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Prosthodontic Management of Malpositioned Implants in Anterior Maxillary Region: A Case Series

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Abstract : *Three cases of prosthodontic management of malpositioned implants have been reported. Case I presented with a severe faciopalatal and a deep apicocoronal position of the implant. Definitive restoration was planned using a UCLA type plastic abutment to fabricate a framework over which a cementable coping was made. Case II presented with severe faciopalatal angulation of the implant. The definitive prosthesis was fabricated using a custom cast abutment. Direct Ceramic build up was done over the abutment and it was attached to the fixture with the abutment screw. Case III also reported with severe labial angulation of both the implants and definitive restoration was done with the help of UCLA type plastic abutment to design a customized framework for the definitive prosthesis. Soft tissue management for all the three cases was done with the use of gingival porcelain on the cervical portion of the metal-ceramic restoration. The use of customized and UCLA abutments presents an easy and cost effective way of functional and esthetic rehabilitation of malpositioned implants.*

Keywords - *Custom cast implant abutment, UCLA abutment, faciopalatal angulation, gingival porcelain*

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I. Introduction

Implant restorations have become a predictable treatment option in dentistry. However, despite scaling great heights, implant supported restorations have various complications. These complications could be due to improper treatment planning; case selection; inadequate communication between the patient, the surgeon, the prosthodontist and laboratory personnel; faulty operator technique, to name a few[1,2]. Improper surgical placement of dental implants is one of the most commonly encountered clinical complication. Prosthetic management for these cases with misaligned and/or malposed implants are usually challenging for both the prosthodontist and the laboratory personnel[3,4]. Many techniques have been presented to overcome such complications including the use of angulated abutments, castable abutments, or in severe cases, removable prostheses[7,9,10].

This case series shows three cases of non-surgical, prosthetic management of malpositioned implants in the anterior maxillary region.

II. Case Description

CASE 1

A 25-year-old patient reported to the Department of Prosthodontics, DAPMRV Dental College, Bangalore, Karnataka, India with chief complaint of mobile tooth in maxillary left central incisor region.

Patient's history and clinical examination revealed that the patient had undergone fixed orthodontic mechanotherapy and had root resorption in maxillary left central incisor region. The patient was given the option of extraction and immediate placement of endosseous implant and she opted for the same. The treatment plan was thoroughly explained to the patient and a written consent was obtained before the commencement of the treatment. The patient revealed no relevant medical history and routine investigations were within normal limits. CBCT was done to evaluate the bone volume, based on which an implant of dimension 2.8 mm *11mm (Hi-Tech; tapered self-thread) was planned for surgical placement. The report also revealed concavity in the labial cortical plate and thus, on the day of surgery, extraction of maxillary left central incisor was followed by ridge split osteotomy and bone graft (NOVA BONE putty; USA) with subsequent placement of internal hex two stage implant.

After 6 months of healing period, the second stage surgery was performed. Cover screw was retrieved and healing abutment was placed.

During treatment planning for definitive restoration, faciopalatal angulation, apicocoronal depth and position of the endosseous implant were evaluated clinically and radiographically. The clinical examination and IOPAR revealed a severe faciopalatal angulation and submerged implant position in apicocoronal direction (Figure 1, Figure 2, Figure 3).

Fig 1 : Radiographic evaluation

Fig 2 : Submerged implant

Fig 3 : Severe faciopalatal angulation

At this stage, following options were presented to the patient:

- Re-submerging of osseointegrated implant followed by a fixed dental prosthesis, with maxillary left lateral incisor and maxillary right central incisor as abutments
- Surgical removal of malposed implant followed by grafting and a second implant placement at a later date
- Prosthodontic management by the use of combination of customized abutment and a hexed UCLA type plastic burn out pattern.

The patient was not willing for surgical procedures and opted for prosthodontic management by fabricating customized implant abutment. An open tray implant-level impression was made using an impression coping (Hi-tech) (Figure 4) and a polyether impression material (Impregum; 3M ESPE) and silicone resin (Ufi Gel P, VOCO) was applied all around the analog to mimic gingival tissue. The implant analog (Hi-Tech) was placed in the impression and type III dental stone (Kalstone; Kalabhai) was then poured, and models were made. A hexed UCLA burn out pattern sleeve (Hi-tech) was fitted to the implant analog.

Fig 4 : Open tray implant-level impression

The height of the sleeve was adjusted to obtain a 2mm clearance from the opposing dentition. Inlay casting wax (Renfert; Germany) was added in an incremental manner to obtain a wax pattern. The wax pattern was invested and subsequently cast.

The obtained customized abutment was tried on the fixture in the patient's mouth and checked for fit, angulation, and clearance (Figure 5).

Fig 5 : Customized abutment trial

The screw access channel was then blocked. Wax up was done over the framework directly using the inlay casting wax (Renfert; Germany) and casting was done to obtain the coping. The coping was tried (Figure 6) and shade selection (Vita toothguide 3D Master; USA) was done, and ceramic build-up was completed. This was followed by a bisque trial of the coping for the definitive restoration to evaluate and confirm the peri-implant soft tissue contour. The anterior guidance for the restoration was decided by the incisal guidance of the adjacent natural anterior teeth. The anterior guidance of restoration was kept as shallow as possible with no interferences in protrusive and lateral excursions with a clearance of 2 mm from the mandibular anterior teeth in centric occlusion.

Fig 6 : Coping trial

The tooth and gingival-colored veneering porcelain (LAVA; 3M ESPE) were added to the coping and it was glazed. The definitive restoration was then evaluated intraorally, and a periapical radiograph was made to verify the fit of the abutment and the restoration(Figure 7). The abutment screw was torqued to 30 N-cm with a

torque wrench (Hi-Tech), and the abutment screw-access channel was blocked using gauze and interim restorative material (Cavit 3M ESPE; USA).

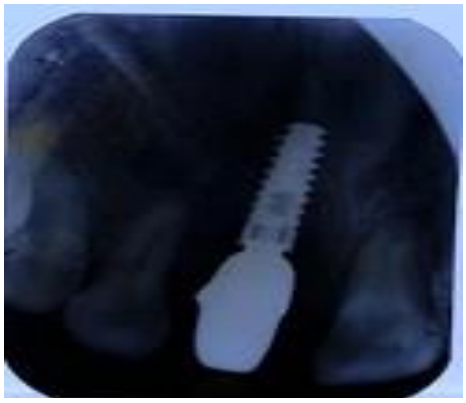

Fig 7 : Radiographic verification

The definitive restoration was then luted using Non eugenol temporary resin cement (Premier implant cement; USA) (Figure 8). The prosthesis was evaluated by regular followup at routine time interval of 1 month,3 months and 6 months.

Fig 8 : Intraoral and extraoral view post cementation

CASE 2

A 75 years old male patient reported to the department of Prosthodontics, DAPMRV Dental College, Bangalore, Karnataka, India with the chief complaint of missing tooth in maxillary left lateral incisor region. Clinical examination revealed root stumps in the maxillary left lateral incisor region. After all treatment options were discussed, patient decided for an endosseous implant supported restoration. The treatment plan was thoroughly explained to the patient and a written consent was obtained before the commencement of the treatment.

No relevant medical history was stated by the patient and results of routine investigations were within normal limits. The CBCT was done to find the bone volume and based on it, an implant of dimension 3.3 mm x 16 mm (Hi-Tech, tapered self-thread) was planned for the placement.

Following this, root stump extraction and immediate placement of endosseous internal hex two stage implant was done in the edentulous area. After six months of healing period, an IOPAR was taken, second stage surgery was done, the cover screw was retrieved and healing abutment was placed.

During treatment planning for definitive restoration, faciopalatal angulation, apicocoronal depth and position of the endosseous implant were evaluated clinically and radiographically. The placement of healing abutment showed severe faciopalatal angulation. (Figure9 ,Figure 10)

Fig 9 : Radiographic evaluation

Fig 10 : Severe faciopalatal angulation

Based on the clinical findings, following options were presented to the patient :

- Complete surgical removal of malposed implant followed by grafting and a second implant placement at a later date.
- Re-submerging of osseointegrated implant followed by a fixed dental prosthesis, with maxillary left central incisor and maxillary left canine as abutments.
- Prosthodontic management by fabricating customized implant abutment.

The patient was not willing for surgical procedures and opted for prosthodontic management by fabricating customized implant abutment.

An open tray implant level impression was made using an impression coping (Hi-tech) and Polyether monophase elastomeric impression material (Impregum penta; 3M ESPE). Implant analogue (Hi Tech) was placed and Silicone resin (Ufi Gel P, VOCO) was applied all around the analog to replicate gingival tissue.The impression was poured with Type III dental stone (Kalstone) to obtain a model.

Inlay casting wax (Renfert; Germany) was chosen for fabrication of wax pattern for custom cast abutment. Die lubricant was applied into the internal hex of the implant analog. A thin layer of wax was applied into the internal hex compartment, and the abutment screw was slowly screwed into place. This process was repeated couple of times till wax of adequate thickness was visible around the abutment screw. Inlay wax was then added to this incrementally to obtain a framework similar to the morphology of a maxillary left lateral incisor. [Figure 11].

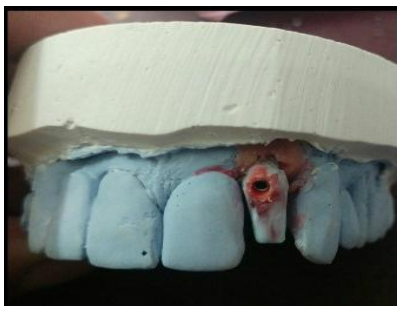

Fig 11 : Inlay wax pattern

The abutment screw was carefully removed, and the wax pattern was immediately invested and cast following standard casting procedures using Nickel-chromium alloy(SuperCast) [Figure 12].

Fig 12 : Casting of the crown

The obtained customized abutment was tried on the fixture in the patient's mouth and checked for fit, angulation, and clearance (Figure 13).

Fig 13 : Customized abutment trial

Due to malpositioning of implant, the screw access hole of framework was visible above the gingival zenith of adjacent central incisor. Hence it was decided to veneer that part of framework with gingival porcelain. The customized abutment trial was followed by shade selection (Vita toothguide 3D Master; USA), and ceramic build-up was completed. This was followed by a bisque trial of the abutment framework for the definitive restoration to evaluate and confirm the peri-implant soft tissue contour. The anterior guidance for the restoration was decided by the incisal guidance of the adjacent natural anterior teeth. The anterior guidance of restoration was kept as shallow as possible with no interferences in protrusive and lateral excursions with a clearance of 2 mm from the mandibular anterior teeth in centric occlusion.

The tooth and gingiva-colored veneering porcelain (LAVA; 3M ESPE) were added to the coping and it was glazed (Figure 14).

Fig 14 : Ginigival porcelain added

The definitive restoration was then evaluated intraorally and periapical radiograph was made to verify the fit of the abutment and the restoration. The abutment screw was torqued to 30 N-cm with a torque wrench (Hi-Tech), and the abutment screw-access channel was blocked using gauze and interim restorative material (Cavit 3M ESPE; USA). Composite resin(3M ESPE)was used to fill the access hole. The prosthesis was evaluated by regular followup at routine time interval of 1 month,3 months and 6 months.(Fig 15)

Fig 15 : Intraoral view post crown fixing

Case 3

A64-year-old patient reported to the Department of Prosthodontics, DAPMRV Dental College,Bangalore, Karnataka, India with chief complaint of missing teeth and wanting fixed replacement for the same.

Patient history, clinical examination, revealed all missing maxillary teeth except the left and right canine and endosseous implant in maxillary left and right central incisor region (Figure 16).

Fig 16 : Pre op image

The implants were surgically placed in the right and left maxillary central incisor region 6 months back and patient wanted the definitive prosthesis for the same.

Fig 17 : Surgical exposure of implants

Upon exposure of implant site and placement of healing abutment it was observed that the implants had an unfavourable faciopalatal angulation (Figure 17).

To overcome this, following options were presented to the patient:

- Re-submerging of osseointegrated implant followed by a fixed dental prosthesis, with maxillary left and right canine as abutments
- Complete surgical removal of malposed implant followed by grafting and a second implant placement at a later date.
- Prosthodontic management by the use of combination of customized abutment and hexed UCLA type plastic burn out pattern.

The patient was not willing for surgical procedures and opted for prosthodontic management by fabricating customized implant abutment. The treatment plan was thoroughly explained to the patient and a written consent was obtained before the commencement of the treatment. A closed tray implant-level impression was made using two impression copings (Hi-tech) and a polyether impression material (Impregum; 3M ESPE) and silicone resin (Ufi Gel P, VOCO) was applied around the analog to mimic gingival tissue. The implant analouges (Hi-Tech) were placed in the impression and type III dental stone (Kalstone; Kalabhai) was then poured, and models were made. Two hexed plastic castable abutment burn out pattern sleeves (Hi-tech) were fitted to the implant analogues. The height of the sleeves were adjusted to obtain a 2mm clearance from the opposing dentition. Inlay casting wax (Renfert; Germany) was added in an incremental manner to obtain a wax pattern. The wax pattern was invested and subsequently cast to obtain a framework. The obtained customized abutment was tried on the fixture in the patient's mouth and checked for fit, angulation, and clearance. The screw access channel was then blocked. Wax up was done over the framework directly using the inlay casting wax (Renfert; Germany) and casting was done to obtain the coping which was tried in the mouth (Figure 18).'

Fig 18 : Framework and Coping trial

Shade selection (Vita toothguide 3D Master; USA) was done, and ceramic build-up was completed. This was followed by a bisque trial of the coping for the definitive restoration to evaluate and confirm the peri-implant soft tissue contour. The tooth and gingiva-colored veneering porcelain (LAVA; 3M ESPE) were added to the coping and it was glazed (Figure19).

Fig 19 : Final coping with gingival porcelain

The definitive restoration was then evaluated intraorally, and periapical radiograph was made to verify the fit of the abutment and the restoration. The abutment screw was torqued to 30 N-cm with a torque wrench (Hi-Tech), and the abutment screw-access channels were blocked using gauze and an interim restorative material (Cavit 3M ESPE; USA) (Figure20)

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Fig 20 : Prosthesis delivery

The definitive restoration was then luted using Non eugenol temporary resin cement (Premier implant cement; USA)(Figure 21). The prosthesis was evaluated by regular followup at routine time interval of 1 month,3 months and 6 month.

Fig 21 : Extraoral view post cementation

III. Discussion

The placement of an endosseous implant in the anterior esthetic zone requires careful diagnosis and meticulous treatment planning. The most commonly encountered and avoidable error is the axial malpositioningof implants which poses a challenge to the Prosthodontist[2]. This is because of the angulation between the anterior maxillary alveolar bone and the coronal portion of the natural tooth. Added difficulty is the concavity of the alveolabial sulcus along with thin labial bone.

Axial malpositioning especially in the maxillary anterior region, precludes the development of ideal facial gingival contours, which compromises esthetics and in the long run leads to periimplantitits and subsequent implant failure[2,9,10].

A number of procedures for restoring a malposed implant have been reported in the literature. These include the use of prefabricated angulated abutments, customized abutments and UCLA type abutments. Surgical procedures such as sub apical osteotomy and segmental osteotomy are reserved for severe malpositioning. These procedures enhance the ease of restorability for the definitive prosthesis[7,10].

However, most of the times patients do not want to undergo a second surgical intervention, hence the prosthodontist is left with the options of angulated abutments, UCLA abutments and customized abutments.

The aim of this case series was to rehabilitate esthetics and function in anterior maxillary region using custom and UCLA type plastic abutments to correct the implant malpositioning[2,9].

Case I presented with unfavourable faciopalatal angulation of the implant. The definitive prosthesis was fabricated using a custom cast abutment. Direct Ceramic build up was done over the abutment and it was attached to the fixture with the abutment screw. Soft tissue around malpositioned implants also poses a challenge to the clinician especially when the patient presents with a high smile line, when the screw access hole is above the gingival zenith of adjacent teeth or when the apicocoronal positioning of implant is submerged.In this case the screw access hole was labial and above the gingival zenith of adjacent teeth. This was managed with theuse of gingival porcelain on the cervical portion of the metal-ceramic restoration, which is the easiest method of managing these problems[2,7,8,10].

Case II presented with unfavourable faciopalatal and a deep apicocoronal position of the implant. Definitive restoration was planned using a UCLA type plastic abutment to fabricate a framework over which a cementable coping was made and soft tissue management was done with gingival porcelain[2,9].

Case III also reported with severe labial angulation of both the implants and definitive restoration was done with the help of UCLA type plastic abutment to design a customized framework for the definitive prosthesis[7,8].

The therapeutic effect with immediate implant placement (Case 1 and Case 2) is the reduced period of edentulousness and overall reduced treatment period which would be psychologically benefitting to the patient.

Also, the unfavorable angulation of the implant necessitated the use of custom cast abutment and UCLA abutment to reduce the horizontal offset thereby directing the forces along the long axis of implant, thus reducing the torque value on the implant and hence reducing crestal bone loss.

Custom cast and UCLA type plastic abutments allow for easy restoration of the gingival tissues, which offers precise adaptation, associated with an accessible treatment cost. At the same time, the aesthetics of the metal collar can be corrected with the application of gingival ceramics. Alternative treatment option can be the use of CAD/CAM technology to fabricate customized abutments. It also facilitates the duplication of abutments in future from the same scanned file on the computer. However, this treatment alternative due to its high cost is still restrictive.

IV. Conclusion

To achieve an esthetically pleasing outcome, harmony between position and color of the definitive restoration with the adjacent teeth in the maxillary anterior region should be attained. Thus, when implants are malpositioned in relation to the adjacent teeth and/or associated with soft-tissue defects, the challenge to create harmonious mucogingival contours may be achieved with the placement of an appropriate customized, UCLA type plastic abutment and use of gingival porcelain.

Considering the patient's unwillingness for a second corrective surgical procedure, the above mentioned modalityprovides the Prosthodontist an easy, non-invasive, time saving and cost effective manner of restoring patient's esthetics and function.

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