

## Transient Reduced Mineral Density Associated with BMP-enhanced Spinal Fusion

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**INTRODUCTION:** BMP-2 has gained broad acceptance as an adjuvant to spinal fusion when used with an interbody fusion device. Given that BMP promotes regional changes in bone mineral density, bone mass, and bone geometry, the purpose of this study was to evaluate metabolic reactions that might affect both short-term and long-term stability of the interbody fusion.

**METHODS:** The clinical and surgical experience of 17 patients treated for degenerative lumbar spine disease has been compiled. In combination with dorsal fixation with pedicle screws each patient received two poly-ether-ether-ketone (PEEK) interbody cages with 6 mg of BMP-2 in each cage. Patient follow-up consisted of pre-operative radiographs and clinical evaluation, followed further at 3 months, at 6 months, and at 1 year after surgery. Seventeen patients, 8 males, 9 females, mean age 67 years, 14/17 at L4-5. Radiographs, Spiral CT reconstruction, and BMD measurements were used to interpret morphology, cage stability, and fusion at 3 months, at 6 months, and 1 year following surgery.

Data were collected in a retrospective analysis of all patients. Dallas Questionnaire and Prolo Score and overall pain on Visual Analog Scale (VAS) were used to assess outcome. Particular attention was focused on vertebral bone tissue adjacent to the fusion mass above and below the fused level.

**RESULTS:** Clinical assessment demonstrated clear improvement in all patients over the course of the 1-year follow-up. An unexpected finding, apparent at 3-month's follow-up in every patient, was reduced mineral density at the vertebral endplate both above and below the level of fusion. This regional osteopenia was transient in all patients however, and at both the 6-month and at the 1-year evaluation had resolved.

**DISCUSSION & CONCLUSIONS:** Although confirmation by biopsy could not be obtained, apparent osteolysis adjacent to the BMP-stimulated fusion mass may be interpreted by two mechanisms. Interbody fusion, or surgery in general, creates an inflammatory stimulus to the vertebral bodies, and when coupled with BMP stimulation has the potential to enact a metabolic response where osteoid deposition overrides mineral supplementation. Despite the fact that trabecular bone may indeed be forming within the matrix, delayed mineralization interpreted by radiographs would suggest a lack of bone formation. A potential second mechanism might be accounted in considering regional, humoral hypercalcemia. While generally associated with myeloma and hormonal-laden systemic effects, a potential for high concentrations of anabolic growth factor to stimulate regional osteoclastic mechanisms can not be discounted. In conjunction with the PLIF techniques in this series of patients, sufficient stability was attained through the construct to delimit the transient finding as an observation rather than as an adverse event. With the advent of resorbable fixation systems for vertebral application, recognizing a transient potential for reduced mineral density following high doses of BMP underscores the importance of sustaining fixation sufficient for achieving therapeutic intent.

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