CASE REPORT

Fixation techniques in surgical repositioning of the prognathic pre-maxilla during alveolar bone graft surgery in bi-lateral cleft lip and palate patients

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Introduction

Patients with bilateral cleft lip and palate (CLP) may present with a prognathic pre-maxilla. Many erroneous surgical practices have been executed in the past for management of pre-maxillary segment such as amputation of pre-maxilla [1]. Dynamics of facial growth were appreciated with the development of new scientific knowledge in anatomy. With better understanding of the vascularity and growth potential of the premaxilla (PM) in the growing child, surgeons revisited previous surgical techniques.

The current surgical practice of alveolar bone grafting promotes mobilization and repositioning of the PM between lateral segments [2]. The firm stabilization of the osteotomized and mobilized prolabium is vital for the success of the alveolar bone graft surgery. Several techniques have been used for fixation of the osteotomized segment, but no single technique is considered the standard [3-5]. We describe different techniques used in a tertiary care facility for fixation of the PM following osteotomy.

Case presentation

The age range for secondary alveolar bone grafting (SABG) was considered to be 8-12 years. In each patient, the osteotomy and ostectomy were performed and the pre-maxilla was repositioned into the upper arch between lateral segments. Autogenous Iliac cancellous bone was used to fill the alveolar cleft. Primary stabilization of fractured pre-maxillae were achieved using different techniques as appropriate for the case (Table1). In all cases, SABG was performed unilaterally.

Case1 - A 10 year old male patient with bilateral alveolar clefts and a severe prognathic PM: During secondary alveolar bone graft surgery (SABGS), 5mm of bone was removed above the root apices of the premaxilla and the was repositioned superiorly and posteriorly. A four-hole titanium straight plate of 1.3 mm thickness with two screws was used to achieve semi-rigid fixation (Figure 1). The pre-maxillary segment was fixed to the ipsilateral segment above the tooth buds labially and a unilateral bone graft surgery was performed. In addition to the bone plate, a composite (resin cement) with stainless steel wire was used for additional stabilization.

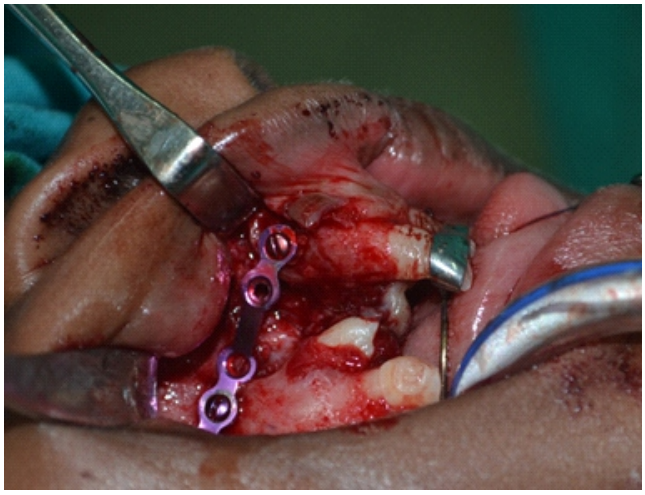

Figure 1. Multi-hole straight 1.3 mm diameter titanium bone plates with screws were used to achieve semi-rigid fixation

Case 2 - A 9 year old female patient with bilateral alveolar cleft had a prognathic PM: Preoperatively, a customized tooth borne appliance was fabricated. The pre-maxillary segment was stabilized using an acrylic bulb, and molar bands to lateral segments which had been connected by a stainless steel bar (Figure 2). After the surgical procedure, the device was cemented to stabilize the fractured segment. The appliance was removed in 3 months due to the unsatisfactory stability of pre-maxilla.

Case 3 - 11 year old female with bilateral alveolar clefts and a prognathic PM: After completion of surgery, the premaxillary segment was fixed by 1.3 mm titanium bone plate and monocortical screws palatally and the arch bar was fixed after completion of bone graft surgery for additional fixation.

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Results

Table 1. Case series and results of techniques adopted for fixation of PM.

Age, Gender	Type Of Fixation Used	Bone Graft	Remarks
10 years, Male	Titanium plate and screws, Resin composite + stainless steel wire.	Succeeded with an adequate union in bony segments	Segments were stable; tooth buds might interfere; needs a second surgery. Difficulty in isolation for composite splint placement. (Figure 1)
9 years, Female	Tooth borne appliance with acrylic bulb	Not acceptable stability	Difficult to stabilize the acrylic bulb; interference to the occlusion; poor patient compliance; Procedure needs prior model surgery in planning which causes additional burden: unpredictable positioning. (Figure 2)
11 years, Female	Titanium plate and screws, Eric arch bar	Succeeded with the adequate union in bony segments	Stable fragments; Prior assessment of site of fixation should have been done; tooth buds might interfere; need second surgery; arch bars cause trauma to soft tissue.
12 years, Female	Eric arch bar	Succeeded with the adequate union in bony segments	In mixed dentition, it interferes tooth buds. Traumatic to soft tissues and teeth. Oral hygiene maintenance is difficult. Need a second procedure for removal. (Figure 3)
11 years, Female	Tooth borne appliance	Acceptable Success	Difficult to exactly fit into the anterior segment. Need prior model surgery to achieve the presumptive position for fabrication of appliance. Stability not adequate,

Case 4 - A 12 year old female patient with a prognathic PM: - A prefabricated Eric arch bar and 26 gauge stainless steel wires for fixation of the pro-labial segment (Figure 3) to the two lateral segments.

Case 5 - An 11 year old female patient with a prognathic PM: We used tooth borne external fixation with a slight modification to the second case. In this case, we used molar bands for lateral segments and customized bands for incisors of PM. Later it was cemented to the teeth using Glass Ionomer cement.

Discussion

In neglected clefts, we occasionally find protruded PM. Osteotomy of PM at secondary alveolar bone grafting is considered ideal [6]. Commonly encountered complications in these types of cases where the loss of alveolar bone graft and mobility of PM due to fibrous union or non-union. This leads to tipping of the segment labially or palatally.

Many techniques have been practiced for stabilizing PM in literature. In 2009 Carlini et al [4] reported fixation of premaxilla using mini-plates and screws in combining with a splint in 50 patients, with 96% success rate. In Case 1 and Case 3, we followed similar methods of fixation using mini plates, as one plate fixation is not rigid enough. All cases required an additional method for stabilization. However, Rahpeyma A et.al. yielded satisfactory results in fixation of PM using a mini plate [7].

Preoperative cone beam computed tomography reduces the risk of damaging tooth buds during plate fixation. Use of resorbable plate and screws eliminate the need for second surgery. As the final position of the premaxilla is decided during the surgery (on the surgical table) ability of surgeons for manipulation and fixation of PM is ample. This technique can be adopted in severely protruded PM. In arch bar fixation, an advantage is good control of osteotomized segments and can be used in severe protruded cases. Disadvantages are that arch bars are more traumatic to soft tissues, and cannot be used in mixed dentition and edentulous cases. It also requires the second stage for removal of an arch bar and maintaining of oral hygiene is difficult so it is our least preferred method of fixation. Alexander et al in 1990 reported a prefabricated appliance aid in stabilization, using that idea we fabricated two different devices, which had been used in second and fifth cases [6]. But challenges faced during surgery were poor control over the osteotomized PM and three-dimensionally inadequate stability of bodily movement of the osteotomized PM. This technique cannot be used in edentulous PM. Also, maintaining the sterility during the procedure is compromis-

ed, when achieving dry field for resins. This technique can not be adopted in severely protruded PM.

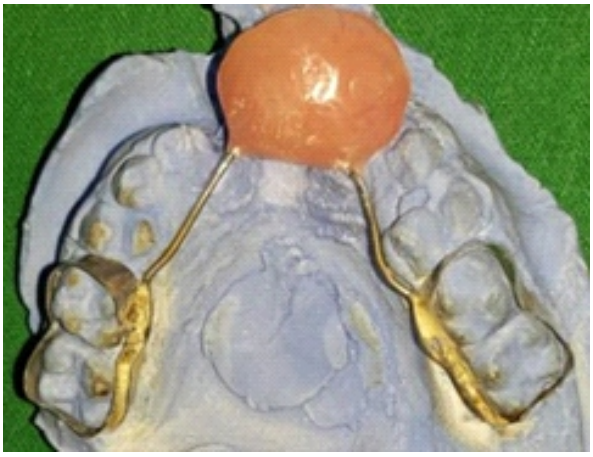

Figure 2. The premaxillary was stabilized using an acrylic bulb, and molar bands to lateral segments which were connected by a stainless steel bar

As appliance construction is done prior to surgery, improper planning and inadequate coordination between surgeons and orthodontists will lead to complications. Further, this appliance increases the risk for plaque accumulation and

Figure 3. Pre-fabricated Eric arch bar and 26 gauge stainless steel wires for fixation of the pro-labial segment

ultimately leads to surgical site infection. After bridging the lateral fragment and PM, alveolar cleft bone graft reinforces stability and vascularity to the repositioned PM [2, 4, 5]. However, some surgeons prefer bilateral alveolar bone grafting [2, 4, 5, 7]. We preferred two-stage surgery as these techniques employed are new to us. In future, we will try to employ simultaneous PM repositioning and graft bilaterally.

Conclusion

Clinical experience suggests that no single fixation method is successful in achieving solid fixation of premaxilla during secondary alveolar bone graft surgery. Therefore, we are in the process of studying the effectiveness of a combination of two methods of fixation in PM. Further, this paper highlights the possibility of carrying out pre maxillary fixation with basic surgical facilities as some techniques do not necessitate sophisticated instruments.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

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Learning Points:

- In a prognathic premaxilla with bilateral alveolar clefts , fracture and repositioning of the PM segment is necessary
- In such cases, achieving a good stable fixation allows successful take of the bone graft
- Combination of two fixation methods provide better success