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A Novel Approach for Maxillary Rehabilitation and Esthetic Problem Solving in Egyptian Patient - Case Report

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Abstract

Background: Tooth loss due to caries and or vertical bone loss are a common phenomenon among middle age Egyptians which require esthetic and surgical management . This case report discusses the management of restoring missing teeth and esthetic smile makeover with vertical bone loss.

Methodology: Thorough patient assessment was followed by taking impression, diagnostic casts and radiographic examination including cone beam CT. After patient agreement on the proposed treatment plane, open and close sinus lift surgeries followed by implants and monolithic zirconia full coverage restorations in addition to restoration of carious teeth were carried out. The patient was followed up for one year postoperatively.

Conclusion: Esthetics and function were restored successfully with a combination of surgical and prosthetic intervention.

1 Introduction

Full mouth rehabilitation including functional reconstruction and esthetic rehabilitation is a topic of major interest in dentistry. Extreme vertical bone loss due to loss of teeth for long time is considered a major challenge that require surgical intervention to restore it.[1-2] Ridge resorption is a stumbling block for implant insertion thus it causes both functional and esthetics complications.[3] To overcome this problem, there are many treatment modalities including bone grafting, Schneiderian membrane elevation and guided bone regeneration.[4] Smile Makeover in parallel with restoring badly mutilated teeth and missing teeth are also challenging as there are multiple factors affecting the treatment plan. According to World Health Organization, untreated dental caries is the most common dental health condition. Dental caries is multifactorial disease that affects the surface of the tooth due to the interaction between the bacteria and sugar intake producing acids that demineralize the tooth structure. [5] Caries may cause pulp involvement and root canal intervention; it may even lead to destruction of the majority of tooth structure which necessitates extraction. [5]

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This case report discusses a novel technique for esthetic and functional restoration.

1.1 Case Presentation:

This case report has been described according to the 2013 CARE checklist for case report writing and publishing guidelines.[6]

1.2 Patient Information:

A 45-years-old male patient came to the outpatient clinic, October University for Modern Sciences and Arts, faculty of Dentistry, complaining from difficulty of chewing and non-esthetic smile. The patient's medical history showed no medical illness. The patient is an employee living in Giza, Egypt. The patient has been to the dentist multiple times for extractions of badly mutilated teeth. The patient has poor oral hygiene and barely brush his teeth.

1.3 Clinical Findings:

Clinical examination showed multiple remaining roots #11 #26 #37 #45 #46 #47, multiple edentulous spaces, extensive decay in tooth number #12 #13 #21 #24 #34. Plaque and calculus deposits including moderate chronic periodontitis at lower incisors with three mm clinical attachment loss measured from cemento-enamel junction to the base of the sulcus and chronic mild periodontitis at the lower lateral and canine teeth. Generalized plaque induced gingivitis at upper teeth is also seen on periodontal examination. Preoperative intraoral photographs were recorded from different aspects using Nikon 3500 DSLR and macro lens with aid of intraoral mirrors and mouth retractors (**Figure 1**).

Figure 1: A pre-operative photo showing multiple remaining roots and carious teeth

1.4 Diagnosis and Assessment:

The diagnosis started with primary impression using stock tray and alginate impression material for upper and lower arches to get a study cast. panoramic radiograph was taken to assess the remaining dentition regarding the prognosis of the remaining roots #11 #26 #37 #45 #46 #47 and checking the absence of any bony lesions. The radiographic examination includes cone beam Computed Tomography (CBCT) to observe the patient's bone volume and presence of any sinus disease.[7] According to Jensen [8], the patient's residual bone height at right side was category C (Four mm) so the suggested treatment modality was maxillary sinus elevation with lateral access and bone graft and immediate or delayed placement of implants. Regarding the left side, residual bone height was category D (Two mm) so the suggested treatment modality was maxillary sinus elevation with lateral access and bone graft and delayed placement of implants. The patient was non-smoker which minimized the risk of failure of the treatment plan. [9]

2 Methods

2.1 Stage 1 Periodontal treatment:

The treatment started by supragingival and subgingival scaling and root planning using ultrasonic scalar. Secondly, the patient was reinforced on proper oral hygiene measures such as the correct technique of tooth brushing and the importance of brushing three times daily. After two weeks revaluation is done on oral hygiene by checking the amount of plaque on teeth. The patient follows the oral hygiene measure which is an extremely crucial stage before completing the treatment plane. After six months, revaluation on the hygiene done again and the plaque was minimal so scaling using ultrasonic scalar and polishing was done.

2.2 Stage 2 Restorative phase:

Restoration of teeth #12 #13 #14 #22 #24 #34. For compromised teeth restorability, remaining tooth structure was evaluated after caries removal. Minimal two mm supragingival remaining tooth structure was considered restorable.

Teeth #13 #14 # 24 were restored by direct composite restoration (3M ESPE FILTEK Z250XT, Germany) using layering technique. Teeth #12 #22 #34 were pathologically exposed resulted from excavation using sharp excavator (Dentsply, Germany). Root canal treatment were done using rotary files (Pepsi gold, China) after checking the working length using apex locator (E connect, Eighteeth, China) under complete isolation using rubber dam. Master cones (Meta, Korea) were verified by tug back tactile sensation and X-ray. Irrigation was done using 2.5% sodium hypochlorite (Clorox, Egypt) using side vented

needle shortened two mm from actual working length followed by activation using ultrasonic device (Woodpecker, China). Obturation was done using vertical compaction technique. Fiber posts (Glassix, Swizerland) were cemented using resin cement (Voco,Germany) followed by core build up (Han Core, Korea).

2.3 Stage 3 Surgical phase:

Started by extraction of non-restorable remaining roots tooth #11 #25 #26 #37 #45 #46 #47 using elevators and remaining root forceps. After six months, the socket tooth #26 healed, thus the plane to restore it was done on two stages as the available bone height was two mm. The first stage was open sinus lift using direct/lateral window technique using Dask kit.

The procedure was done as following:

Anesthesia: posterior superior alveolar and greater palatine nerve block through slow infiltration by speed one ml/min. Then soft tissue incision that provide enough space for lateral window first by mid crestal incision by blade 15C then a vertical incision ten mm anterior to the wall of the maxillary sinus by blade 15C then a full thickness flap is reflected using muco-periosteal elevator.

Lateral window: the apical outline of the window was seven mm from the crest of the alveolar ridge. The size of the window is 20 mm mesiodistally and 15 mm apicocoronally so easy surgical access. Using Dask drill with gentle paintbrush strokes to create the lateral window until a bluish hue appeared. The bone is removed as the sinus is shallow. The final shape of the window is oval with smooth edge (**Figure 2**).

Figure 2. Intra-oral photo showing open sinus lift procedure for tooth #26 with intact Schneiderian membrane

Sinus membrane elevation starts by detaching the membrane then elevating the membrane by sinus curette starting from the floor of the sinus then anterior and posterior walls. The membrane integrity is tested by asking the patient to breathe deeply and checking the lifting of the membrane then 0.5mm bovine bone is augmented with gentle packing using a condenser. In addition, collagen resorbable membrane is placed over the window with no fixation needed.

Finally, suturing by vacryl 4 0 using simple interrupted technique. The patient is instructed to not use this side in chewing for at least two weeks, not to blow or cough for one week. A broad spectrum one gm Antibiotic was prescribed for one week, analgesic, anti-inflammatory drug and nasal decongestion for one week and dexamethasone intramuscular injection once immediately after the surgery and to go soft diet for at least one week. After five days, the patient is recalled to check the surgical site for any pain or inflammation. There was absence for any inflammation and the gingiva healed so the suture was removed. After six months, the patient was asymptomatic and cone beam CT reveled that the bone height was six mm so this means that the Schneiderian membrane was successfully elevated four mm initiating stage two which is close sinus lift to gain another two mm and insertion of implant at the same visit this is done as following: Anesthesia using four percent articaine with epinephrine 1/100000: posterior superior alveolar, greater palatine nerve block through slow infiltration by speed one ml/min. Then soft

tissue incision by blade 15C then a vertical incision by blade 15C then a full thickness flap is reflected. At the planned site for implant a pilot drill is used with length five mm which is one mm below the sinus membrane according to measurements from cone beam CT. An osteotome is used by gentle pushing motion to elevate the Schneiderian membrane another two mm to get a full length eight mm. Sequential drilling to prepare the implant site till the final drill with width 4.5 mm and length eight mm. Then, Nucleoss T6 implant placed using torque wrench (**Figure 3**).

Figure 3. Intra-oral photo showing implant placement using Hand wrench

Covering screw is placed over the implant and finally, suturing by vacryl 4 0 using simple interrupted technique.

After the surgery, a broad spectrum one gm Antibiotic is prescribed for one week, analgesic, anti-inflammatory drug for one week and dexamethasone intramuscular injection once immediately after the surgery and to go soft diet for at least one week. After five days, the patient is recalled to check the surgical site for any pain or inflammation. There was absence for any inflammation and the gingiva healed so the suture is removed. After three months, a cone beam CT reveled that an osteointegration formed around the implant so a crestal incision done using blade 15C, removing the covering screw then inserting the healing collar then suturing. After one week the gingiva healed following the shape of the healing collar so the healing collar was removed and the abutment is placed using the screw drive. Regarding right upper quadrant, based on cone beam CT, the bone height at the site tooth #16 was four mm so open sinus lift followed by bone augmentation and implant was done same as tooth # 26 except the implant and bone augmentation were inserted at the same visit. The patient is instructed to not use this side in chewing for at least two weeks, not to blow or cough for one week. A broad spectrum 1gm Antibiotic is prescribed for one week, analgesic, anti-inflammatory drug and nasal decongestion for one week and dexamethasone intramuscular injection once immediately after the surgery and to go soft diet for at least one week. After five days, the patient is recalled to check the surgical site for any pain or inflammation. There was absence for any inflammation and the gingiva healed so the suture is removed. After three months, a cone beam CT reveled that an osteointegration formed around the implant so a crestal incision done using blade 15C, removing the covering screw then inserting the healing collar then suturing. After one week the gingiva healed following the shape of the healing collar so the healing collar was removed and the abutment is placed using the screw drive. For tooth #36 Nucleoss T6 Implant with width four mm and length ten mm is placed. During drilling there was resistance in drills and implant placement.

2.4 Stage 4 Definitive Prosthetic Phase:

Prosthetic phase was designed using (Exocad, Germany) to compensate for disproportion vertical height defect of tooth # 21, gingival porcelain was intended to be used . The design included single crowns for teeth # 12, 13, 23 and 3-unit bridge using teeth # 11, 22 to restore tooth # 21. Teeth preparations were done according to the guideline of all ceramic preparations to receive full coverage high translucent zirconia fixed prostheses (**Figure 4**).

Figure 4. Intra-oral occlusal view showing reduced maxillary anterior teeth abutments for receiving zirconia restorations.

Mockup was done to verify the smile design using milled wax. Try in was done to check the margins integrity, stability and the design of the prothesis. Further phonetics analysis was done to verify incisal length and position. Finally, protheses were cemented using glass ionomer cement under isolation and gingival retraction using 00 retraction cord. Excess cement is removed using curette and dental floss for the contact areas. Occlusion was also checked using articulating paper. Tooth #34 is prepared to receive full coverage zirconia crown with the same procedure as anterior preparation. After three months from implant placement for tooth #16 and #26, cone beam CT revealed an osseointegration around the implant

so it is ready to receive the prosthetic part. After inserting the abutment, indirect impression technique was done. The crowns for the implant were cement retained using glass ionomer cement. Regarding lower posterior arch, an acrylic removable partial denture was constructed.

3 Results

After two weeks from implant insertion of tooth # 36 the patient was complaining from pain at the surgical site.

Clinical examination revealed severe inflammation and peri-implantitis related to the implant site and radiographic examination showed peri-implant radiolucency with no signs of osseointegration. Antibiotic and anti-inflammatory treatment was started for one week, but no improvement was observed. So, the implant was removed. The treatment plan for lower arch is shifted to removable partial denture. Follow up was performed four weeks and 12 weeks after the completion of the treatment plan (definitive prosthetic phase) with no complain and extreme patient satisfaction. In his own words, he regains his confidence and regains the ability to smile again (**Figure 5**).

Figure 5. Post-operative photo showing the full smile of the patient

Clinical and radiographic examination revealed complete osseointegration around the implants with no pain. The gingiva healed with no signs of inflammation. One year postoperative, the patient was recalled for clinical and radiographic follow up which showed no complaints (**Figure 6**).

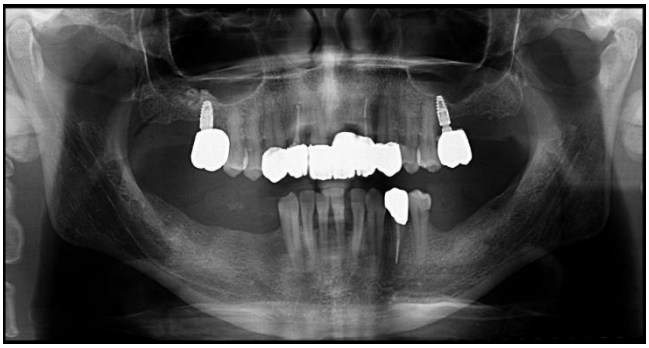

Figure 6. One year follow up panoramic view

Patient Perspective

The patient was satisfied from the final result. He regained his smile again and enhanced his chewing experience. The only disadvantage was the timeline of the treatment plan.

Informed Consent

The patient accepted and signed a written informed consent to allow this case report and associated photographs to be published.

4 Discussion

This case study discusses multidisciplinary approaches to full-mouth rehabilitation, which include periodontal, restorative, surgical, and prosthetic interventions. The main challenge for this patient was the bone loss at the posterior area. After extraction, the alveolar bone resorbs and the maxillary sinus becomes pneumatized, especially in the posterior maxilla. Restoring this edentulous space was done by one of the most conservative methods which are implants.

The implant success rate is linked to the implant bed's bone quality.[10] High Failure rate shown in posterior maxilla as the bone usually has poor density. [11-12] So, when the bone height is diminished, the bone height of the posterior maxilla can be increased by elevation and augmentation of maxillary sinus.[13] A lateral window sinus lift technique is mainly used as it shows greater success in bone height gain regardless the size of pre operative remaining bone height.[14-15] The elevation of the membrane followed by insertion of the implant was eight mm as it has lower risk of complication 3 times than inserting a longer implant.[16] These findings are in contrast to those reporting that the implant ≥10 mm has better prognosis than short implants as longer length distributes the functional forces better throughout the implant. [17-18] Another study shows no significant difference between long and short implants survival rates.[19]

Implant for tooth #36 exhibit periimplantitis which was a pathological disorder that affects the tissues

surrounding dental implants and was characterized by inflammation in the peri-implant mucosa and increasing loss of supporting bone.[20] The failure of implant of tooth #36 happened due to the density of lower mandible was D2, in addition the patient did not follow the post operative percussions regarding oral hygiene, also, there was high resistance during drilling which may lead to high heat generation even under copious coolant. This implant was the only failed one in the treatment plane.

Regarding the final prosthetic material, Zirconia was chosen as it has the highest mechanical properties among all dental ceramics.[21] Zirconia also exhibit low bacterial adherence which is essential in survival of the prothesis.[22] 135° shoulder finish line known as radial shoulder finish line was utilized because it has a higher fracture resistance than the 90° shoulder finish line. Shoulder finish line due to elimination of sharp internal angles so less stress concentration on tooth and crown.[23] Some hypothesis claim that chamfer margin is more rounded so less stress concentration on tooth and crown. [24] Since the radial shoulder does not have a steep angle, it has a low stress concentration. Furthermore, with low-strength ceramics like feldspathic ceramic, the difference in stresses would be large but in this case the restoration was zirconia that has high strength. Therefore, radial shoulder is suitable for all ceramic restoration than 90° shoulder which is previously commonly used.[25] Regarding the cementation, radial shoulder provides better seating of the restoration and allow easy escape of the excess cement[26].

Gingiva colored porcelain was added to pontic restoring tooth #21 to overcome the bony defect at this area for esthetic purpose.[27] Therefore, no implant is inserted for tooth #21 to save the patient for necessary preparations. Other authors suggest surgical approach for reconstruction of bony and gingival defect.[28] This approach was successful throughout 15 years[29] but this approach may cause numerous complications including infection. Therefore, pink porcelain was selected as it is more conservative approach.

5 Conclusion

This case illustrates that the use of bovine bone and collagen resorbable membrane with no fixation for open sinus lift and the simultaneous implant placement were effective and yields favorable results.

Zirconia also exhibited low bacterial adherence as well as using the radial shoulder finish line showed high fracture resistance.

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