Rehabilitation of atrophic maxilla with pronounced buccal concavities using extra sinus approach zygomatic implants

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Citation

ABSTRACT
Restoration of severely resorbed maxilla poses a greater challenge to the surgeon and as well as to prosthodontist. The pneumatisation of the maxillary sinuses along with the type of bone seen in posterior maxilla makes it difficult in placing and restoring with implants. Zygomatic implants are used in such type of cases and these are alternative to other procedures such as complex bone grafting and sinus lift procedures. Case report of such Zygomatic implants is discussed in this section.

Keywords: Edentulous maxilla, resorbed maxilla, zygoma, hybrid denture, all – on – 4 prostheses

1. INTRODUCTION
Implant supported prostheses for replacing missing teeth is an established treatment option with favourable success, but there are certain areas and situations where the placement and restoration is technique sensitive. Restoration of posterior maxilla with conventional dental implants is often jeopardised due to various reasons such as excessive bone resorption, poor quality of bone and pneumatisation of the maxillary sinus (Paulo Maló et al., 2008). To overcome these problems, surgical techniques to increase the bone volume are being followed but these procedures are either complex or time consuming. So to avoid these complex
procedures, different treatments options were developed such as placing the implants in the pterygoid and Zygoma (FotiosTzerbos et al., 2016).

Branemark performed the original protocol of placing the zygomatic implants. According to the literature, placement of zygomatic implants is done through intra sinus approach and extra sinus approach (Araujo et al., 2016), but later Stella and Warner introduced the Sinus Slot technique of zygomatic implant placement. This case study describes the prosthetic rehabilitation of the atrophic maxilla with zygomatic implants placed in extra sinus approach.

2. CASE REPORT

Diagnostic phase
Patient aged 58 years reported with a chief complaint of missing teeth in both upper and lower arches (Figure 1). Dental Panoramic Tomogram (DPT) revealed inadequate bone height in the posterior region of maxilla. After analysing the factors, it was suggested that implant supported prostheses is the best treatment option. Patient wanted the prostheses in shorter duration of time, so it was decided to place zygomatic implants in the posterior region with two axial implants in the anterior region of maxilla. Preliminary procedures were carried out till the wax try-in and the trial denture was then duplicated incorporating the radiopaque markers. Cone beam computed tomography (CBCT) was advised to the patient to assess the available bone and also to assess the approximity of the vital structures. Surgical stent was fabricated with the help of CBCT data.

Figure 1 Intra oral photograph and CBCT planning made with radio opaque markers
Surgical phase
Prophylactic antibiotics were administered to the patient before the procedure. The entire procedure was carried out under general anaesthesia. After administering local anaesthesia (Lignocaine with 2% adrenaline), midcrestal incisions and posterior releasing incisions were made in the maxillary arch. Mucoperiosteal flaps were raised to expose the alveolar crest, the lateral wall of the maxillary sinus, and the inferior rim of the zygomatic arch. The surgical stent was placed and the implant site was prepared, drilling from the palatal crest of the alveolar ridge pointing the zygomatic arch. The sinus membrane was left intact, without touching integrity. The osteotomy procedure was done following the standard protocol Branemark System Zygoma Round Bur, Nobel Zygoma 0° Twist Drill 2.9 mm, followed by the Nobel Zygoma 0° Twist Drill 3.5 mm and finally with Nobel Zygoma 0° Twist Drill 4.0 mm diameter. Constant saline irrigation was done during the drilling process to prevent overheating.

Zygomatic implants of lengths 52 mm were used bilaterally and these were engaged with implant driver and the drilling unit at 20 Ncm insertion torque. All implants were engaged bicortically at the level of the zygomatic bone, with a torque of at 35 Ncm to 40 Ncm. Two conventional implants of dimensions 4.3 x11.5 mm (Nobel active) were placed in the anterior region. Finally suturing was done using resorbable 4/0 polyglactin 910 suture to approximate the flap. Dental Panoramic Tomogram (DPT) was taken to analyse the implants position after the surgery (Figure 2).

Figure 2 Nobel zygomatic and Nobel active axial implants – intra op view and OPG view
Post-operative medications, Amoxicillin with clavulanic acid 625mg, (1 tablet every 8 hours for 5 days), anti-inflammatory diclofenac 100 mg (1 tablet every 8 hours for 3 days) were prescribed, together with rinses 0.12% chlorhexidine gluconate, twice daily for 15 days.

**Prosthetic phase**
The prosthetic phase was divided into two parts –  
Immediate interim prostheses and b) Definitive prostheses
Sterile impression copings were connected to the multi-unit abutments and Impression procedures were carried out immediately after the surgery to receive interim prostheses. Screw retained all acrylic interim hybrid prostheses was fabricated for the upper arch. The hybrid prostheses were inserted and the abutment screws were torqued to 15Ncm torque. The screw access holes were closed with non - eugenol temporary luting cement. After 6 months of interim prostheses, definitive prostheses were planned for the patients. The implants were checked for stability, pain and infection.

Open tray implant impression was carried out with polyvinyl siloxane impression material by connecting the open tray impression copings to the multiunit abutments (Kalamalla et al., 2020). A trial jig of pattern resin was fabricated to verify the accuracy of the implant impressions. After the verification cobalt chromium framework was designed following which jaw relation and teeth arrangement was carried on. As the patient was completely edentulous, the mandibular arch was planned for two implant locator attachment system over denture prostheses. Bilateral Balanced occlusal scheme was preferred opposing the lower over denture prostheses. After the trial denture verification, hybrid prostheses with cobalt chromium based metal framework were fabricated for upper arch. Hybrid denture was inserted and the abutment screws were torqued to 15Ncm. The screw access holes were later closed by light cure composite resin (Figure 3).

**Figure 3** Hybrid prostheses in relation to maxillary arch
Follow up phase

Patients were recalled after 6 months of prostheses loading, prostheses were removed and Resonance frequency analyses were done to all the implants to check for the implant stability. The prostheses were also inspected for any damage in the acrylic, metal component part. No complaints of soft tissue inflammation causing gingival problems around the implant were seen in our case, since proper oral hygiene and periodic follow up was done. No reports of sinusitis and oral antral fistula were reported in our case. There were no complications of implant failure, peri-implantitis, fracture of prosthesis frameworks, screw fractures or screw loosening or difficulty in oral hygiene in the patient during the follow-up period.

3. DISCUSSION

Restoring the edentulous maxilla poses a greater challenge. Factors such as masticatory function and phonetics play an important role in fabrication of the prostheses. So a systematic pre-treatment approach is needed for edentulous patients for a better treatment outcome. Three factors are considered as key determinants for successful treatment of completely edentulous maxilla. These factors are a) presence or absence of composite defect, b) visibility or lack thereof of the residual ridge crest without denture in place, with normal smile, c) the amount of bone available in 3 separate zones of the maxilla as seen in panoramic radiograph. The maxillary anterior region is designated as zone 1; the premolar region is zone 2, and the molar region as zone 3. This analysis aids the surgical and restorative team to plan and execute the treatment. Other prosthetic factors to be considered are extra-oral features, aesthetic lip line, inter-arch space, bone quality, bone quantity, existing occlusal plane, maxillo-mandible relationship, arch-form, existing prosthesis (Edmond Bedrossian et al., 2008).

The extensive surgical procedures for bone graft harvesting and time taken for the final treatment lead to many disadvantages such as multiple surgeries, morbidity of donor site possibility of graft failure, waiting periods (3 to 6 months to heal), to overcome these disadvantages. Newer advanced techniques without grafting for treatment of edentulous patients were developed. One such technique was the placement of zygomatic implant developed by Branemark in 1998, which was later modified by Stella and Warner (Prithviraj et al., 2015). The severe resorption on the buccal cortices of the maxilla meant that zygomatic implants placed using the intra sinus approach exhibited pronounced angulations leading to undesirable prosthetic offset in the palate. This led to a bulky prosthetic component resulting in difficulties in both oral hygiene maintenance and phonetics (Al Nawas et al., 2004).

In order to overcome these difficulties, an extra-maxillary approach was suggested by (Aparicio et al., 2014) where the zygomatic implants are placed with an anatomy guided approach. In this approach the zygomatic implants engaged the alveolar process only on the buccal aspect, staying completely exterior to the body of the maxilla and maxillarsinus. This approach avoided the prosthetic offset and its resultant complications. Due to these advantages, the extra maxillary approach was used in this study. The success rate of the zygomatic implants is around 97% (Aghaebig and Bousdras, 2007). Fixed ceramo-metal restoration, implant-tissue supported prostheses (Hybrid prostheses and bar retained prostheses) are considered better prosthetic options in restoring the zygomatic implants. The prostheses should be firm in nature resisting the forces causing deformation and deviation as these forces can lead to implant loss and other screw loosening problems. Hybrid denture prostheses (FP3 type) were considered in our case to restore the maxilla. Implant supported hybrid prostheses were decided to be fabricated since the intra-arch distance was around 33 mm for patient. It has been observed that hybrid dentures offer good masticatory efficiency and better psychological satisfaction to the patients than the conventional overdentures. These prostheses can also be used in cases of combination of tilted and axial implants (Ferhan Eglmez et al., 2015). Cantilever length is also an important parameter that is to be evaluated when deciding to fabricate implant supported hybrid prosthesis. In the current case, cantilever length was 13mm, respectively which is in line with the suggested values.

Two important factors are considered during the designing of the hybrid prosthesis, one is obtaining a passive fit of the framework and other is the framework material. Cobalt – chromium alloy was used as the material of choice, the reason for the choice was its cost effectiveness and its easiness to section and solder the framework. Further, many studies suggest that a rigid material can diminish the bending moment of the framework and this was other reason for the choice of cobalt-chromium framework as the alloy has shown to generate the least amount of strain on the implants (Ferhan Eglmez et al., 2015). The survival rates of the zygomatic implants are around 98-100%. The thick cortical layer of the zygoma bone provides dense and prolonged anchorage. This type of solid and tricortical anchorage supports the masticatory forces applied at the occlusal level thereby increasing both the success and survival rate. The main advantages of the zygomatic implants are elimination of the donor site morbidity and infection in the graft material and decreased treatment time.

Zygomatic implants despite of their advantages have some complications and problems. Complications such as soft tissue inflammation around the abutments, sinusitis and oroantral fistula with or without sinusitis are more commonly seen after the placement of implant (Prithviraj et al., 2015; FotiosTzerbos et al., 2016).
4. CONCLUSION
In conclusion treatment of atrophic maxilla using zygomatic implants is a good treatment option because of its high success rate, evading the complicated grafting procedures and the option of immediate function. The extra maxillary approach can be used for successful rehabilitation of severely resorbed maxilla with pronounced buccal concavities. Thus the use of zygomatic implants has a lot of advantages over its disadvantages improving the overall patient comfort.

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Author contribution
Syed Ershad Ahmed – Contributed To the Study Design, Doing the Case Study, Formatting the Manuscript
S. Parithimar Kalaignan and Saravanan Kandasamy – Collecting the Information and Contributed To the Compilation of the Results

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