Pretreatment of Distraction Docking Sites with Bone Morphogenetic Protein (rhBMP-2)

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Summary

This paper demonstrates a method to achieve osseous union at distraction docking sites without secondary surgery. The efficacy of pretreating anticipated docking sites with recombinant human bone morphogenetic protein (rhBMP-2) at the time of initial osteotomy is shown. Combining the bone induction properties of rhBMP-2 and the local, environmental effects of a converging distraction procedure provides a markedly enhanced situation for bone formation and successful skeletal element construction.

Introduction

Horizontal distraction of maxillary segments is typically used for reconstruction of missing bone segments related to cleft palate and trauma. The process involves the creation of a transport disk that is distracted until it docks with the distant face of the defect. Although the bone surfaces may directly contact, the docking site will most often develop a non-union. In the past, a second surgery was required to remove the interposed soft tissue and to place a bone graft.

This study proposes that the docking site be pretreated with rhBMP-2 at the time of the initial osteotomy. This new method of surgery results in an osseous union at the distraction docking sites without a secondary surgery. The efficacy of treating the osseous faces of the anticipated docking sites with rhBMP-2 at the time of the initial osteotomy is shown.
Materials and Methods

Eight patients underwent horizontal distraction to reconstruct alveolar defects. All of the eight patients had a history of failed autogenous bone grafts at the sites. Seven of the eight patients had alveolar defects related to cleft palate (fig 1, 2). One patient’s defect resulted from traumatic avulsion of the anterior maxilla. Five of the eight patients had bilateral defects. A total of thirteen docking sites were treated with this protocol. Segmental osteotomies were transported using the technique demonstrated by Liou. As a modification of
the Liou method, the anticipated docking sites were treated with rhBMP-2 (fig 3). Preparation of the docking sites to receive the rhBMP-2 involved elevation of the interposing soft tissue and exposing the osseous margins that would dock as a result of the transport. An absorbable collagen sponge impregnated with rhBMP, was placed between the osseous walls of the defect and the wound was closed. Transport was completed in a conventional manner. Follow-up was via radiographs and histology.

Results

All of the defects were successfully closed and an osseous union estab-
lished at all thirteen sites. None of the cases required a secondary surgery at the docking sites. The histology of the docking sites where the union was achieved showed normal, viable bone (fig 4). Clinical and radiographic evaluations showed the constructed bone segments responded normally to tooth eruption and orthodontic movement (fig 5,6).

**Discussion**

Successful construction of missing alveolar segments was accomplished in
all patients despite a history of multiple, prior, failed repair attempts. Autogenous bone grafting, involved in the majority of failures, remains the most common method of repair in the general practice of craniomaxillofacial surgery. In addition, one case failed prior grafting with rhBMP-2 implying that the simple application of morphogenetic protein does not ensure success. In contrast to the history of failures which these patients experienced with autogenous bone grafting; treatment combining rhBMP-2 and converging distraction produced dramatic and rapid consolidation. Even periodontally compromised teeth adjacent to the docking site did not prevent complete alveolar construction. Indeed, in the cases involving damaged teeth, the effect of the treatment was to improve the dental condition.

Management of alveolar defects under this protocol has many advantages including, (1) improved predictability, (2) no need to harvest autogenous grafts, (3) improvement of compromised teeth adjacent to the defect, (4) rapid consolidation, and (5) no need for a second surgery to treat docking site non-unions.

Conclusions

Closing defects by transport distraction typically results in a non-union at the docking site. In the past, establishment of a union would require a second procedure. This study shows that placement of rhBMP-2 into the site of future docking, at the time of initial osteotomy would result in a union when the transport is complete. All of the patients successfully healed their defects despite a history of failed, autogenous bone grafts at the same site. This approach is more predictable than conventional grafting. There is no need to harvest bone for a graft, thereby lowering the inherent morbidity.

References

LIOU EJ, CHEN PKT, HUANG CS, CHEN YR. Interdental distraction osteogenesis and rapid orthodontic tooth movement: a novel approach to approximate a wide alveolar cleft or bony defect. Plast Reconstr Surg 105:1262, 2000