Dental Research Journal

Case Report

Guided bone regeneration: A novel approach in the treatment of pediatric dentoalveolar trauma

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Received: August 2013
Accepted: April 2014

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ABSTRACT

Traumatic injuries in the primary dentition pose major challenges for management. This emergency treatment requires proper planning so as to achieve favorable results. Trauma causing severe dentoalveolar injuries, especially in children, needs an interdisciplinary approach so as to retain normal functional anatomy for that age. This article describes a clinical innovative technique, which utilizes a resorbable membrane in management of pediatric dentoalveolar trauma. The membrane was shaped to cover the multiple alveolar bone fracture, thereby favoring the healing of the bone defects. The use of this resorbable membrane maintained a secluded space for the bone growth and prevented overgrowth of the soft tissue in the region of the defect. This resulted in uneventful healing leading to well-maintained functional bone contour, which further favored the esthetic rehabilitation as well as protected the underlying permanent tooth buds.

Key Words: Healing, bone regeneration, pediatric dentistry, trauma

INTRODUCTION

Oral injuries are the second most common form of injuries in preschool children. Trauma to oral region comprises about 5% of all injuries in this age group.[1] Such injury may hamper development of succedaneous permanent teeth resulting in obvious visible deformities. Loss of primary teeth with severe injuries to the surrounding bone will also interfere with the normal growth and development.[2] Some severe forms of dentoalveolar injuries associated with the loss of multiple primary teeth would result in large bone defects, healing of which is often complicated. Such injuries would require a guide or path for the osteoblasts to regenerate and promote new bone formation. Although many methods of bone reconstruction exist, they all have specific indications and limitations. The concept of an induced membrane represents a strategy for bone regeneration, particularly in cases of large bone defects secondary to trauma, infection or tumor excision.[3] This concept of induced bone regeneration with guidance for the bone growth is called as guided bone regeneration (GBR). The principle of GBR remains similar to guided tissue regeneration (GTR) where a biocompatible membrane is placed over bone defect, which keeps the area secluded and help in bone promotion.[4,5]

This article describes the use of concept of GBR for favorable healing of the bone following multiple dentoalveolar fracture associated with intrusion of multiple primary teeth.

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CASE REPORT

A 2-year-old boy reported to the Pedodontic Emergency following trauma due to self-fall and with the complaint of loss of upper front teeth. A thorough history was taken and medical examination was done to rule out any head and neck injuries and other complications. Dental examination revealed the

de-gloving injury in the region of maxillary anterior teeth with severe intrusion of 51, 52, and 61 [Figure 1]. Radiographic examination confirmed the intrusion of 51, 52, and 61 with 61 impinging on the developing permanent tooth which was in Nolla's stage V (crown almost completed) [Figure 2]. On examination of the region under relative analgesia (conscious sedation with 60% NO_2 and 40% O_2), multiple vertical fractures in the labial cortical plate were noticed, which extended from the socket crest up to the nasal notch [Figure 3]. The challenge in treating this condition was to bring about favorable healing of the fractured fragments without any damage to the underlying permanent tooth buds. With such severe and multiple fractures of the labial cortex, the developing tooth buds were left unsupported and literally floating in the mass of blood clot and surrounding damaged connective tissue. Reduction of the fragments could well be done, but immobilization of these fragments to promote healing without deformities was a difficult task. Further complications could be because of the differential healing of the tissues. The connective tissues would heal fast and the bone would take a longer time to heal. The resulting situation would be that the fast healing connective tissue would occupy the spaces between the fractured fragments and result in mal-union and oro-facial deformities.

Extraction of 51, 52, and 61 was planned as the supporting periodontium was severed. Reduction of the fractured socket walls was done under cautious digital pressure. Placement of mini plates and screws were contraindicated due to the presence of permanent tooth buds. Therefore, for relative immobilization and to promote favorable healing, a resorbable membrane was planned to be placed. The GTR membrane was the best choice which would meet both the requirements. The GTR membrane (PerioCol®-GTR:

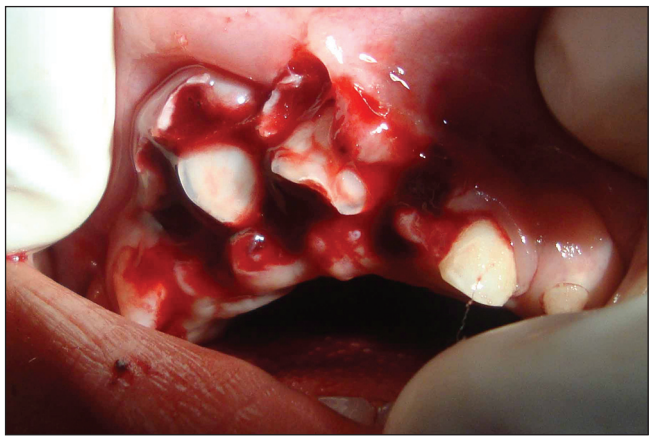

Figure 1: De-gloving injury in the region of maxillary anterior teeth with severe intrusion of 51, 52, and 61.

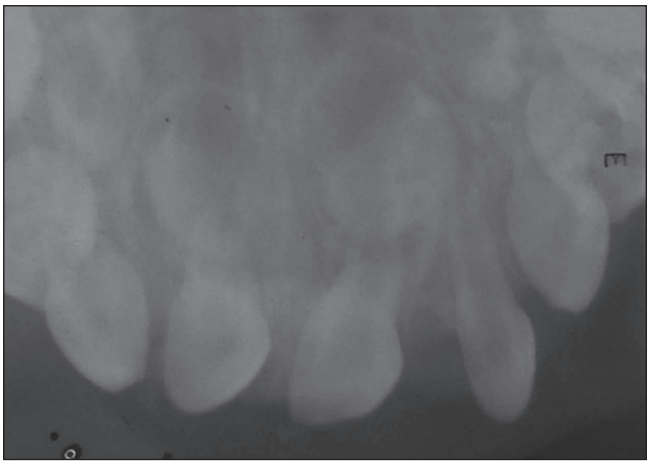

Figure 2: Preoperative radiograph showing intrusion of 51, 52, and 61 with displaced permanent tooth buds.

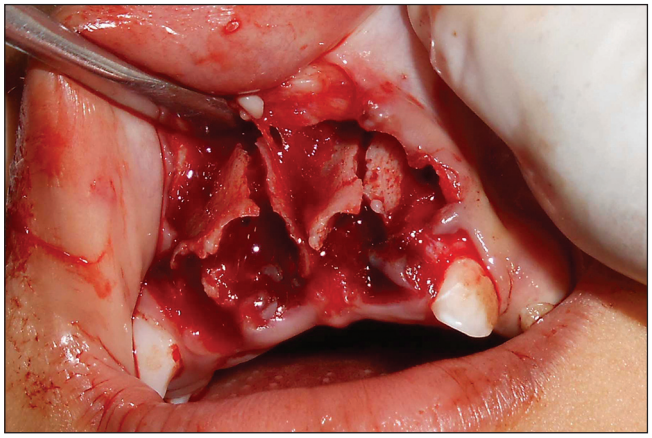

Figure 3: Multiple vertical fractures in the maxillary labial cortical plate extending from the socket crest up to the nasal notch.

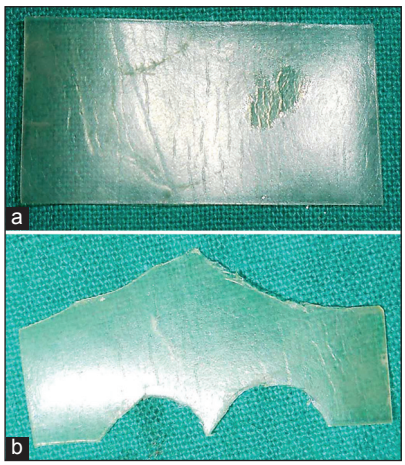

Figure 4: (a) The guided tissue regeneration membrane before trimming and (b) after trimming to match the anatomy of the region.

Sterile collagen periodontal membrane: Eucare Pharmaceuticals (Pvt., Ltd.), India) was trimmed to match the anatomy of the region [Figure 4] and was placed between the reduced fracture fragments and the injured gingiva [Figure 5]. This was followed by the placement of sutures and periodontal dressing (Reso Pac® Hager Werken GmbH & Co. KG, Germany). Parents were instructed to maintain meticulous oral hygiene. The healing was uneventful and at the end of 10 days the sutures were removed.

Thirty days follow-up showed favorable healing of the maxillary anterior labial cortex and the overlying soft tissue [Figure 6]. Postoperative radiograph shows favorable healing [Figure 7]. There was a need of a space maintainer following teeth loss. Cooperation of the patient was compromised as the child was in precooperative stage. Hence, an indirect Ribbond supported fixed space maintainer was planned [Figure 8].

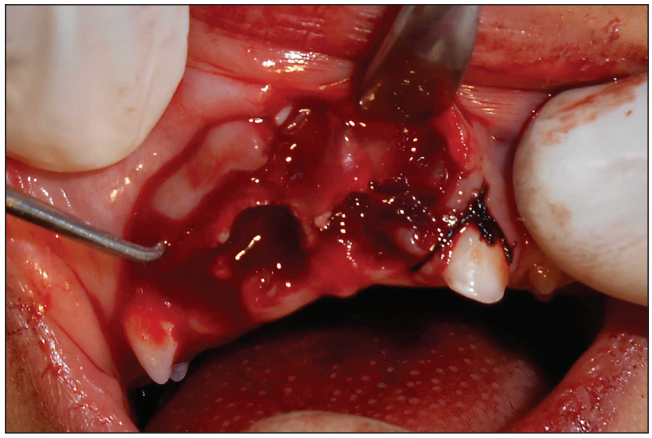

Figure 5: Placement of guided tissue regeneration between the reduced fracture fragments and the injured gingiva resulting in restoration of the bony contour and the socket wall shape.

Figure 6: Healed tissues at 1 month follow-up.

DISCUSSION

Management of traumatic injuries in pre-school children poses major problems. The hurdle in treating such children is the lack of cooperation as the children are in the precooperative stage of behavior. When severe injuries occur, it is essential to rehabilitate the structures close to normal to favor normal growth and development. The concept of GBR similar to GTR has been widely used in periodontal pathologies and also in ridge augmentation procedures before the placement of implants. However, its use in the management of the traumatic injuries, especially in children, has not been explored. The regeneration process occurring within the barrier membrane involves angiogenesis and migration of osteogenic cells from the periphery toward the center to create a well-vascularized granulation tissue. Initial organization of the blood clot is followed by vascular ingrowth and woven bone deposition, subsequent lamellar bone formation and finally remodeling, resembling bone growth.[6,7]

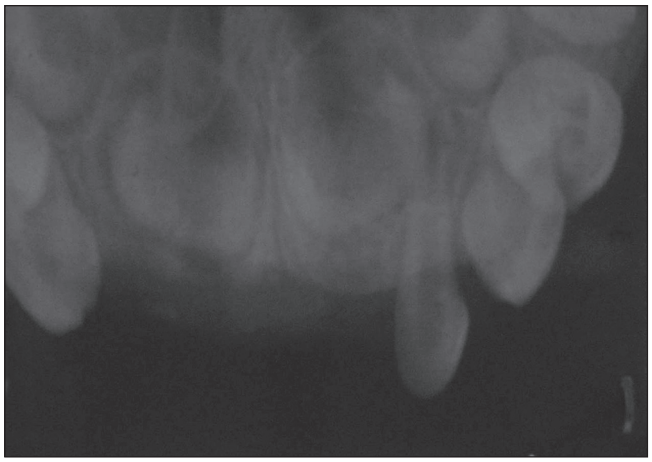

Figure 7: Radiograph showing favorable healing.

Figure 8: Indirect Ribbond supported fixed space maintainer.

The role of the biocompatible barrier membrane used in this particular case is:

1. Protection of the hematoma from the invasion of non osteogenic cells.
2. Stabilization of the hematoma and prevention of its distortion by pressure of the overlying tissue.
3. Protection of the underlying developing permanent tooth bud.
4. Provision of an anatomically shaped mold for healing of dentoalveolar fracture without any gross facial deformities.

The membrane seals off the defect and promotes growth of the bone. This principle is referred to as osteopromotion principle. The barrier provides an isolated membrane in which the osteogenic process (e.g., osteoinduction, osteoconduction, and osseointegration) can occur undisturbed.[8] Based on this principle, the resorbable membrane was used in this case and favorable results have been obtained with the contour of the bone well maintained even after severe crushing injury to the alveolar socket wall and loss of multiple primary teeth.

CONCLUSION

Guided tissue regeneration membrane can serve as a vital tool to mold the traumatized dentoalveolar fragments in children. Such an approach protects the developing permanent teeth as well, by providing a meshwork to support it and by acting as a mechanical barrier preventing any further dislodging forces which may arise due to dynamic functional status of the para-oral tissues. Since the membrane is biodegradable, it resorbs gradually to leave behind well molded, healed normal tissues.

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How to cite this article: Murthy PS, Shivamallu AB, Deshmukh S, Nandlal B, Thotappa SK. Guided bone regeneration: A novel approach in the treatment of pediatric dentoalveolar trauma. Dent Res J 2015;12:285-8.
Source of Support: Nil. **Conflict of Interest:** The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.