

Case Report

Full mouth rehabilitation with All-On-4 concept-A case Report

YuYuan Chan,D.D.S,M.S

Resident doctor,Dental department,
Shin-Kong Wu Ho-Su Memorial
Hospital,Taipei,Taiwan

Corresponding author:**Min-Chieh Liu ,D.D.S,M.S**

Chief, Department of Restorative & Esthetic
Dentistry, Shin-Kong Wu Ho-Su Memorial
Hospital,Taipei,Taiwan

Address:No.95,Wen Chang Road, Shih Lin
District,Taipei City,Taiwan

E-mail: prostholiu@hotmail.com

Tel: +886-2-2833-2211 ext. 2170

Fax: +886-2-2838-9321

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Abstract

The success and surgical complexity of endosteal dental implants are significantly affected by re-sidual bone volume. However, compromised patient conditions such as poor quality of bone and patient's request for short treatment time both are common clinical problems. The following case report describes a case of a 57 year-old female patient with history of severe periodontitis in re-quired of fixed implant restorations. The patient's maximum residual bone height in the posterior mandibular is less than 4mm and there was also severe bone resorption over upper anterior region. In this case, considering its indication for patients with severe bone resorption, the All-on-4 concept was selected as the treatment procedure which can also improve the patient's appearance and chew-ing function.

Key words: tilting implant

Introduction

Nowadays, implant therapy has demonstrated high success rate and its treatment outcome are be-ing accepted by majority of patients. However, anatomic defect of residual alveolar ridge, which may be caused by trauma, periodontitis or sinus pneumatization over maxilla, may complicate the treatment plan and prolong the treatment time. In such cases, patients with severely resorbed bony defect need to go through substantial grafting procedures which may take 6 months or longer to re-construct implant sites¹.

The All-on-4 concept^{2,3} (Nobel Biocare AB,Goteberg,Sweden) is a method that full-arch fixed im-plant reconstruction supported by only 4 implants, which has the biomechanical advantage of occlusal stress distribution on distal cantilever arm and also increases Anteroposterior spread(A-P spread). This method advocates two anterior straight, regular-size implants and two posterior tilting ones both placed in an angle ranged from 30 to 45 degree. Angled multi-unit abutments are used to correct implants angulation and rigid supra-structure to splint four implants in full-arch reconstruction. In Malo's clinical studies up to 10 years follow-up, 98.1% implant-related survival rate and 92.8% implant survival rates for immediate loading were reported^{2,3,4}. However, questions remain with respect to the amount of stress generated at the peri-implant bone surrounding tilted implants which may cause peri-implant bone loss.

With two tilting implants over severe ridge resorption posterior region can avoid complex ridge augmentation procedure like sinus

elevation and increase A-P spread of implants^{5,6}. In the finite el-emment analysis study by Bevilacqua et al., they compared the vertical and 15-degree implant maximum stress values in compact bone with 150 N vertical load were 10.6 MPa for vertical implant and 18.9 MPa for 15-degree, 20.2 MPa for 30-degree angulation 25.0 MPa for 45-degree inclination. It seems that tilting single implants increase peri-implant bone stress compared to straight single implant⁶.

Design of distal tilted implants, splinted with rigid fixed denture over 150 N vertical load-ing, the stress level of the distal implants were -12.9% for 15-degree angulation, -47.5% for 30-degree angulation, and -73.5% for 45-degree angulation⁶. From 5 years follow up clinical result showed that the cumulative success rate were 98% for tilted implants and 93% for non-tilted implants^{2,5}.

Cantilever design is also a problem because of its poor stress distribution over implants and abutments. In the study by Rubo et al⁷ demonstrated that the increase in stress on implants was proportional to increased cantilever lengths. The investigation from Krek-manov et al. showed that distal implants tilted 45 degrees distally (distalization of the implant restorative platform) resulted in reductions of distal cantilevers up to 10 mm, when compared with the use of vertical implants and the load distribution result showed no sig-nificant difference between tilted and the non-tilted implants. Therefore, splinting tilted implants to reduce cantilever length is likely one of the treatment options to patients with compromised ridge condition.

The following full mouth rehabilitation report describes a case of "All-on-4 treatment con-cept", implant-supported fixed denture with minimum cantilever extension. Surgical guide was designed with the CT scan and EXOCAD software to simulate the implant position.

Case report

The healthy 57-year-old female presented with generalized severe chronic periodontitis and maxillary ill-fitting prostheses. The patient required a fixed restorative option which meet such criteria of non-interference of regular life and improve her appearance and chewing function. The patient had advanced alveolar bony destruction over anterior region in both arches and less than 4mm residual bone height over posterior region. (Fig.1)

First treatment option is staged approach and eight implant placement in maxilla and six implant placement in mandible which has more implant support but takes longer treatment period and fee. The other is "All-on-4 treatment concept" which can shorten treatment time and less cost but more biomechanic complication. After discussion, she chose the "All-on-4 treatment concept" for her full mouth rehabilitation.

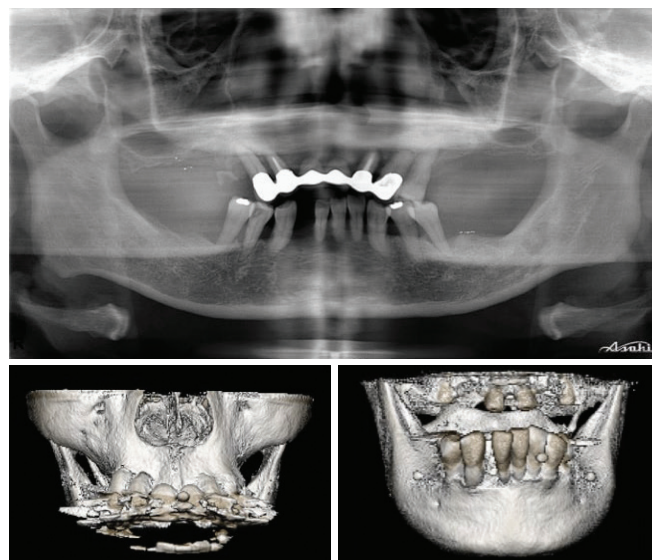


Figure 1. Panoramic radiograph and CT scan.

First, upper and lower anterior teeth were extracted in one appointment and then removable immediate denture was provided to rehabilitate her appearance and function. Lower premolar and canine were preserved for better removable denture stability and anchorage for surgical stent. According to the outline of removable immediate denture, CBCT scan (3DeXam, Kavo) with an image guide was performed for implant surgical design.(Fig.2) During the surgery, two straight implants and two 30-degree tilting implants (I55™ implants, AB Dental Devices, Ashdod, Israel) were placed over up-per and lower arch inter-foramina area with surgical template and anchorage pins. (Fig.3) Angled abutments were placed during the surgery to verify the angulation of implants in the same arch. Af-ter eight months postoperative healing, all implants were osseointegrated according to radiographic examination and clinical charting⁸. Temporary cylinders were placed at implants and were connected to the immediate dentures, which were then modified as interim fixed implant prostheses. (Fig.4) Patient had good feedback to her new fixed implant prostheses in terms of esthetics and function. Six-months after interim prosthesis delivery, upper and lower



Figure 2. Surgical guide design with EXOCAD.

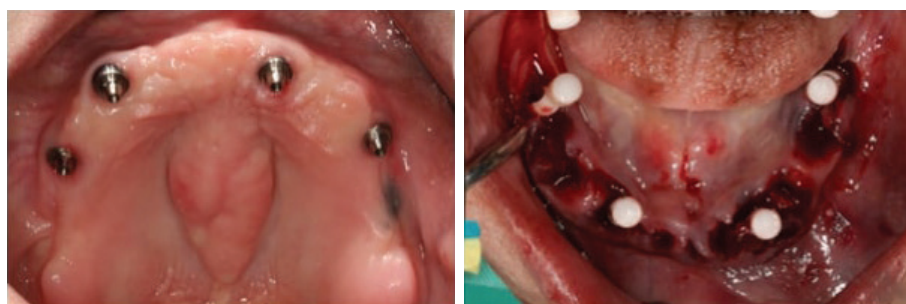


Figure 3. Implant placement and angulation.



Figure 4. Provisional Intraoral view.



Figure 5. (Upper) Master cast and (Lower) Verification jig.

implant abutment level polyether im-pressions were taken (3M ESPE Impregum Penta™ soft) with splinted impression cylinders.(Fig.5) The accuracy of the master casts were examined by verification

jig placing on implants with one-screw test^{9,10}. Both of the master casts were proven to be accurate. Then the interim fixed prostheses were placed on the master casts and casts were mounted on an articulator(Artex, Amann Girr-bach).(Fig.6) Putty matrix was made to record the interim occlusal setup as definitive denture teeth setup. (SR Orthosit PE, Ivoclar Vivadent)(Fig.7) During the clinical try-in, patient was satisfied with the esthetic of new prostheses.(Fig.8) Both the master casts and teeth arrangement were then digitally scan. Framework was designed as a 4x4 mm titanium milling bar and at least 2mm acrylic resin thickness was provided to attach denture teeth. The frameworks were milled as alumina replica for try-in first and checked with radiographs. (Fig.9) Definitive titanium frameworks were milled and denture teeth were arranged on them. After final wax-denture try-in and processing, the defini-tive prosthesis were delivered to the patient.(Fig.10) Recall checkups were done to verify occlusal condition, oral hygiene maintenance and structure integrity every 3 months.



Figure 6. Master cast mounting by provisional.



Figure 7. Denture teeth arrangement with use of putty matrix.



Figure 8. Wax denture Try-in.



Figure 9. Aluminum replica radiograph(Left) Framework design and aluminum replica try-in (Right).

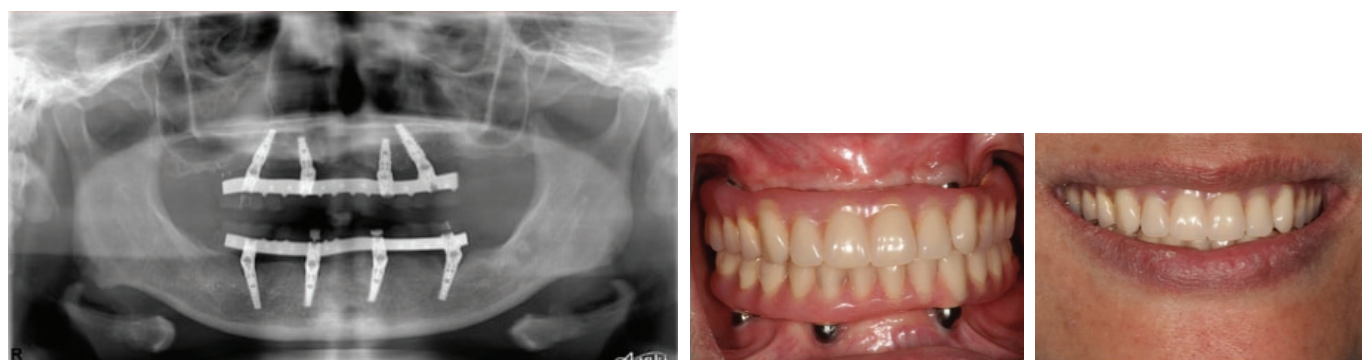


Figure 10. Final Radiograph(Left) Definitive Prosthesis(Right).

Discussion

The superstructure of implant supported fixed partial denture has two common designs: metal-ceramic fixed bridge and metal-acrylic resin complete implant supported fixed partial denture (ISFPD). There was no systematic study directly compared the incidence of prosthodontics complications between two kinds of design. From the viewpoint of technical complication, metal-acrylic resin ISFPD had more veneer chipping rate than metal-ceramic ISFPD in 15 years follow up. However veneer fractures may be caused by insufficient material thickness, design issues or technical errors^{5,11}. In our case, the superstructures were consisted by metal framework and acrylic resin. There were two reasons to support the design idea. First, in the condition of excessive inter-arch restoration space, constructing with metal-ceramic prosthesis may cause high incidence of casting distortion and high laboratory fee. Second, repaired acrylic resin is easier than ceramic restoration in full-arch complex design.

In this case, using provisional prosthesis for jaw relationship registration is more convenient and reliable than traditional method by using wax rim and record base. The provisional which were used for more than 6 months can offer direct patient information such as occlusal plane, incisal edge position, flange extension and occlusal guidance. With this information, the technician can easily process the definitive prosthesis and time efficient for dentist to proceed clinical adjustments.

Conclusion

With severe residual ridge resorption, full arch implant rehabilitation is challenging. One should consider simplifying the treatment procedure to meet the current esthetic dental standards and patient expectation. The All-on-4 concept satisfies patient's need in this case. By using tilted distal implant and hybrid prosthetic design, patients didn't go through complicated bone augmentation and multiple implants surgeries. It is also much simpler for a clinician to communicate with laboratory technicians for the fabrication of framework and prosthesis which was used to be time-consuming. In this case, a successful full mouth rehabilitation with the All-on-4 concept was demonstrated. There were no complications in the one-year recall.

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