

THE CHANGES ON THE FACET JOINTS OF UNFUSED SPINE AFTER APPLICATION OF THE INTERSPINOUS SEGMENTAL INSTRUMENTATION (Experimental study on lambs)

Erol YALNIZ MD*

Murat İMER MD**

Selçuk BİLGİ MD***

ABSTRACT :

In this study, the changes on the facet joints of 5 lamb's spine which immobilized by application of interspinous segmental instrumentation without arthrodesis for detecting the preservation of longitudinal vertebral growth was investigated. Their twins were selected as a control group. Interspinous segmental instrumentation was applied for eight segments at thoracolumbar area when they were eight weeks of age. Both groups were followed for seven months. All animals were killed at the end of this period. In study group, intervertebral discs were thin and atrophic, like an other part of vertebral column and under pressure posteriorly because of the developed lordosis. Histologic examination of the facet joint cartilage revealed thinning, fibrillation, and loss of normal cartilage cellularity. These findings were consistent with the histologic appearance of osteoarthritis.

Key Words: Facet joint, fusion, interspinous segmental instrumentation, intervertebral disc.

INTRODUCTION

The spine surgeon confronted with immature patients who have scoliosis that do not respond the conservative treatment. It's well known to use spinal instrumentation without arthrodesis for skeletally immature patients with spinal deformities. This method may allow longitudinal growing besides holding the curve in correction and permit postponement of fusion until a more optimal time (9, 10, 11).

Some authors recommended the use of spinal instrumentation with a limited fusion area in the treatment of thoracolumbar fractures (2, 7). They expected to regain the mobility of the unfused segments after removing the instrumentation.

The minimizing the motion between vertebral segments with instrumentation may lead to atrophy and degeneration of the facet joints. In this study, the changes of facet joints of spine which immobilized with interspinous segmental instrumentation were investigated.

MATERIAL AND METHODS

5 eight week old twins lambs were used in this experiment. 5 lambs were used in this experiment. 5

lambs were served as study group (Group I), while their twins as control group (Group II). The lambs were anesthetized with I.M. injection of xylazine (0.1 cc/kg) and ketamine 10 mg/kg. Standart aseptic surgical techniques were used in surgical group. The exposure of spinous processes was carried out through a midline posterior incision. Laminae and facet joint were not exposed to avoid extensive fibrosis and spontaneous fusion. 4 mm. diameter of stainless steel single rod that bended proximal end was applied and fixed to spinous processes with button and wire for eight segments (4 thoracal and 4 lumbar) (Fig. 1).

The average operation time was 40 minutes. All wounds healed by primary intention without complications. Prophylactic antibiotics were not given. No external immobilization was used, and immature lambs were allowed full activity. Anteroposterior and lateral roentgenograms were taken with monthly interval for both groups.

7 months after surgery, which was at age 9 months, the lambs were killed and the spines were resected. The specimens which were taken from facet joints of instrumented area in Group I and from those in Group II were fixed in 10% formalin and decalcified 4% nitric acid and embedded in parafine. The 5 μ sections were stained with hemotoxilin eosine and examined by light microscope.

University of Trakya Medical Faculty. Departments of Orthopaedic Surgery*, Neurosurgery**, Pathology***, Edirne, TURKEY.

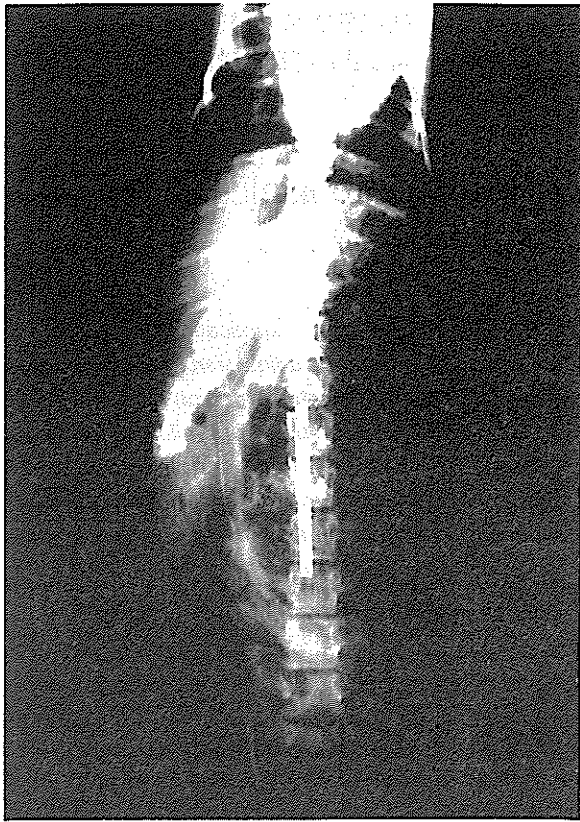


Figure 1. AP roentgenogram of lamb after the operation. 8 segments were immobilized by interspinous segmental instrumentation in thoracolumbar area.

RESULTS

In Group I, shortening of longitudinal length occurred for all spines. Average 43% of the growth potential was preserved with segmental spinal instrumentation without fusion (14). The dense fibrotic tissue occurred in instrumented area. Vertebrae in Group I were significantly smaller than those in Group II (Fig. 2). Lordosis developed in instrumented spines and intervertebral discs were under pressure posteriorly (Fig. 3). There was no pathology on adjacent discs.

The capsule of facet joints appeared to be thin and atrophic. The motion on facet joints were markedly decreased. Gross examination of the facet joints revealed fissures and thinning of cartilaginous surface. Every specimen revealed histologic evidence of degenerative changes characteristic of osteoarthritis. The most common findings were fibrillation and loss of the

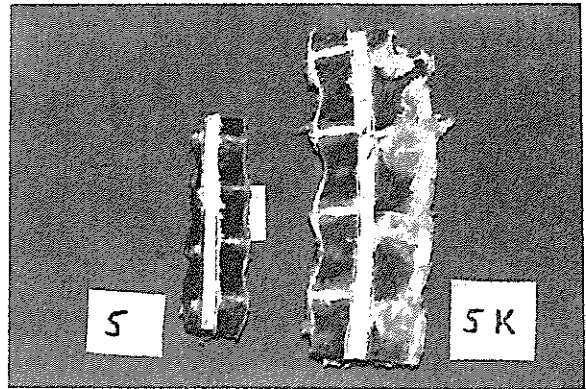


Figure 2. Sagittal sections of the spines of 5th twins. The instrumented spine is shorter than the other.

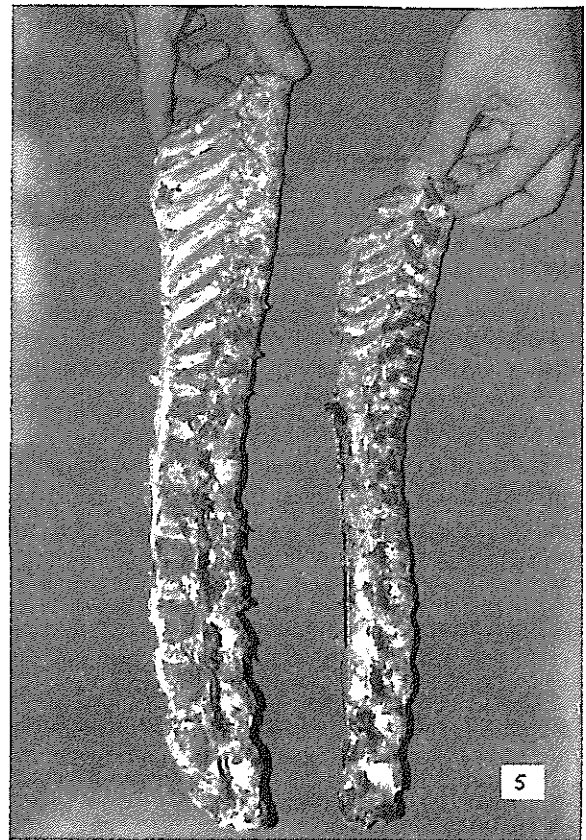


Figure 3. The pathologic lordosis in instrumented area.

normal cartilage cellularity, areas of cartilage erosion, subchondral remodeling, osteophyte formation (Fig. 4,5).

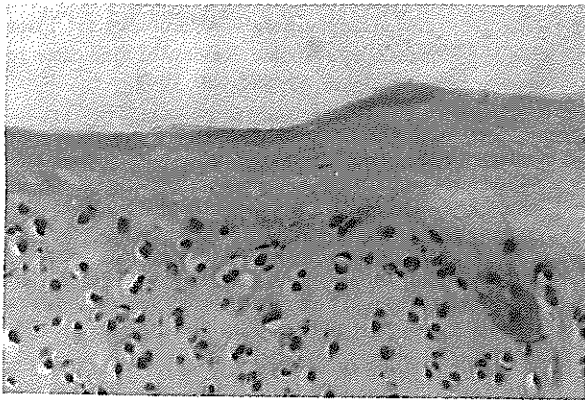


Figure 4. Irregularity of facet joint cartilage and loss of the normal cartilage cellularity in study group. H+E. X 200.

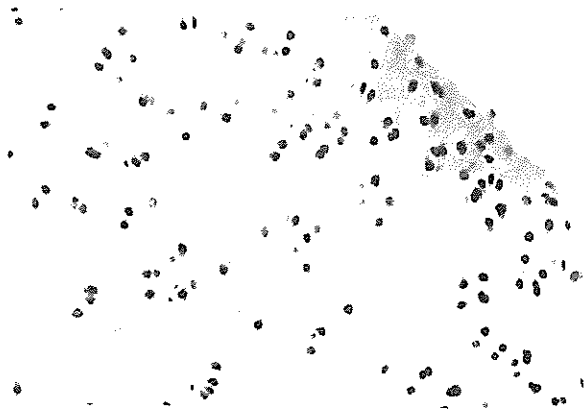


Figure 5. Regularity of facet joint cartilage in control group. H+E. X 200.

DISCUSSION

Although there have been a lot of clinical and experimental studies investigating the effect of immobilization on unfused joints in extremities, very little investigation has been conducted on the effects of immobilization without fusion of the facet joints in spine. Tredwel and O'Brian (13) suggested that facet joints degeneration developed in 47% of patients treated with prolonged halo-pelvic distraction. Baker (1) examined the effect of immobilization on facet joint cartilage in patient who had been treated with anterior fusion because of Pott's disease. Holm and Nachemson (5) described the reducing in water content of nucleus pulposus in spine which underwent posterior fusion in dogs and also determined that the

hypoactive disc might be predisposing factor for degenerative changes. In this study, we aimed to observe the changes on the facet joints of spine which instrumented without fusion.

In Group I, the spontaneous fusion has begun at 6th months, whereas atrophy of facet joints at 3th months. These findings have been shown radiologically. Kahanowitz et al. (8) suggested that varying degrees of chondrolysis, cloning and loose of proteoglycans at 2 months postoperatively in immobilized joint cartilage. They also determined that the degenerative changes were not reversible. Yoshida (15) showed that degenerative changes had developed after two weeks spinal immobilization and distraction on the facet joint in rats and pointed out these changes become irreversible between 4 and 8 weeks.

The presence of immobilized spine with or without arthrodesis influences the adjacent unfused segments by increasing the load and motion. Frymoyer (3) found that fusion had a significant compensatory increase in motion above the fusion. Hunter et al. (6) described the degenerative radiographic changes of the cervical joints above and below anterior cervical fusions. Nagata et al. (12) reported that immobilization of long segments of the spine effected the remaining mobile segments in fresh canine cadaveric spines. In this study, no pathologic changes in facet and discs of adjacent segments have been observed. Two reasons may lead to this result; short following time and the presence of minimal motion of instrumented segments.

The changes of the cartilage resemble the characteristic appearance of osteoarthritic cartilage of joints of the extremities. It's necessary a long-term following period to say whether degeneration of facet joints result the spontaneous fusion. Gardner and Armstrong (4) reported two autofused facet joints in 75 facets of 20 patients who had Harrington instrumentation without fusion with an average follow-up period of 8.0 years.

In conclusion, instrumentation of spine without fusion is not an innocuous procedure and may lead to degenerative changes that result in symptomatic spondylarthritis.

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