POST-ANKYLOTIC DEFORMITY CORRECTION USING EXTENDED LATERAL SLIDING GENIOPLASTY TECHNIQUE WITH THE AID OF PRE-OPERATIVE 3D PRINTED MODEL – A PRELIMINARY STUDY

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(Received on Date: 15 February 2018 Date of Acceptance: 28 February 2018)

ABSTRACT

The aim of this study was to assess the ease of extended lateral sliding genioplasty with the aid of 3D printed medical models in the correction of post-ankylotic deformity. The present case was a patient with facial deformity following unilateral ankylosis in a 20 year old female patient. She was treated earlier for ankylosis release and was planned for an extended lateral sliding genioplasty aided by pre operative 3D printed medical models. Postoperative results showed improved facial symmetry with no post operative complications. Extended lateral sliding genioplasty has shown satisfactory results in correction of facial asymmetry. With the aid of 3D printed medical models, the procedure has performed with better accuracy and lesser surgical duration.

***Keywords*:** Ankylosis; Asymmetry; Genioplasty; 3D medical model.

No: of Figures: 8 **No: of References: 10**

INTRODUCTION

Temporomandibular Joint (TMJ) ankylosis leads to varying degrees of anatomical, functional and esthetic disturbances on the involved side of the face. Retrognathia, obstructive sleep apnea, occlusal discrepancies in the bilateral TMJ ankylosis causes severe facial deformity as well as functional disturbances[1]. Although patients with unilateral ankylosis present with facial asymmetry, maxillary cant and some amount of occlusal discrepancy, functional disturbances are minimal. In cases of unilateral asymmetry, patients are mostly concerned with the external appearance of the face; hence various procedures have been advocated for correction of post ankylotic deformities. Currently, distraction osteogenesis, bimaxillary osteotomies and genioplasty have been widely for this purpose[2]. 3D printed medical models have been used in the presurgical planning for osteotomy procedures, which enables the surgeon to pre-plan the osteotomy cuts and pre-bend. The plates hence reducing the time of surgery as well as the complications associated with the procedure[3]. Therefore, we report a case of post-ankylotic deformity of unilateral TMJ ankylosis treated with extended lateral sliding genioplasty to correct the facial asymmetry using the aid of 3D printed model surgery.Patients with facial asymmetry are often psychologically impacted by their external appearance rather than the functional disturbances. Depending on the level of deformity and facial asymmetry, surgical procedures are chosen. Bimaxillary osteotomies along with genioplasty, augmentation surgery, genioplasty, craniofacial implants and bimaxillary distraction procedures are widely used[4].

Distraction osteogenesis is being widely used in recent times for the correction of both esthetic and functional imbalance in the craniofacial syndromes involving maxillary and mandibular hypoplasia, TMJ ankylosis or post-traumatic deformities. In cases of TMJ ankylosis, distraction has not proven to be satisfactory since it deranges the occlusion which may further require orthodontic corrections[4].Orthognathic surgeries have also been indicated for the correction of facial asymmetry but are associated with complications due to soft tissue discrepancy, which restricts the maximum advancement[2].Tessier explained the advantages of the long osteotomy extending to the gonial notch bilaterally[5]. Horseshoe shaped osteotomy increases transverse dimension posteriorly and width of the jaw line increases as the chin is advanced.3D printed models are widely being used in craniomaxillofacial procedures such as correction of asymmetric faces associated with craniofacial syndromes, orthognathic surgery, distraction osteogenesis, reconstructive surgery following excision of pathology in craniofacial region, temporomandibular joint surgery and much more. Keyhan et al.,[6](2016) illustrated that 3D printed models can be used precisely in genioplasty procedures which aids in preoperative guide of

osteotomy and plate bending so that it helps novice surgeons to be able to perform genioplasty with much ease and confidence. Wang L et al.,[7] (2017) obtained surgical templates using 3D printed models and precise repositioning instrument to guide the osteotomy in 8 patients with complex facial asymmetry and concluded that it showed satisfactory postoperative results.

MATERIALS AND METHODS

This study was reviewed by an institutional ethical board and informed consent was obtained prior to the procedure. A 20 year old female patient (Fig. 1 Frontal view) was operated for release of right TMJ Ankylosis with Interpositional gap arthroplasty using temporalis myofascial flap via Alkayat-Bramley approach under general anaesthesia 4 years ago at our department of oral and maxillofacial surgery. Patient showed satisfactory results and was under constant follow-up. After 4 years there was adequate mouth opening without recurrence. For the correction of facial asymmetry, cephalometric (COGS) and PA view (Grummon's analysis) was done and an extended lateral sliding genioplasty was planned.

Figure 1- Frontal view

A CT scan with 3D reconstruction was done (Fig. 2 CT Scan 3D reconstruction), which was then converted into an STL file. This was transferred to a 3D printer where the medical model was fabricated. The 3D printed medical models were then used for analyzing the extent of facial deformity and also in educating the patient regarding the procedure. The skeletal and dental midlines were marked and the extent of deformity deviating from the midline was assessed. A model surgery was performed on the model.

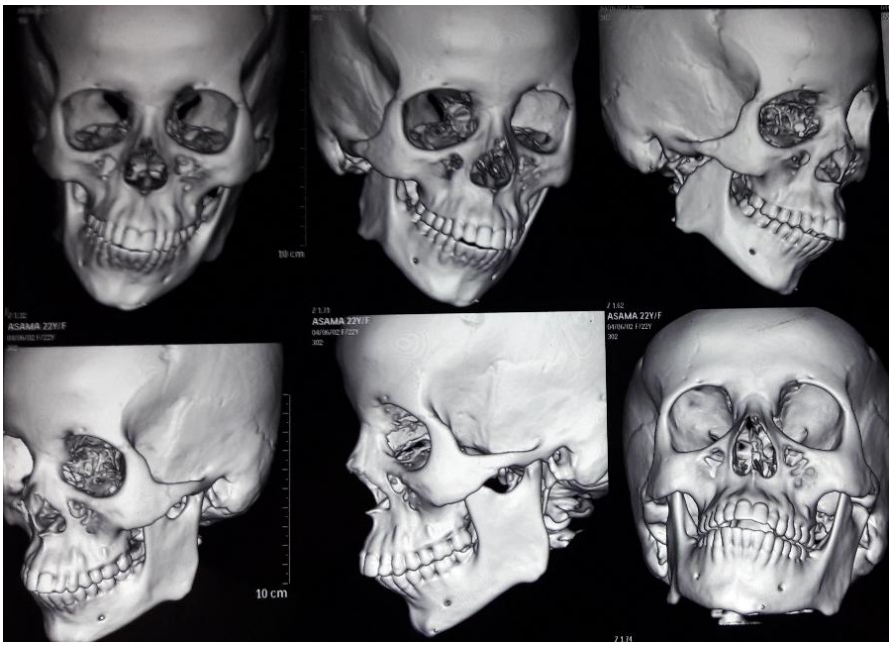

Fig. 2 CT Scan 3D reconstruction

Mock Surgery

The facial midline was drawn by a line (M) drawn perpendicular to the intercanthal line (ICL) at its midpoint on a 3D printed model of the patient. This line is extended upwards to the frontal region and downwards beyond the chin region. The midpoint of the glabella region on the facial midline is marked (point G). The pogonion, the midpoint of the chin, also marked (Pog). Asymmetry of the mandible and face is marked by a line from the glabella to the pogonion. The distance between the M-Pog is calculated as amount of deviation to be corrected to achieve the facial symmetry (Fig.3 Markings placed).

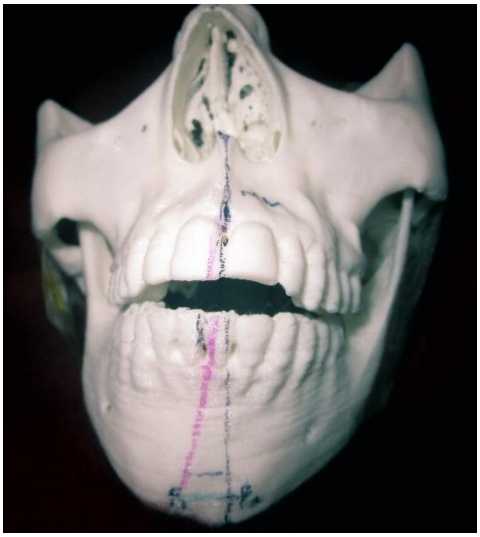
Fig.3 Markings placed

After the markings were placed, mock surgery was performed by placing the osteotomies using an oscillating saw. Following mobilization of the oseotomised segment, the caudal segment was advanced and rotated (Fig.4 Osteotomy and advancement). The advanced segment was stabilized with the wax and pre-adaptation of miniplates was done on the models (Fig.5 Preadaptation of miniplates).

Fig.4 Osteotomy and Advancement

Fig.5 Preadaptation of miniplates

Surgical Procedure

After the patient preparation, intermaxillary fixation was carried out using Gilmer's wiring technique. Local infiltration using 2% lignocaine with adrenaline in 1:2,00,000 concentration was given in the vestibule. A degloving incision was placed using monopolar electrocautery extending from mandibular first molar to the first molar of other side. After the flap was reflected, bilateral mental nerves identified and protected, mentalis muscle was dissected to expose the symphysis and dissection carried out further to expose the lower border of mandible till the gonial angles bilaterally. An inferior border osteotomy cut placed using no. 701 straight fissure bur 5mm below the mandibular canal anterior to the mental foramen with the angulation of 45 degrees to avoid the damage to root apices(Fig: 6Osteotomy cut placed). In the symphysis region, the bur was slanted upwards to include a larger segment of the chin maintaining the 5mm distance from canal. The oseotomy was extended posteriorly anterior to the gonial angle bilaterally till the mandibular second molar. Osteotomy was completed with an osteotome maintaining the vascularity of the segment with the lingual pedicle. The osteotomised horse-shoe segment was mobilized and slided laterally about 7mm of distance to the normal side and advancement of about 5mm achieved. Preadapted inverted Y shaped miniplate fixation was done on the symphysis region and laterally, one two-holed and one four-

holed miniplate fixation was done on either side (Fig.7 Preadapted miniplates fixation). Wound closure done in layers using 3-0 vicryl with simple interrupted sutures.

Fig:6Osteotomy cut placed

Fig.7: Pre-adapted miniplates fixation

The procedure of extended lateral sliding genioplasty with the aid of 3D printed medical models in the correction of post-ankylotic deformity is a versatile technique for surgical correction of facial asymmetry and unilateral mandibular deficiency. It not only allows lengthening of the deficient side, but also gives fullness to the sunken side. Since only the inferior part of the mandible is moved, the occlusion is not disturbed.

RESULTS AND DISCUSSION

Postoperative results showed the improved facial symmetry with the pogonion coinciding with the facial midline (Fig.8 Post-operative Frontal view).

Fig.8 Post-operative Frontal view

The dental midline was however still deviated since the procedure involved only the basal bone and not the occlusion.No post operative complications were encountered and no paraesthesia was noted with respect to both the mental nerves.TMJ ankylosis often leads to functional and esthetic facial deformities. It is characterized by retrognathic mandible,

deviation of the chin towards the involved side restriction of mandibular movements, atrophy of muscles, obstructive sleep apnea and occlusal plane cant[5].Unilateral ankylosis of the temporomandibular joint occurring during the growth phase is often complicated by the development of deformities in the structure, shape, and size of the mandible along with the soft tissues of the involved side[1].

In this case, since the patient was more concerned about the facial appearance and the occlusion on the involved side was satisfactory, extended lateral sliding genioplasty was considered to correct the facial asymmetry and chin prominence. Mani et al.,[8] (2004) advocated the use of extended lateral sliding genioplasty in unilateral TMJ ankylosis between the year 1991 to 2001; which showed promising results with no intra-operative and postoperative complications associated with this technique. In a study by Troulis et al.,[9] (2000) on extended genioplasty, it was concluded that the long osteotomy ensures proper proportionality between the advanced segment and the posterior mandible. Hoeing[10](2007) in his 10 years experience of sliding genioplasty for correction of facial aesthetic imbalance suggested that it is a reliable procedure for gaining facial symmetry.

Similarly, this technique was advocated in our case with slight modification of osteotomy limited about 3cm anterior to antegonial notch. Hence, preoperative 3D printed models were used for model surgery to evaluate the extent of osteotomy and amount of rotation required using this technique.

CONCLUSION

Extended lateral sliding genioplasty has shown the satisfactory results in correction of facial asymmetry with the aid of 3D printed models. The added advantages of 3D printed models for this surgery was patient education by aiding in the explaination of the type of surgery and show the possible outcomes of the procedure. It also helps in analyzing the amount and length of the bone present on the affected side which helps in the selection of the suitable procedure and also gives the idea of whether any graft is to be used by planning the site, extension and level of osteotomy to be placed therefore avoiding complications such as bad splits or neurovascular damage. Moreover, contemplation of amount of advancement and rotation of the segment to achieve symmetry can be assessed which gives the idea of number and type of plates to be used and preoperative adaptation of the miniplates hence, reducing the time of surgery. The prebending og the plates saves a lot of surgical time. The use of prebent plates serves by itself as a template for the ideal position of the osteotomised segment.

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