Bone Morphogenetic Protein Enhancement of Alveolar Distraction in Humans

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Introduction

This paper demonstrates bone morphogenetic protein (rhBMP-2) enhancement of alveolar distraction osteogenesis in humans. Vertical alveolar distraction has been shown to be an effective method to augment the alveolar ridge. Extreme hypoplasia of the site or damage from multiple prior surgeries may decrease the predictability of the technique. Enhancement of distraction site healing has been demonstrated by Boyne in non-human primates. Combining distraction and bone morphogenetic protein enhancement may allow effective management of compromised cases.

Materials and Methods

Six patients underwent alveolar distraction osteogenesis with rhBMP-2 enhancement. All patients in this series had multiple prior augmentation surgery failures or had severely deficient bone sites. None were considered good candidates for conventional alveolar distraction. Vertical alveolar distraction was performed using the Leibinger Endosseous Alveolar Distraction (LEAD) system. At the time of distraction osteotomy, the regeneration chamber was opened to 4mm. Absorbable collagen sponges containing rhBMP-2 were placed into the regeneration chamber. The central portion of the chamber was filled with inorganic bone mineral soaked in rhBMP-2. After 5 days without device activation, the segments were transported at 0.8mm per day. All distraction sites were successfully transported and achieved osseous union. Radiographs confirmed consolidation of the distraction chambers. The sites were examined surgically at the time of implant placement and found to be stable.
Case Presentation

A 50 year old woman presented with extreme atrophy of the right and left posterior mandible. Tomography showed 4mm of bone above the neurovascular bundle on the right and 2mm on the left side (fig 1, 2). An osteotomy mobilized a very thin transport segment. Bone morphogenetic protein was placed into the distract chamber which was opened to 4mm intraoperatively. The segment was transported with a LEAD device (fig 3, 4). The site was re-entered at 12 weeks for placement of dental implants. At that time the transport segment was stable and the regeneration chamber filled with bone (fig 4). Four months after placement of dental implants, the site was re-entered revealing well healing implants and further remodeling of the regeneration chamber (fig 5, 6).

Results

All sites achieved adequate augmentation to place dental implants.
No local or systemic adverse effects of the rhBMP-2 were observed.

Discussion

Experience with human alveolar distraction osteogenesis has shown sites compromised by multiple prior surgeries or by severe deficiency of the volume frequently fail to consolidate. Incomplete consolidation of the regeneration chamber may develop during alveolar distraction in the posterior mandible when the transport disk is thin and primarily cortical. These conditions may be regarded as relative contraindications. Enhancement of the distraction healing process may improve the predictability when applied to compromised sites and extend the clinical indications for alveolar distraction.

Enhancement of healing with rhBMP-2 in vertical alveolar distraction osteogenesis has been previously shown to be effective in non-human primates. This paper demonstrates the clinical use of rhBMP-2 for enhancement of healing in alveolar distraction osteogenesis in humans. Further investigation is needed to determine the best timing for placement of enhancement agents, optimum carrier materials, benefit of repeated application of agents, combination of different agents, and ideal concentration of enhancement agents.

References


Dr. Martin Chin has a patent license agreement with Stryker-Leibinger Surgical.