Optimizing Stability of Segmental Le Fort 1 Osteotomy in Unilateral Cleft Lip and Palate Patient Using Cobalt Chromium Palatal Bar: A Technical Note


Abstract: Le Fort 1 osteotomy is a common procedure in cleft orthognathic surgery. However, the stability of the segmentalized maxillary bone components remains a major issue as it contributes to the long term successful surgical outcome. Based on the literature, the unilateral cleft anterior segment has the tendency to relapse back due to the high soft tissue tension and lack of rigidity of the device used for example acrylic splint or an archbar to maintain the surgically corrected maxillary arch position and alignment. An eighteen year old Malay male presented with a repaired left unilateral cleft lip and palate came complaining of anterior open bite on the left cleft side. He underwent unilateral segmental Le Fort 1 osteotomy on the cleft segments and the arch was stabilized with a customized Cobalt-Chromium (Co-Cr) palatal bar and stainless steel wire. Post-operative 1 year and 8 months later shows good healing with no relapse. Our novel technique of using Co-Cr palatal bar provide adequate post-operative support and can be applied by surgeons in segmental cleft orthognathic surgeries.

Key words: Cleft, stability, relapse, splint, osteotomy.

Introduction

Complete cleft lip and palate (CLP) patients frequently present with maxillary hypoplasia in all dimensions, class III skeletal relationship with concave facial profile and scar tissue especially on the upper lip and anterior maxilla from the earlier surgical repair. Inevitably, 25–60% of these cases required surgical maxillary advancement to correct the open bite and antero-posterior discrepancy. Orthognathic surgery is usually among the last surgical treatment for CLP patients and Le Fort 1 maxillary osteotomy is the most common correction surgery performed in CLP. The amount of movement that can be achieve however can be quite limited. The stability of Le fort 1 osteotomy segments especially at cleft site has been reported to have the highest tendency for relapse ranged from 25% to 50%. Good et al. reported an overall of 21% of CLP patients required a Le Fort 1 osteotomy to achieve an adequate functional relationship of the jaws and teeth. The need for Le Fort I osteotomy also correlated with severity of cleft. Although many efforts have reported in the literature with regards to improve post orthognathic surgery stability, there is still a great tendency of relapse in cleft patients compared to non-cleft patients.

The aim of this report is to share a technique that we believe can minimize the relapse rate especially on the cleft maxillary segment following Le fort I osteotomy.
Case Report

An 18-year-old Malay male came to see us with a complaint of having a concave profile on the left side of the face and left anterior open bite secondary to his cleft condition. He was born with a left complete unilateral cleft lip and palate and had received cheiloplasty at 40 days of infancy and palatoplasty when he was 11 months old in private hospital. He also had posterior maxillary segmental osteotomy with bone grafting at the posterior expansion segment site at age 16 for correction of maxillary transverse discrepancy. There was no history of orofacial congenital anomalies or deformities in his family. He had no other relevant medical history. The extraoral examination showed a midface deficiency with a Millard Scar on the left side of the lip. He has a depressed left alar and deviated nasal dorsum to the right. The intraoral examination showed an Angle Class III incisor relationship with an anterior open bite especially on upper left canine extending to second premolars where it is superiorly slanted with 10mm of open bite (Fig. 1). The upper left central and lateral incisors are missing and he presented with a reverse overjet of 5mm. His maxillary dental midline was deviated by 1 mm to the left in relation to the facial and mandibular dental midline. The panoramic radiographs showed that areas of vertical bone deficiency on nasal floor and inadequate alveolar bone graft on cleft site side (Fig. 2). The cephalometric radiographs showed within normal range of skeletal and dental profile. The surgery was planned mainly to correct the intra-arch relationship first to get a good arch shape. The inter-arch relationship will be addressed later by another surgery.

The patient underwent unilateral segmental Le Fort I osteotomy on the left cleft segments followed by bone harvesting from left iliac crest. The cleft segment was brought downward and corticocancellous block was placed in the space and secured with L-plate at the nasomaxillary buttress region and customized cobalt chromium (Co-Cr) palatal bar was placed and secured with 0.5mm stainless steel wire to optimize the stability of the newly positioned left maxillary segment (Fig. 2). Post-operative recovery was uneventful. He was discharged home 2 days later and was on close follow up in our clinic.

Figure 3 and 4 shows post-operative 6 months review and we noted that the Co-Cr palatal bar is still firmly holding the upper dental arch and the canine tip of the cleft segment was in the same intra operative position. The palatal bar was removed 6 months post-surgery and the patient went to abroad...
for further study. The latest follow up was recently exactly at 1 year 8 months post-surgery and the anterior segment was noted to be at the planned position as before as evidence by no change by the measure open bite distance (Figure 5). Patient was satisfied with the outcome and the following staged surgery of bimaxillary orthognathic surgery to correct the facial profile are to be scheduled after the completion of his study.

Discussion

Long-term stability of the surgically repositioned maxilla and mandible is vitally important to the oral and maxillofacial surgeon’s ability to successfully correct dentofacial deformities. Cheung et al. reported that distraction osteogenesis (DO) can be considered as an alternative and is more favourable of reducing relapse rate compared to conventional orthognathic especially in advancement and down-grafting movements of the cleft maxilla.

Conventionally, unilateral segmental Le Fort I surgery when indicated, is also an integral procedure in the management of occlusal and skeletal imbalances. It enables opening or closing of the cleft alveolar gap to, facilitate alveolar bone grafting, and closure alveolar fistulas and allowing implant placement. It can widen the maxillary arch, allow differential movement of greater and lesser segments, align the occlusal plane, and maximize intercuspation to improve postoperative stability.

Watts et al. reported that conventional single piece Le Fort I osteotomy can allow control of the maxilla in sagittal, vertical, and rotatory positioning thus allowing specific occlusal problems related to the cleft deformity to be addressed. As such, this technique was indicated in our case as the anterior quadrant of the cleft deformity was very superiorly positioned and tilted thus indicating segmentation and down-grafting to the new corrected occlusal plane.

Bailey et al. reported that stability of Le fort I osteotomy in downward movement carries the highest relapse rate compared to superiorly positioning and advancement of the maxilla from their comprehensive database containing over 3000 patients with initial records and over 1400 patients with at least 1 year follow-up. Taking this into consideration, we emphasized on a rigid and stronger form of splint option in order to hold the segmentalized cleft maxillary arch at the new position.

The alloy used for fabrication of the modified palatal bar consists mainly of cobalt (62–65%), chromium (23–31%) and molybdenum (4.5–5.5%). Cobalt in the alloy enhances good mechanical properties and reduces the viscosity of the alloy, chromium improves the chemical stability of the alloy and its stability in the mouth, while molybdenum increases the chemical stability of the alloy and its elasticity and bonds with the excess of unburned carbon (increasing the brittleness of the alloy), creating molybdenum-carbide (Mo6C). After the surgery, we would like to recommend that the Co-Cr bar should be retained for at least 6 months to strengthen bony consolidation thus reducing relapse rate as per reported by Chua et al. that the highest incidence of relapse of cleft osteotomy segments occurred during the first 6 months post operatively. The stability can be assessed by measurement of the cleft segment prior removal of the palatal bar after 6 months. As for this case the gap between tip of upper left canine to the lower occlusal plane was 1mm prior removal of the palatal bar, then 1 year and 8 months later, the gap remain similar.

The fabrication of Co-Cr palatal surgical bar framework is very complex and requires high precision from both the technician and the OMF surgeon. Having good knowledge of all phases of the complex laboratory fabrication contributes to better quality of fabrication of this prosthesis. Cost for producing Co-Cr bar are less than rm200 in Malaysia and the time taken will be an extra few days but its action in preventing relapse makes the cost and time taken to construct it worthwhile.

The use of new original alloys guarantees safety and precision thus ensuring smooth fitting and external surface of the casting and perfect fit in the desired dental arch.

The technique using Co-Cr palatal surgical bar allows adequate support for the surgically corrected cleft maxillary arch following a segmental Le Fort I osteotomy procedure. When indicated, our novel technique is relatively simple and can be easily applied by surgeons in any cleft orthognathic surgeries.

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References


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