resonance images (MRI) of the associated IVDs.

Materials and Methods: A total of 55 cadaveric human spines were received from the Gift of Hope Organ and Tissue Donor Network. Ages of the donors ranged from 15 to 85 years (mean =59yrs). Following magnetic resonance imaging of the intact spine, the facet joints from L1 – L5 (total = 400 joints or 800 facet articular surfaces) were isolated, opened, examined under low magnification (x8), dissected, and processed for histology, immunohistochemistry for Collagen types I (Col I) and II (Col II) and Western Blot analysis for superficial zone protein (SZP). The joints were graded for degenerative appearance (under x8 and 40x magnification) according to a scale from 0 (normal-appearing cartilage) to 4 (more than 30% of the articular surface eroded down to subchondral bone (Muehleman et al. 1997). Osteophytes were graded on a scale from 0 (none) to 3 (large & extensive).

Results: Microscopic examination showed that nearly all facet joints displayed cartilage degeneration that was widespread across the superior and inferior articular surfaces. Positive correlations were found between the following: age and IVD degeneration as assessed through MRI (R2 = 0.4811, p<0.05); age and microscopic facet joint degeneration ([Fig. 1]; R2= 0.2354, p<0.05); and IVD degeneration and facet joint degeneration (R2= 0.3227, p<0.05). By the age of 40, nearly all donors displayed at least moderate (grade 2 = deep fissuring) facet joint degeneration. The mean scores for overall surface degeneration were: L1/L2 = 2.2; L2/L3 = 2.0; L3/L4 = 2.1; L4/L5 = 2.5. By the age of 42 yrs., no donor displayed a facet articular surface that was normal in appearance. Degeneration was always most severe along the articular borders ([Fig. 2]). The results of the immunohistochemistry demonstrated that facet joints with lower levels of degeneration stained stronger for collagen II fibers than specimens displaying severe cartilage degeneration. Western blot analysis demonstrated the presence of SZP. Osteophytes were present in all individuals with the exception of the 15 year old, who also did not display cartilage degeneration. Of all 800 articular surfaces studied, 42% displayed osteophyte formation, nearly always at the dorso-lateral margin. The most extensive osteophytes were associated with the most severe cartilage degeneration.

Discussion: This is the first study of degeneration on the overall surface of all lumbar facet joints, which are difficult to evaluate with current imaging methods, in a younger sample. Degeneration within the facet joint displayed characteristics seen in other synovial joints, however, facet joints degeneration generally occupied most of the articular surface, sparing little surface in its wake. Furthermore, in comparison to the level of degeneration seen in the hip and knee joints as previously reported (Muehleman et al.), degeneration occurs in the facet joint at an earlier age and more severely. This may be due to the fact the facet joint is small, with most, if not all of its superior and inferior surfaces in contact with one another throughout spine motion. This is unlike the situation with joints such as the hip and knee, in particular, in which the regions of weight-bearing change through the gait cycle; some areas even being low-load regions. The L4/L5 facet joints displayed greater degeneration than did the higher lumbar levels which agrees with previous reports (Tischer et al.). The strong correlation between facet joint degeneration and IVD degeneration hints at a possible connection between the two. Certainly, because of the close association between these joints within the confines of the spine, it is apparent that any biomechanical change in one joint will negatively effect the alignment of that segment as well as at other segments of the spine. Results on presence of osteophytes agree with previous reports in older individuals (Tischer et al.). Taken together these results demonstrate that the facet joint should not be overlooked when assessing OA of the spine and causes of lower back pain.


Fig. 1 Age vs. facet cartilage degeneration.

Fig. 2 Example of Grade 2 degeneration (x100).

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