The encroachment in neutral posture after burst fracture with respect to intact showed significant decreases with respect to neutral posture, whereas flexion and extension around both canal diameter and foraminal area were calculated and compared. In this study, however, the results showed that extension force, which reduces the flexion deformity, should be applied to the spine. In this study, however, the results showed that extension enlarged both canal diameter and foraminal area only significantly when the burst fracture was observed from the lateral radiography. After the final impact, the molds which protected the T12 and L2 vertebrae were removed and 5mm diameter Schanz screws were inserted into the pedicles of these vertebrae. A specially designed apparatus with two rotation hinges on bilateral sides was attached to the Schanz screws. Centers of rotation (COR) for sagittal plane motion were located at five points on the mid-vertebral plane: anterior longitudinal ligament (A), spinous process (B), tip of spinous process (C), and three points equally spaced between these two points (from anterior to posterior: B, C and D). Flexion/extension moments of 5kNm around each center of rotation were applied to the specimen and lateral x-rays in full flexion and extension were taken. Twelve x-rays (Intact = 1, Burst: Intact = 1; Flexion = 5; Extension = 5) were fixed longitudinally on the mid-sagittal line of both anterior and posterior borders of the spinal canal. For the intervertebral foramina, 0.7mm diameter steel balls mounted with the L1 vertebral body horizontal. In order to measure the soft canal diameters, a series of 1.6mm diameter steel balls were applied around COR at both L1 and L3 vertebrae. After lateral x-ray of the intact spine was taken, T12 and L2 vertebrae were molded in order to produce injury only to the L1 vertebra. The specimen was fixed to the impact apparatus and a wedge was put on the top of the specimen so that flexion-compression force would be applied to the specimen. The specimen was first impacted with a 2kg mass dropped from 1.4m height. Lateral x-ray was taken in order to know the severity of the injury. The additional impacts of 2kg weight increment were applied until the burst fracture was observed. All device adjustments can be equated to a rotation around a center of rotation which are posterior to the canal and foramen in order to decompress and not damage the neural content. For treatment of a flexion type injury, it is believed that extension force, which reduces the flexion deformity, should be applied to the spine. In this study, however, the results showed that extension enlarged both canal diameter and foraminal area only significantly when applied around COR at E, which is posterior to both canal and foramens. On the other hand, flexion around COR at A enlarged both canal diameter and foraminal area. During an operation with a posterior approach, the inside of the spinal canal and intervertebral foramens cannot be seen by surgeons unless combined with laminectomy. Therefore, the results of the present study give important information to surgeons: extension force should be applied only around centers of rotation which are posterior to the canal and foramens in order to decompress and not damage the neural content.

Introduction
Thoracolumbar burst fractures are one of the most important and common injuries in spinal trauma. The goal of treatment is to restore mechanical stability and neurological function. Although pedicle screw fixation is widely adopted for surgical treatment for this type of injury, the optimal adjustment of such a device to maximize neurological relief is still unknown. All device adjustments can be equated to a rotation around a center of rotation. In this study, rotations around five centers of rotation, which were placed on mid-vertebral plane of the fractured vertebrae, were applied to the specimens through pedicle screws. Changes of spinal canal diameter and intervertebral foraminal area were investigated to determine the optimal location of the center of rotation.

Materials and Methods
Nine fresh frozen human cadaveric spine specimens, T11-L3, were used for this study. T11 and L3 vertebrae were mounted with the L1 vertebral body horizontal. In order to measure the soft canal diameter and foraminal area with respect to the intact were calculated and compared. In this study, rotations around five centers of rotation, which were placed on mid-vertebral plane of the fractured vertebrae, were applied to the specimens through pedicle screws. Changes of spinal canal diameter and intervertebral foraminal area were investigated to determine the optimal location of the center of rotation.

Discussion:
For the treatment of thoracolumbar burst fractures with neurological deficit, operative treatment combined with instrumentation has been widely adopted. Not only restoration of the mechanical stability but indirect reduction of the bony deformity can be achieved by application of a pedicle screw system. Flexion and extension moments are applied to the vertebrae through this device for the reduction of the impaired vertebra and decompression of the neural content. For treatment of a flexion type injury, it is believed that extension force, which reduces the flexion deformity, should be applied to the spine. In this study, however, the results showed that extension enlarged canal diameter and foraminal area only significantly when applied around COR at E, which is posterior to both canal and foramens. On the other hand, flexion around COR at A enlarged both canal diameter and foraminal area, and flexion around COR at both B and C enlarged foraminal area. During an operation with a posterior approach, the inside of the spinal canal and intervertebral foramens cannot be seen by surgeons unless combined with laminectomy. Therefore, the results of the present study give important information to surgeons: extension force should be applied only around centers of rotation which are posterior to the canal and foramens in order to decompress and not damage the neural content.

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