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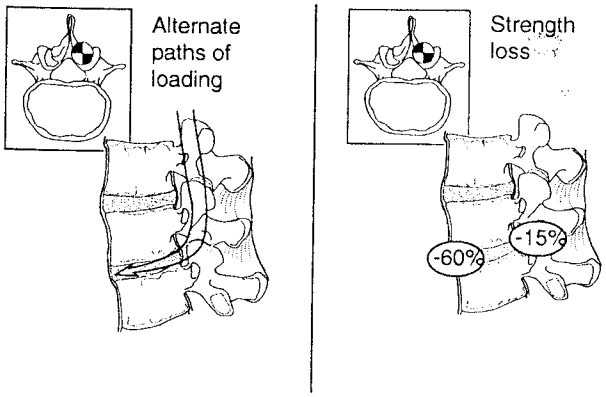
Fever, diarrhea, and abdominal distension following lumbar spine surgery can be the result of C. dificile colitis which if diagnosed and treated promptly with antibiotics can decrease the potential morbidity. Failure to recognize and treat C. dificile colitis can lead to sepsis and severe postoperative morbidity.

THE ROLE OF THE LUMBAR FACET JOINTS IN SPINAL STABILITY; IDENTIFICATION OF ALTERNATE PATHS OF LOADING.

T Haher, M O'Brien, J Dryer, R Nucci, R Zipnick: SUNY-HSC @ Brooklyn, NY. J Orchowski; Cooper Union School of Engineering, NY.

The mechanism by which the lumbar facet joints are able to resist axial compression is unclear. It has been reported that 1)The load sharing of the joints in compression is 10 -15% of the total load 2) that destruction of one facet joint renders the contralateral joint incapable of supporting a load and 3) facet arthrosis and degeneration never occurs without the presence of adjacent disc degeneration. This study was devised to examine 1) the contribution of the facet joints to load sharing in various load applications, 2) to explain alternate loading paths that may exist with facet destruction and, 3) to identify the clinical significance of facet incompetence.

Materials & Methods: Ten human lumbar spines were placed in an Instron Model 4206 Tensile Testing Machine. The physiologic sagittal curves were maintained. Markers were placed on each vertebral body in two planes. Video and still photography cameras were used to analyze the motion in the AP and Lateral planes during. Compressive loads of 200 Nm were applied to the specimens at a rate of 20 N per minute. The loads were applied: 1) over the center of the disc, 2)over an individual facet joint to produce an extension moment. The facet joints and annulus were then destroyed sequentially and the loading cycles were repeated. Load - deflection curves were generated for each loading modality and compared to the intact specimen. **Results**: The axial loaded specimens showed a three fold increase in stiffness compared to those loaded eccentricly. A 15 % decrease in strength resulted with unilateral or bilateral facet destruction. A 75% decrease resulted with removal of the anterior annulus and the anterior longitudinal ligament. Lateral annulus destruction did not alter the strength of the spine. **Conclusion:** The disc is the responsible structure for resisting



and dampening compressive forces. Loss of one or both facet joints does not significantly effect the load response curve. With facet destruction the compressive load is resisted by the anterior portion of the annulus. This alternate loading pathway through the disc explains the minimal contribution of the facet joints in supporting compressive loads. Disc degeneration precedes facet arthrosis due to this imbalance of load sharing.

Clinical relevance: Although facet joint destruction will not produce acute instability, it will accelerate the degeneration of the adjacent disc.

C. T. Evaluation of the Normal Adult Odontoid; Implications for Internal Fixation

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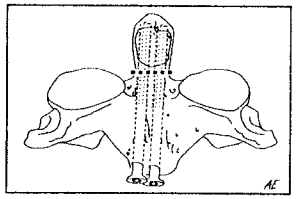
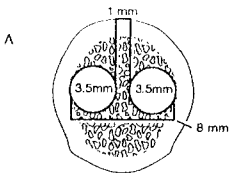
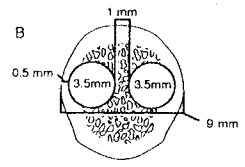
The optimal method for fixation of Type II dens fractures has not yet been determined. Reduction with C1-C2 posterior wiring and fusion may limit head rotation and is not possible with posterior arch fractures. Odontoid screws have recently become popular as a method of internal fixation. There is debate concerning the number of screws used for optimal fixation and whether two screws can always negotiate the odontoid canal. We have attempted to answer these questions on a prospective basis by reviewing axial C.T. images of the normal adult odontoid in the area of a Type II dens fracture.

Materials & Methods: Ninety two consecutive computerized tomography scans of the dens were performed using a General Electric 9800 HR C.T. scanner. All patients were 18 to 87 years of age with a mean of 51 years. No atlanto-axial pathology was present. There were 53 males and 39 females. The C.T. cuts were made perpendicular to the long axis of the dens corresponding to the level of a Type II fracture according to the classification of Anderson and D'Alonzo. The correct orientation of the C.T. cuts were determined by the lateral scout film. Measurements were taken from the narrowest portion of the dens. The outer and inner cortical diameters in the medial-lateral and anterior-posterior planes were measured at this level. Comparisons were made to the critical outer diameter of 9.0mm. With tapping, this allows 1mm between screws and 0.5mm of lateral cortex outside each 3.5mm screw (figure B).





Intermedullary screws:



Tapped screws

Results: The medial-lateral outer and inner diameters was not significantly different between males and females. The average M-L outer diameter was 10.4mm with a standard deviation of 1.1 mm and a range of 8.2 - 13.2mm. The average M-L inner diameter is 7.2mm with a standard deviation of 1.4mm and a range of 4.4-11.0mm. In five cases the M-L outer diameter of the odontoid was less than 9.0mm. Without tapping, two 3.5 mm screws would fit in the canal in only 33% of cases (figure A). **Conclusion:** Correct orientation of the C.T. scanner is critical for accurate measurements of the odontoid in the region of type II fractures. 95% of odontoids measured could accommodate two 3.5mm screws with prior tapping to 9.0mm.

THE USE OF COMPUTERIZED MOTION DIAGNOSTIC IMAGING IN THE EVALUATION OF LOW BACK PATHOLOGY

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To correlate spinal pathology with abnormal spinal motion, 62 patients were evaluated using computerized motion diagnostic

imaging. 33 patients had symptomatic lumbar disc disease, 20 patients had non organic low back pain and 9 patients had organic low back pain. The average age of the patient was 45 with range of 24 to 77. 28 women and 34 men were studied. The presence of a herniated nucleus pulposus was documented by CT myelography and MRI in the disc disease group. These patients had hard neurologic finding compatible to the level of their disc disease. Cervical, Thoracic, Lumbar, and pelvic motion was evaluated using computerized motion diagnostic imaging. The spinal motion in flexion, extension, lateral bending and rotation was studied and compared to the organic and non organic groups. Percent of normal ranges of spinal motion (AMA accepted values) and velocity were computed for each axis of motion. **Results:** Each spinal region studied demonstrated significant decreases in extension with the presence of an HNP. The decreases were greatest in the lumbar and pelvic regions. Symptoms amplifiers were identified and confined to the non organic group. **Conclusion:** Qualitative differences were observed in each group through the graphic representation of the data. Computerized motion diagnostic imaging is a reliable tool in the evaluation of lumbar pain. The differences in the quality of spinal motion among all the groups studied were statistically significant. Functional spinal assessment must incorporate a physiologic and dynamic motion study to objectively demonstrate spinal pathology.

RESULTS OF SURGICAL TREATMENT OF ADULTS WITH IDIOPATHIC SCOLIOSIS.

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Purpose: The purpose of the paper is to retrospectively evaluate a cohort of adults with Idiopathic Scoliosis treated surgically.

Conclusion: The authors conclude that surgery to treat adults with Idiopathic Scoliosis can be beneficial and have an acceptably low complication rate.

Significance: The authors offer recommendations that can facilitate successful surgery for adults with Idiopathic Scoliosis, with an acceptably low complication rate.

Summary of Methods and Results: Previous studies (Hall and Nachemson- JBJS June 1977) have shown complication rates as high as 62% with their conclusion being that "in view of the high rate of complications, there might be limited gains to fusion, and that this must be explained to the patient preoperatively." In this study 52 patients with the same criteria as Hall and Nachemson were evaluated. The inclusion criteria were:1) patients greater than 25 years of age, 2) adolescent onset of Idiopathic Scoliosis and 3) follow-up greater than 3 years. The average age of the patient population was 37 years of age with a female to male ratio of 9:1. Curve patterns consisted of major thoracic, thoracolumbar, major lumbar and double major with the predominant curve being major thoracic. Surgical procedures consisted of Luque, Cotrel-Dubousset, and Harrington rod instrumentation with sublaminar or Drummond wires.

The results consisted of evaluation of surgical procedures with percentage of correction, estimated blood loss, residual pain and major and minor complication rates. The authors found that the Cotrel-Dubousset procedure had the best correction for major thoracic with a 63% correction rate and that it also had the lowest estimated blood loss (EBL) with an average of 1139cc. In comparison, the Luque procedure had the most EBL with an average of 2486cc. The Harrington Rod instrumentation combined with sublaminar wires had the best percentage correction for thoracolumbar curves and lumbar curves. Our overall complication rate was 18% with a major complication rate (Pseudarthroses, 1 death) of 13%. This is strikingly lower than the results of previous published studies. Some of the factors that we propose for this rate are 1) the use of the Cotrel-Dubousset Instrumentation; 2) every operative procedure had an intraoperative Swan-Ganz catheter to monitor blood volume; and 3) the use of SSEP's-somatosensory evoked potentials. These factors may possibly account for the lower complication rate, lower blood loss, and better percentage correction.

In addition , the McGill pain and function questionnaire was mailed to all participants to evaluate pain and function 3 years post-op. 79.4% of respondents had little or no pain, while 72.4% had good sleep patterns and 72.4% marked "good" for present activity level.

BIOMECHANICAL RATIONALE FOR THE BAK LUMBAR INTERBODY FUSION SYSTEM. S.D. Kuslich, T.R.Oxland*, D.W.Kohrs*, G.W.Bagby**, 606 24th Ave. S. Minneapolis, MN 55454, * Spine-Tech 980 E.Hennepin Ave. Minneapolis, ** 105 W.8th Ave. Spokane WA.

The purpose of this study is to outline the specific biomechanical rationale for the design and the subsequent mechanical testing of the BAK lumbar implant. A comprehensive biomechanical evaluation of a spinal implant system should consist of the following three tests: 1) strength, 2) fatigue and 3) stability [Panjabi 1988]. The results of these biomechanical evaluations for the BAK implant are presented below. Five implants were loaded individually to determine their **ultimate strength**. Each sustained 30.6 kN without failure. The test was discontinued at this load level since it exceeded our compressive strength design criteria of 9600N by a factor of three. Five implants were loaded individually to determine their **fatigue strength**. The devices were loaded from 880 to 9600N at 15 Hz. No devices sustained observable microscopic damage when the tests were halted beyond 5 million load cycles. Several **stability** tests have been performed. Butts et al [1987] tested solid interbody screws in a calf spine model. In flexion-extension, the stiffness increase over the intact spine was 81% and in lateral bending it was 480%. Wilder et al [1993] studied the flexibility of baboon spines in flexion-extension before and after implantation of BAK implants. They observed significant increases in stiffness in both loading directions. Brodke et al.[1993] compared the flexibility of the BAK system and TSRH pedicle fixation in a calf spine model in the loading directions of flexion, extension, bilateral axial torque and axial compression. They observed the BAK system to provide excellent immobilization of the intervertebral disc in comparison to the pedicle screw fixation alone or with interbody bone graft. In summary, the biomechanical rationale for the BAK interbody fusion system was described and demonstrated to be an effective system for immobilization of the intervertebral disc.

A PROSPECTIVE, RANDOMIZED COMPARISON OF THE OUTCOMES OF THE CHRISMAN SNOOK AND MODIFIED BROSTROM PROCEDURES FOR CHRONIC LATERAL ANKLE INSTABILITY W. Hennrikus MD, P Lyons MD, R Mapes MD, J Lapoint MD. Naval Hospital, San Diego, CA.

Purpose: To prospectively and randomly compare the outcomes of the Chrisman-Snook (CS) and modified Brostrom (MB) procedures for chronic lateral instability. **Methods:** This study was approved by the hospital research committee, and informed consent was obtained to prospectively study 40 consecutive patients from July 1989 until Aug 1992. Only patients with isolated chronic lateral instability of the ankle were included. Patients with generalized lig laxity or X-ray evidence of DJD or tarsal coalition were excluded. Average age was 25.7 years (19-37). Pre-op radiographic talar tilt using the TELOS device averaged 14 degrees. The patients were randomly assigned to CS or MB procedures. **Results:** Average follow-up was 28 months (6-49). Both procedures resulted in 80% Good or Excellent functional results rated on the Sefton Scale. Post-op radiographic talar tilt averaged 5 degrees in the CS patients and 7 degrees in the MB patients. Six CS and 5 MB patients were boarded out of the service due to ankle complaints post-op. More complications occurred in the CS patients. For example, 5 of 20 CS patients had a post-operative wound complication, 8 had sensory loss over the sural nerve distribution, 1 developed a painful iatrogenic pes planus presumably due to over-tightening the lateral side of the ankle, and 2 complained of residual instability unchanged or worse than prior to surgery. No wound problems or permanent nerve injuries occurred in the MB patients. One MB patient suffered a re-rupture 14 months after surgery while running on the obstacle course.**Discussion:** Both the CS and MB procedures effectively correct lateral ankle instability; however, the CS procedure has