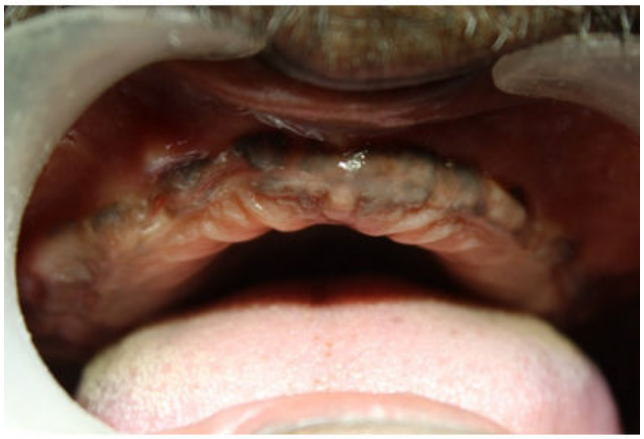

Figure 1: Intra-oral maxilla.

After analysing the past history and intra oral features including the bone height and width it was concluded that, implant supported complete denture prostheses is the best treatment option for the patient. Since the bone height in the posterior region of maxilla was insufficient for placing implants, options such as on lay bone grafting over the posterior region of maxilla were discussed. Patient was not interested in such extensive surgical procedures and wanted the prostheses in shorter duration of time, so it was decided to place bilateral zygomatic implants in the posterior region, two axial implants in the anterior region in maxilla and later rehabilitate with implant supported prostheses. Two implant supported over denture was decided to be the treatment option in the mandibular arch. Both the zygomatic implants were decided to be placed in extra sinus approach rather than the classical approach as the patient gave the history of sinusitis [3].

Preliminary impressions were made in upper and lower arches with alginate impression material. Border moulding and secondary impressions were made with addition silicone putty light body wash. Master casts were fabricated along with record bases and occlusal rims. Tentative jaw relation and wax try-in was done establishing the vertical dimension.

The trial denture was then duplicated and radiopaque markers were incorporated in the duplicated denture. Cone Beam Computed Tomography (CBCT) was advised to the patient to assess the quantity of the existing bone available and the approximity of the vital structures (Figure 2). Routine blood investigations were assessed. Surgical stent was fabricated from the trail denture (Figure 3). CBCT data was analysed and the regions of implant placement both in maxilla and mandible were selected. As per the CBCT data, modifications were made in the surgical stent [4].

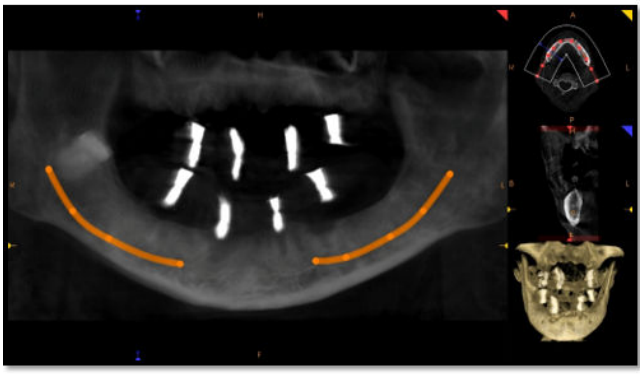

Figure 2: CBCT planning made with radio opaque markers.

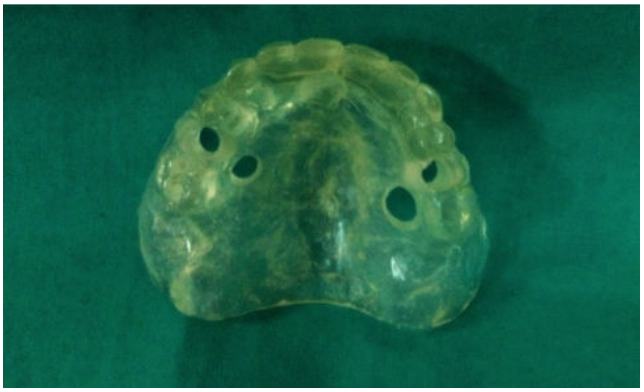

Figure 3: Surgical stent fabrication for placement of zygomatic implants.

With the help of CBCT data, a stereolithographic model was fabricated using 3-D printing technology (Figure 4). A simulated implant placement was done in the model to analyse the position and angulation of the implants (Figure 5).

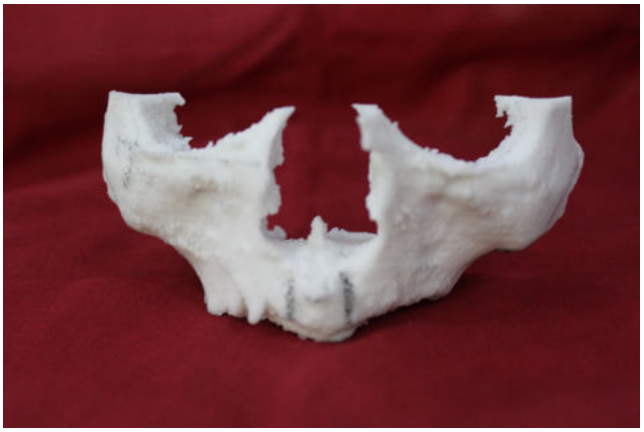

Figure 4: Stereo lithographic model using 3-D printing technology.

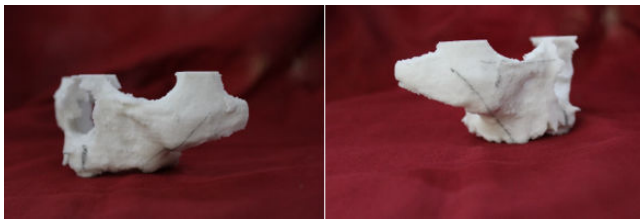

Figure 5: Simulated implant placement in stereo lithographic model.

Surgical phase

The entire treatment procedure was carried out under general anaesthesia. After administering local anaesthesia, midcrestal incisions were placed all along the maxillary arch from maxillary tuberosity of one side to another. The mucoperiosteol flap was elevated and the excess bony spicules were reduced with help of osteotomy burs. Surgical stent was placed in the upper arch and the desired osteotomy sites were marked. Implant osteotomy procedure was carried out with the help of surgical stent in the region of 12 and 22. Nobel active implants of size 4.3 mm × 11.5 mm were placed in the selected region of 12 and 22 (Figure 6).

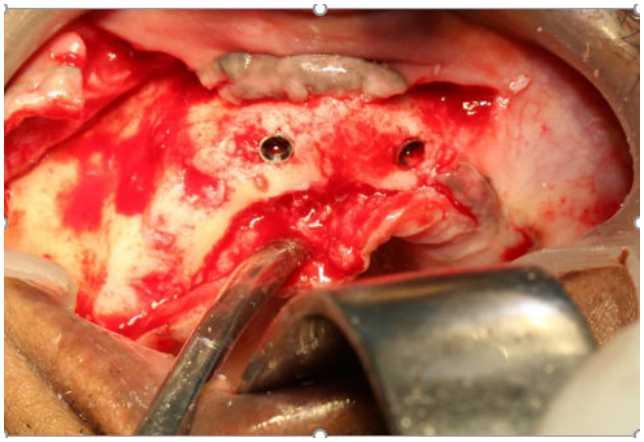

Figure 6: Placement of anterior implants in the region of 12 and 22.

Nobel zygoma 450 implants of size 45 mm in length were selected. With the help of surgical stent the regions of implant placement was marked bilaterally. The entire mucoperiosteal flap was elevated till the zygomatic bone. The initial osteotomy was done with round bur in the zygoma on both the sides. After the site was marked with round bur, pilot drill 3.5 mm short (length 75 mm) and twist drill 2.9 short and 3.5 short were used for osteotomy procedure (Figure 7). Since the implant placement was an extra sinus approach, groove running down from zygoma to the maxillary alveolar ridge was created. Once the osteotomy was completed, zygoma implants of size 45 mm in length was placed bilaterally. The implant head was oriented on the premolar region of the alveolar ridge bilaterally [5].

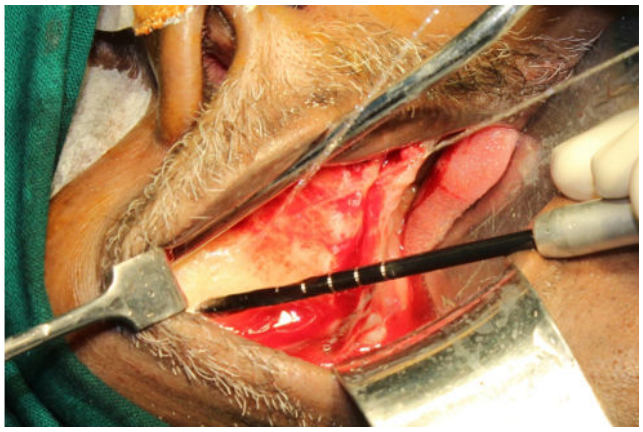

Figure 7: Osteotomy procedure for placement of zygomatic implants.

Nobel 170 multi-unit abutments were placed on the implants and torqued with the help of driver (Figure 8). To these multi-unit abutments, multi-unit healing cap was connected. Simple sutures were placed, with horizontal mattress sutures to ensure correct flap closure, using reabsorbable 4/0 polyglactin 910 suture.

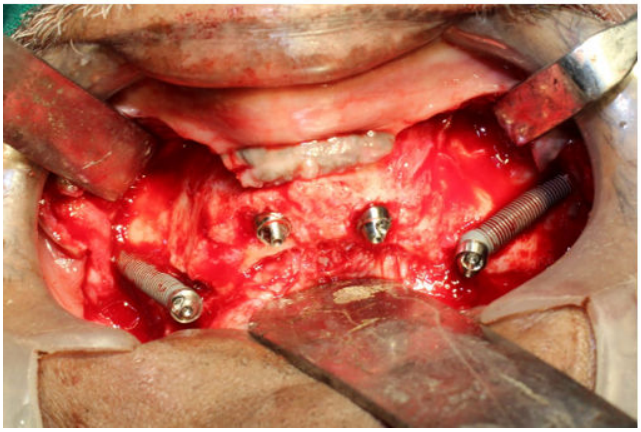

Figure 8: Nobel multi-unit abutments on the implants (zygomatic and anterior implants).

Two nobel active implants of size 4.3 mm × 11.5 mm were placed in the region of 33 and 43. Healing abutments of 5 mm height were connected to the implants. Orthopantomogram (OPG) and sinus view extraoral x-ray was taken to analyse the implants position (Figures 9 and 10). Antibiotic amoxicillin plus clavulanic acid combination drug 625 mg, (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.

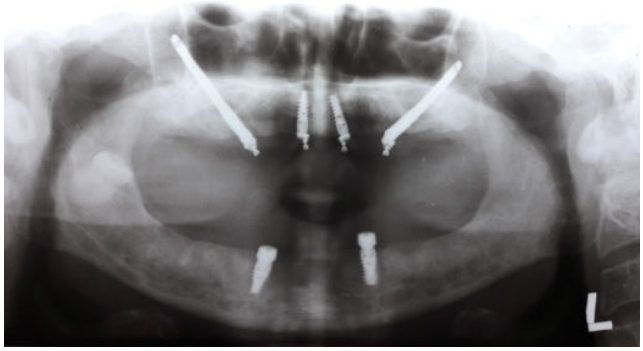

Figure 9: OPG view after implant placement.

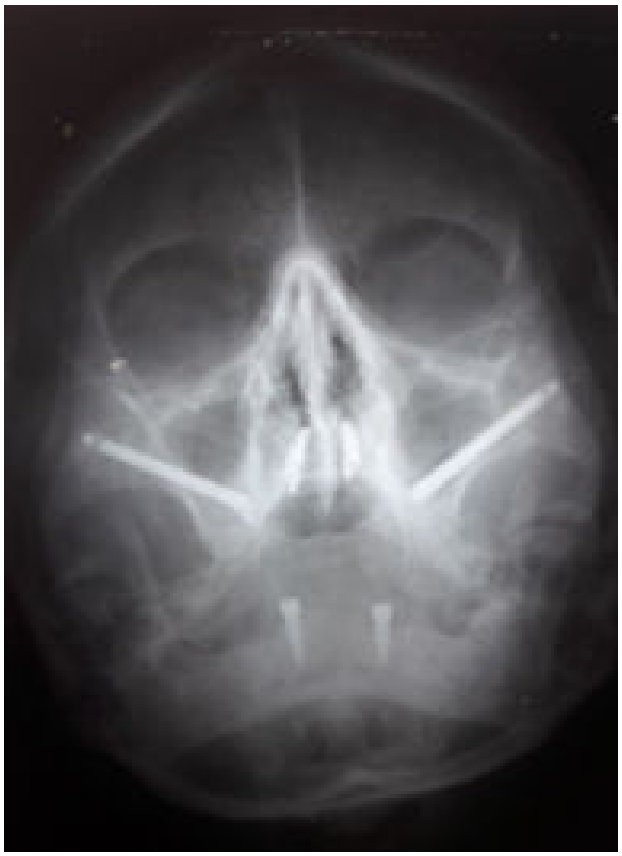

Figure 10: Extra oral sinus view to analyze the implant position.

Prosthetic phase

The prosthetic phase was divided into two parts-immediate temporary prostheses and definitive prostheses. The temporary prostheses was fabricated chair side on the day of surgery. The existing upper and lower denture of the patient was modified as temporary all acrylic prostheses. The labial and buccal flange of the existing upper denture was trimmed 1 mm-2 mm short of the vestibular depth. Light body consistency of addition silicone impression material was injected onto the denture and an index in the denture was made for identification of multiunit abutment position. Holes were made on the denture corresponding to the position of the multiunit abutments in the index. Later temporary abutments were connected to the multi-unit abutments and the pickup of the temporary abutments was done with auto polymerising acrylic resin. Screw retained temporary hybrid prostheses was fabricated for the upper arch. The hybrid prostheses was inserted and the abutment screws were torqued to 15 Ncm torque. The screw access holes were closed with non-eugenol temporary luting cement (Figure 11).

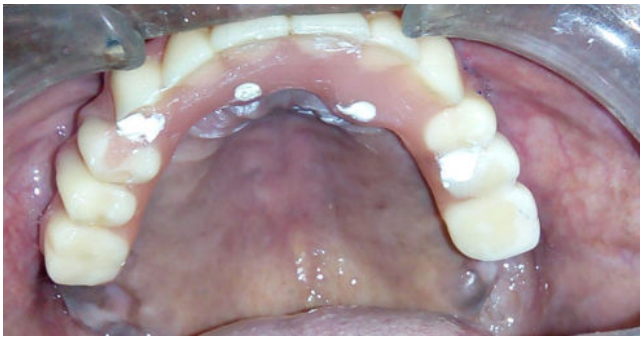

Figure 11: All acrylic temporary hybrid prostheses.

For the lower arch, the locator abutments were connected to the respective implants and the corresponding attachments (locator metal housing) were picked up in the lower denture with auto polymerising resin with cap inside the metal housing [6]. Patient was asked to report for regular periodic visits to review the temporary prostheses.

The definitive prostheses was done six months after the surgical procedure. The existing temporary prostheses was inspected and it was removed. The oral health status and the condition of the abutments were checked. Multi-unit healing caps were connected to the abutments and an alginate impression was made for the fabrication of special tray. Open tray impression copings were attached to the multiunit abutments. The copings were splinted with the help of pattern resin by brush bead technique (Figure 12).

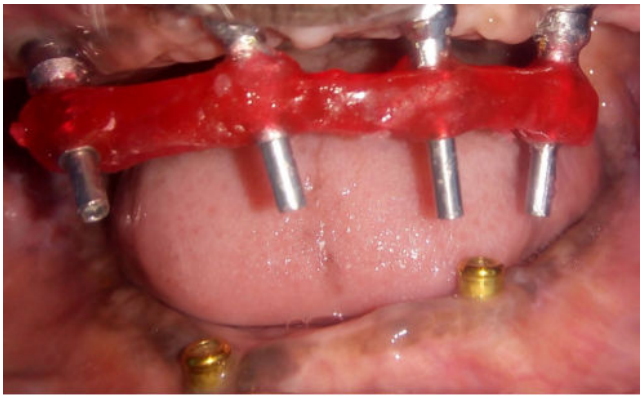

Figure 12: Splinted copings in maxillary arch.

The fit of the special tray was checked intraorally and later the impression copings were picked up by PVS putty wash impression. In the lower arch, special tray was constructed. Border molding and secondary impression was made with polyvinyl siloxane impression material (Figure 13). Master cast was fabricated with type IV dental stone for both upper and lower arches. On the upper master cast abutments were

connected to the cast and a jig trial of pattern resin was made. It was checked intraorally to verify the accuracy and position of the abutments picked up in the impression. After the jig verification, cobalt chromium framework was fabricated. Face bow transfer and jaw relation was done following which teeth arrangement was carried on (Figure 14). Bilateral balanced occlusion was decided as the scheme of occlusion for this case. Wax try in was inserted, factors such as esthetics and phonetics were evaluated. After the trial verification, denture processing was carried out. Hybrid prostheses with metal framework for upper arch and in lower arch locator attachment overdenture was fabricated (Figure 15).

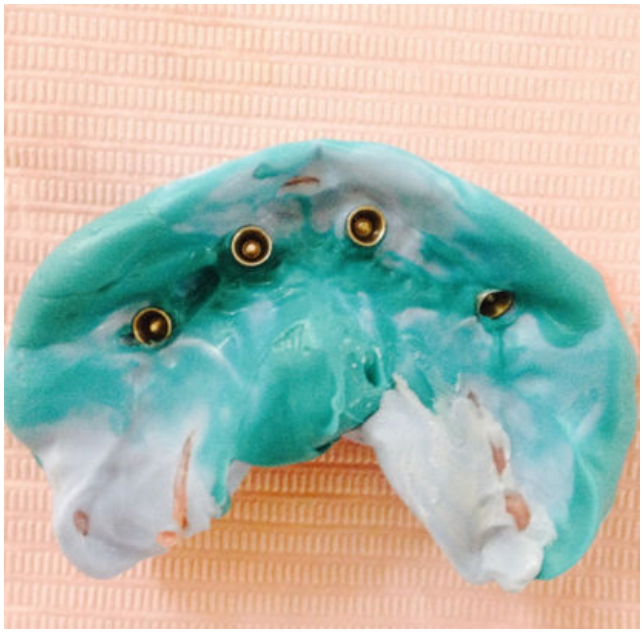

Figure 13: Maxillary arch abutment level impression with polyvinyl siloxane impression material (open tray impression).

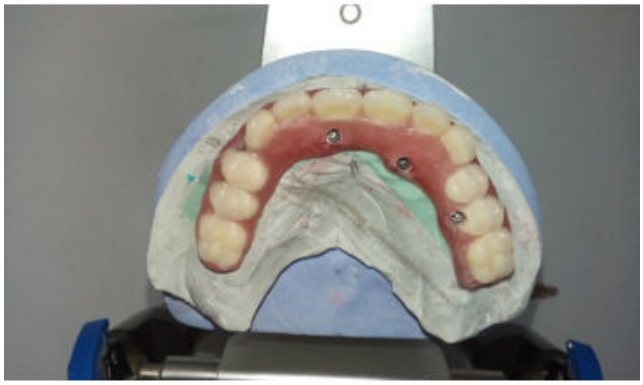

Figure 14: Teeth arrangement done in maxillary arch.

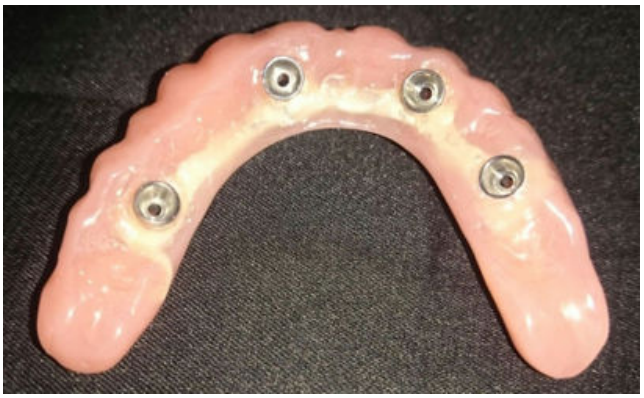

Figure 15: Intaglio surface of the hybrid prostheses in relation to maxilla.

The screw retained hybrid prostheses was inserted and the abutment screws were torqued to 15 Ncm. The screw access holes were later closed by light cure composite resin (Figure 16). Lower arch over denture was fabricated similar to the steps followed in temporary prostheses. Occlusion was checked and occlusal prematurities were removed. Soft occusal splint was fabricated for the maxillary arch covering the hybrid denture. The splint was given to decrease the occusal stress and harmonise the occusal force distribution. The patient was asked to wear the splint for fifteen days to a month duration (Figure 17). Periodic review was followed up after the treatment [7].

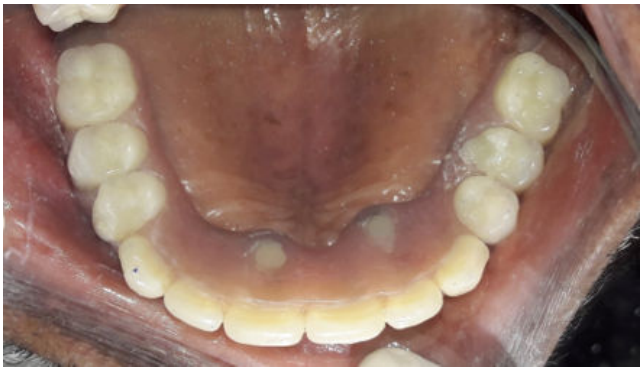

Figure 16: Hybrid prostheses with metal framework for upper arch.

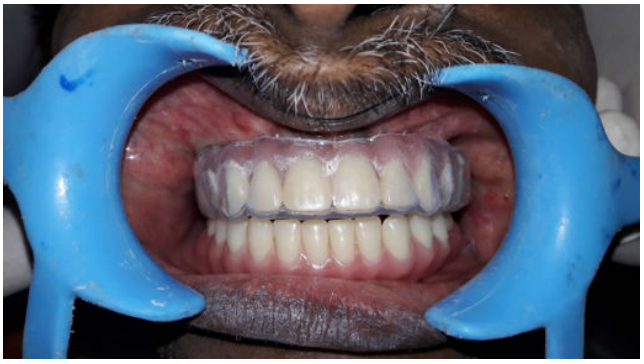

Figure 17: Soft occusal splint on the maxillary hybrid denture.

Discussion

Restoring the edentulous maxilla poses a greater challenge. Factors such as masticatory function and phonetics plays 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:

- Presence or absence of composite defect.
- Visibility or lack thereof of the residual ridge crest without denture in place, with normal smile.
- 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 and existing prosthesis [8].

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), additional number of implants considering failure of any, lack of provisional restorations, only delayed loading, decreased patient comfort. 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.

There are many surgical techniques for the placement of zygomatic implants, the initial classic technique was first described by Branemark. The survival rates of the zygomatic implants is 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, oroantral fistula with or without sinusitis are more commonly seen after the placement of implant.

Soft tissue inflammation can cause gingival problems around the implant. No such complaints were seen in our case, since proper oral hygiene and periodic follow up was done (three months once). No reports of sinusitis and oral antral fistula was reported in our case. The success rate of the zygomatic implants is around 97%. 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) was 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 over dentures. These prostheses can also be used in cases of combination of tilted and axial implants. 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 13 mm, respectively which is in line with the suggested values [9].

The other important factor during the manufacturing of implant-supported hybrid prosthesis is obtaining a passive fit of the framework. In the current case, verification index was fabricated, the material of choice of the index was pattern resin. This index was checked intraorally to confirm the accuracy of the implant positions seen in master cast. Other important factor to be consider when fabricating implant supported complete prosthesis is the framework material. In the current scenario, base metal alloy was used to fabricate the frameworks of the prostheses. 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 [10].

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. Thus the use of zygomatic implants have a lot of advantages over its disadvantages improving the overall patient comfort. No implant failure, peri-implantitis, a soft-tissue complication related to prosthesis design, fracture of prosthesis frameworks, screw fractures or screw loosening or difficulty in oral hygiene were noted in the patient during the follow-up period. 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.

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