

In Vivo Assessment of Bone Graft/Endplate Contact Pressure in a Caprine Interbody Pseudarthrosis Model: A Preliminary Biomechanical Characterization of the Fusion Process for the Development of a Microelectromechanical Systems (MEMS) Biosensor

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ABSTRACT

BACKGROUND

In this preliminary study we used a goat model to quantify pressure at an interbody bone graft interface. Although the study was designed to assess fusion status, the concept behind the technology could lead to early detection of implant failure and potential hazardous complications related to motion-preservation devices. The purpose of this study was to investigate the feasibility of in vivo pressure monitoring as a strategy to determine fusion status.

METHODS

Telemetric pressure transducers were implanted, and pressure at the bone graft interfaces of cervical interbody fusion autografts placed into living goats (Groups A and B) was evaluated. Group A constituted the 4-month survival group and Group B the 6-month survival group. One goat served as the study control (Group C) and was not implanted with a pressure transducer. An additional six cadaveric goat cervical spines (Group D) were obtained from a local slaughterhouse and implanted with bone grafts and ventral plates and used

for in vitro biomechanical comparison to the specimens from Groups A and B.

RESULTS

All goats demonstrated an increase in interface pressure within the first 10 days postoperatively, with the largest relative change in pressure occurring between the sixth and ninth days. The goats from Groups A and B had a 200% to 400% increase in relative pressure.

CONCLUSIONS

Although this was a pilot study to assess pressure as an indicator for a fusion or pseudarthrosis, the preliminary data suggest that early bone healing is detectable by an increase in pressure. Thus, pressure may serve as an indicator of fusion status by detecting altered biomechanical parameters.

Key Words: Pseudarthrosis, biomechanics, pressure, vertebral endplate, cervical spine, goat, telemetric. *SAS Journal*. Winter 2008. 2:1–8. DOI: SASJ-2007-0102-RR

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From The Cleveland Clinic Foundation (Gordon, Schlenk, Coquillet, Fleischman, Roy, Togawa, Bauer, and Benzel) and OrthoKinetic Technologies, LLC (Ferrara).

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Institutional and individual conflicts of interest in research are disclosed to, and reviewed and managed by, the Clinic's Conflicts of Interest Committee and are subject to approval by the Clinic's Institutional Review Board. The Clinic has retained independent monitors to review the protocols, subject enrollment and follow up, and data reporting and analysis of the research reported in this publication.

The treatment and euthanizing of animals in this study followed standardized protocol compliant with the Animal Review Committee for the Cleveland Clinic.

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This paper was submitted on May 29, 2007, and accepted on October 27, 2007.