Vertebral Osteophytes: An Experimental Animal Model
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**Introduction.** Osteophytes are formed as a secondary reactive process to primary degenerative changes of spinal motion segments. The authors’ hypotheses are that osteophytes are formed purposefully to restabilize unstable motion segments that are caused by primary degenerative changes; that the size, shape and location of these osteophytes are, therefore, precisely determined by the nature of the primary instability; and that resection of osteophytes will recreate instability of motion segments. The purpose of this study was to develop an animal model for vertebral osteophyte formation and study the restabilizing effect of osteophytes.

**Materials and Methods.** The study consisted of two parts. First, in vitro biomechanical testing of twenty canine cadaveric lumbar spinal motion segments was conducted to determine normal compressive and torsional properties. Second, an in vivo study was conducted in which thirteen coonhounds (weight 20 to 30kg) received three different types of surgical procedures: anterior annular incision and nucleotomy (Group I, n=3); anterior nucleotomy and vertebral endplate decortications (Group II, n=5); and anterior nucleotomy, endplate decortications and insertion of an eccentrically placed spacer (Group III, n=5). The spacer was a 1cm diameter electrometric cylindrical rod. All thirteen animals were sacrificed at three months postoperatively. Lumbar spinal motion segments were harvested and tested in the same manner as the normal group. For mechanical testing on a servohydraulic testing system, spinal motion segments were prepared in vertebral bone-disc-vertebral bone units by removing posterior elements and potting in custom tubular grips. Nondestructive tests were conducted in axial compression and torsion. All lumbar spines in Groups I, II and III were evaluated radiographically and histologically for osteophytes formation.

**Results.** Vertebral osteophyte formation was predictably found in all five lumbar spines of Group III, while none of the animals in Groups I or II had formation of osteophytes. The results of mechanical testing indicated that spinal motion segments with osteophytes (Group III) require statistically more force to rotate to 3° in axial torsion than those in Group I with no statistical difference between Group III and normal spines (p<0.05). Deflection of spinal motion segments with osteophytes resulting from a 100N compressive load was statistically less than both Groups I and II. When spinal motion segments were evaluated for torsional stiffness, osteophyte specimens (Group III) were significantly stiffer than Group II and statistically equivalent to normal. Compressive stiffness measured beyond the toe region of the force-displacement graph (100 to 200N) resulted in no significant difference among all four groups.

**Conclusion.** A successful animal model for vertebral osteophytes formation has been developed. Vertebral osteophytes have been demonstrated to function in the restabilization of experimentally induced instability.