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(CASE REPORT)

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Simple dental implant treatment for rehabilitating posterior mandibular teeth

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Abstract

Dental implant became the solution to conventional dentures and bridges these days. Both single crown implants and implant-supported fixed partial dentures came as the options for restoring partially missing teeth. Fixed implant supported restorations could be screwed, cemented, or both through cemented prosthesis with palatal or lingual fastening screws. Understanding the advantages and disadvantages of each system are important. This case report will show step by step of implant placement using bone level implant fixture and screw and cement retained zirconia restoration. Transgingival healing was achieved by using healing abutment through one step surgery. Good emergence profile acquired from the use of healing abutment will give good aesthetic outcome. Digital workflow was included in this treatment to replace impression process with digital scanning of implant. The fabricaton of the restoration used in this case also using CAD/CAM technology. Zirconia ceramic has proven to have strength and good aesthetic results in dentistry. Cementation of the restoration became one of the important steps in this case report, therefore determining the appropriate cement for zirconia would affect long-term outcome of the restoration. Patient were required to maintain oral hygiene before and after the implant placement. The aim of this case report is to show simple way in restoring missing teeth in posterior region of mandible by using dental implant.

Keywords: Dental implant; Bone level implant; Screw and cement retained prosthesis (SCRP); Zirconia restoration

1. Introduction

In public appearance, dentition is one of the most important things required these days. Teeth participate primarily as of the main components of smile. Decaying or missing teeth are very common these days. Some people still having poorly treated teeth and periodontal tissue, leading to total edentulism [1]. Figuring the right pattern of tooth loss in a population will help in determining the quality of dental health care given, which varies across countries [2]. Fortunately, prosthodontics gives a lot of solution for these problems, such as denture, crown, bridge, and dental implant. The option depends on local conditions and financial aspect of the treatment [1].

Dental implant came as the solution to conventional dentures and bridges. Both single crown implants and implant-supported fixed partial dentures (FPDs) became the available options to restore missing teeth. The important concept of dental implants is osseointegration, where osteoblasts grow and integrate with implant titanium surface [2]. Osseointegration concept first introduced almost 50 years ago by Branemark. Since then, implant dentistry has developed into predictable and successful treatment when replacing missing teeth [3, 4]. In comparison with other treatment modalities, dental implants preserve adjacent tooth structure and bone. Furthermore, implant rehabilitation for edentulous patients enhances masticatory function and quality of life [5].

Implant-supported dental prostheses have given new treatment options for rehabilitating dental arches with various condition from single or few missing teeth to completely edentulous jaws. Single missing tooth restoration using dental

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implant in posterior region of maxilla and mandible has a high survival rate. Various protocols for staging and loading to be able to manage implant after placement remain controversial. One of the traditional staging protocols was developed by Branemark. Placing implant in edentulous area after extraction of tooth/teeth, 3 to 6 months healing period is needed before placing an implant and another healing period for 3 to 6 months, followed by second stage surgery to expose implant, and then loading prosthetic restoration. This traditional protocol required longer treatment times and more steps. Research on dental implants has a lot of progress over many years, modification of implant surface roughness and macro-design has been one of the primary focus. These enhancements made clinical researchers started moving forward to immediate implant placement following tooth extraction [6].

Fixed implant-supported restorations may be screwed or cemented to the implant, or both through a cemented prosthesis with palatal or lingual fastening screws. Decision to use which system have to be planned before the surgery. Finding advantages and disadvantages of each system are very important. Screw-retained commonly indicated for prostheses with multiple abutments for easier cleaning and repairs possibility. Comparing this system with cement-retained prostheses will show that screw-retained show lesser marginal misfit at crown-implant surface, however screw-retained have higher complications, like screw loosening [7].

Cement-retained systems are more ideal where aesthetics is primary concern, as the system compensate unfavorable angulation of an implant related to the crown, simpler to fabricate, and reducing laboratory complications. However, clinician needs to avoid using too much cement, this will be causing soft tissue inflammation surrounding the restoration [7]. Screw retained implant restoration reduces the risk of cement retained implant restoration posed and subsequent soft tissue complications. Screw loosening can be minimized by using internal connection between abutment and implant fixture. The retention of single restoration combined with angulated screw channel abutment has shown good outcomes without any complications [8].

Zirconia ceramic being used in dentistry because of its high elastic modulus (220 GPa) and high flexural strength of the restoration, which give reliability to the dental surgeon in fatigue resistance to this material. The use of zirconia in implant-supported restoration being seen as a way to avoid adhesive problems because of the possibility to make screwed or cemented restorations on titanium bases with more parallel walls than a dental preparation [9]. Zirconia restoration on single tooth implant replacement have a high successful rate for 5 years as much as 97.1%. However, common complication that usually arise is the veneering material especially in the posterior region. For this problem, monolithic zirconia could become the choice for avoiding the technical complication [8].

2. Case Report

Female patient 56 years old came to RSGM Universitas Airlangga wanted to restore missing teeth in oral cavity with few dental implants. General condition of the patient is good. Extraoral view showed that patient have good condition. Intraoral condition showed that patient has missing teeth on 18, 28, 26, 38, 37, 45, remaining roots of teeth 47 and 48, and irreversible pulpitis on tooth 46. Radiograph shown that patient has low sinus floor, but patient rejected sinus lifting, and bridge for teeth 25, 26, 27 was planned. For teeth 37, 45, 47, dental implants were planned to restore the missing teeth. Zirconia monolithic material was used for bridge and for the implant, bone level tapered implant was used for the fixture. As for the abutment design, screw cemented retained prosthesis was used. Each solitary crown for the implant is using zirconia monolithic material. 3Y zirconia is chosen in this case because of its strength properties and in this case the implant will replace posterior teeth.

Figure 1 Patient intra-oral examination

Pre-surgery procedure started with scaling and root planing, continued with root canal treatment for tooth 46. Remaining roots of teeth 37 and 47 were extracted and patient waited for 3 months before starting the implant placement. For the surgery phase, it started with asepsis for implant equipment using autoclave and operator using surgical gown. Local anesthesia was done on buccal and lingual part of tooth 37 using Articaine hydrochloride 4%. Opening flap with envelope flap design, horizontally on top of 37 ridge following the gingival margin of tooth 36 and vertical incision on distal side of tooth 36. Flap was done using scalpel and blade number 15.

Figure 2 Local Anesthesia on tooth 37 region

Next step, flattening the implant area using round bur Ø 3,1 with max speed 800 rpm. Decrease the bone slowly and smoothen tapered ridge, after the procedure bone with flat surface and wide will be acquired. On bone area that will be inserted with implant, marked the area using round bur Ø 1.4 mm with max speed 800 rpm or needle drill Ø 1.6 mm. After that, marked implant axis by drilling until 6 mm using X Pilot VeloDrill Ø 2.2 mm. Confirmed that implant axis orientation with Ø 2.2 mm Alignment Pin. Continued the preparation using X Pilot VeloDrill Ø 2.2 mm with 8 mm length and 800 rpm max speed. Ø 2.2 mm Alignment Pin was used to check the depth of preparation and implant axis. Confirm the preparation using periapical X-ray with alignment pin inserted into the drilled area.

Figure 3 Profile drilling using BLT profile drill Ø 4.1 mm

Widen the implant bed using Ø 2.8 mm X VeloDrill with speed 600 rpm, on this step implant bed position could also be corrected. Use Ø 2.8 mm Depth Gauge to check preparation depth. Continued with Ø 3.5 mm X VeloDrill with speed 500 rpm and check the preparation depth using Ø 3.5 mm Depth Gauge. Implant preparation should be 2 mm below CEJ of adjacent tooth.

Figure 4 Tap drilling using BLT Tap Drill Ø 4.1 mm

This patient bone type is D1, so drilling process continued with BLT profile drill Ø 4.1 mm with speed 300 rpm. Tap drilling manually with Ø 4.1 mm BLT Tap Drill over the full depth of the implant bed preparation or by using handpiece with maximum speed 15 rpm. Implant placement using ratchet, make sure the implant is 2 mm below CEJ from tooth 36, attached ratchet adapter to Loxim and click sound will appear (adapter attached correctly), remove implant from the carrier and place implant with ratchet adapter into the implant bed, and move the ratchet clockwise.

Figure 5 Implant fixture placement using ratchet with adapter attached to Loxim Transfer Piece

Next, correct implant orientation while approaching the final implant position, make sure the height marking on the blue transfer part are oriented exactly orofacially. Remove instruments with Loxim, the Loxim can easily be re-inserted to finish uncomplete implant placement. If the implant needs to be removed during surgery, the Loxim allows for counterclockwise turns. After implant insertion has finished, detached the Loxim with adapter. If insertion torque over 35 Ncm is achieved before implant final position, check the implant bed preparation to avoid overcompression on bone. This case was planned with transgingival healing with delayed function. Insert transgingival type healing abutment, RC healing abutment conical shape. Continued with suturing on flap area.

Figure 6 Suturing the flap area around healing abutment

After the operation, patient was given antibiotics (Lincomycin 500 mg) and anti-inflammatory (Cataflam 50 mg) for 5 days. Control was done one day after surgery. Patient still felt pain on implant location, there was redness and gingiva swelling around implant location, and suture condition was good. One week after operation, another control was done and patient did not feel any pain and no abnormality was found around implant, and suture was absorbed well. 2 weeks after first control, patient was called back for another examination and gingival condition was good without any abnormalities.

Figure 7 Periapical X-ray of tooth 37 region after 3 months osseointegration process

After 3 months waiting for implant osseointegration process, patient came for periapical X-ray to see resorption around bone crestal. Healing Abutment was removed, the emergence profile formed according to shape of the healing abutment. In this case, impression process was replaced with digital workflow using intraoral scanner (IOS). Before starting the scanning process, area around implant should be dried. Firstly, start scanning the region around implant and the most important thing is emergence profile. After that insert implant Scanbody and start scanning again until the whole region is complete. Scan the antagonist region of implant, occlusion, and articulation of the jaw. Finally, the scanning result can be sent after shade guide selection for the restoration. Removed the implant Scanbody and insert the healing abutment back again.

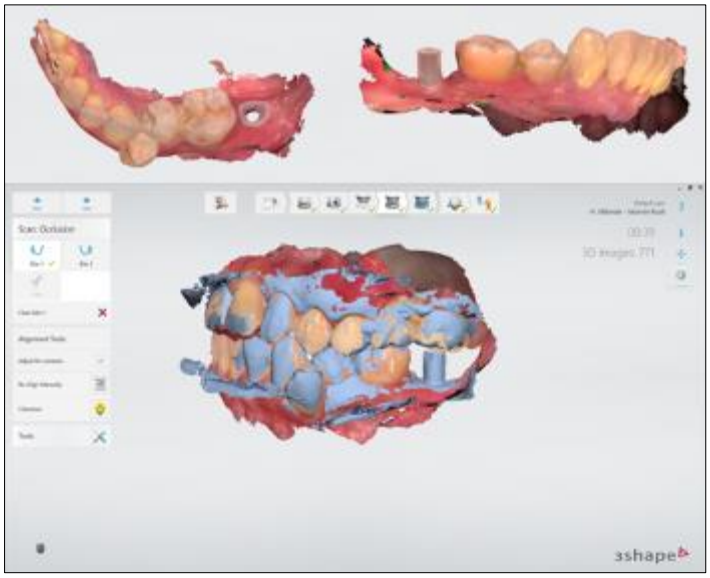

Figure 8 Scanning emergence profile, Implant Scanbody, and occlusion using Intra-Oral Scanner (TRIOS 3Shape, Denmark)

Next appointment, remove the healing abutment and check condition around implant. Insert abutment (Variobase) using guide and restoration, then checked occlusion, retention, stability, and pain. Checked the occlusion using articulating paper and adjustment is needed when there was premature contact. Applied Z-Prime on zirconia crown, continued with cementing using dual cure resin cement.

Before cementation, insert Teflon tape into abutment hole to avoid cement filling the area. After the cement already set, abutment and crown were detached from implant. Cleaned the remaining cement around the abutment and crown. Re-insertion of the abutment using ratchet with torque 30 Ncm.

Figure 9 Crown cementation using dual cure resin cement and re-insertion of the abutment

Refill the abutment hole with Teflon tape and filled the hole with composite restoration and polished the restoration. Control the restoration 24 hours after the cementation, if there were no complaint addressed by patient and no redness around gingiva, patient was instructed to cleaned proximal area of crown with dental floss. Final control done one week

after crown insertion. Patient did not feel any pain or discomfort. Clinical assessment showed no redness and swelling around crown area, percussion and palpation test was negative.

Figure 10 Insert Teflon tape to abutment hole and filled with composite restoration

3. Results and discussion

In this case, missing teeth in patient's mouth was restored with dental implant for teeth 37, 45, 47 and bridge for teeth 25, 26, 27. Before the rehabilitation process begin, tooth 46 with irreversible pulpitis et causa periapical abscess was treated. From radiograph, there was radiolucent appearance around the apex of tooth 46. Root canal treatment was indicated and performed for this tooth. According to Reiser and Nevins classification, there were active lesion and tooth to implant lesion, one of the causes of implant periapical lesion (IPL) are microbial contamination originated from tooth adjacent to implant with periapical lesion. Main purpose of this IPL treatment is to eliminate infection. There are 4 stages of this therapy, such as 1) Determining early symptoms; 2) Identifying the cause; 3) Eliminating the source of infection; 4) Reconstructing missing tissue for implant placement [10].

Dental implants have many size and variation. This variation helps surgeon to adjust remaining alveolar bone condition, including bone height, bone width, bone length, and bone angulation. For this patient, bone level implant was indicated for teeth 37, 45, 47, because of bone width and length available for this area. For tooth 45 aesthetics is still needed for the patient smile. Implant fixture material used for these cases are Roxolid SLA, Alloy material consist of titanium and zirconium (Ti-15Zr). This material has high strength, and Roxolid material could be accepted biologically by alveolar bone tissue, and do not raise any reaction against foreign object after placement. Research comparing material properties between Roxolid with titanium implant showed few things: 1) Roxolid tensile strength exceed titanium by 10-15%; 2) Fatigue endurance of Roxolid proved to be much more than titanium by 30%; 3) Fatigue endurance on Roxolid is bigger by 11-3% than on titanium depends on the design. From this results, Roxolid material can be a promising replacement for titanium as implant fixture material [11].

Implant size was chosen according to space available between adjacent teeth or bone length. Calculation is important on deciding where implant will be placed, at least 1 mm inferior from maxillary and nasal sinus, incisive canal (maxilla median line) should be avoided, 5 mm anterior from mental foramen, 2 mm superior from mandibular canal, ≥1 mm from orofacial area, ≥3 mm from adjacent implant, and ≥ 1.5 mm from root of adjacent teeth [12]. From the calculation made before the surgery, it is decided that implant size that will be used are 4.1 mm implant Regular Crossfit. Transferring implant into oral cavity will be using Loxim Transfer Piece, the advantages are easy and safe to use when moving the implant into oral cavity, can be operated with available adapter, Loxim has self-retaining feature that attached to adapter after implant already inserted, has small diameter and short make it easy to use in narrow interdental area or on posterior case, have alignment pin for re-insertion of the implant, and have restoration-safe torque stop.

One stage surgery is being chosen for this case. After implant placement, transmucosal type healing abutment is installed (RC Conical Healing Abutment). Healing Abutment will shape soft tissue according to the shape of the abutment while the soft tissue in healing process. To acquire optimal abutment size, it needs to be stable for a long time, fit accuracy of the component to avoid screw loosening while functioning, have biocompatibility, and aesthetically pleasing. There are 2 types of abutment materials titanium and ceramic, each material has good response to bone margin stability and soft tissue, these 2 materials induced attachment of the mucosa surrounding it. While metal-

ceramic abutment causing soft tissue recession and increase crestal bone resorption. Abutment available in as pre-fabricated and custom type, each have different use for various cases.

Precision impression taking on implant are important step to avoid mechanical and biological complication. Conventional impression technique tends to encounter problem that causing displacement on implant component. By using intra oral scanner (IOS) and using CAD/CAM technology, clinical and laboratory error can be reduced. Blood, saliva, and other kind of fluid should be avoided because it will interfere with object scan quality. IOS produce impression with lowest error rate than any other technique [13]. After scanning emergence profile, implant Scanbody is inserted, this is very important because it will represent the position and direction of the implant, analog, and abutment while scanning procedure is ongoing. This Scanbody will help CAD/CAM software to align CAD/CAM restoration correctly.

Restoration fabricated for this case are solitary crown with zirconia monolithic material. This material selection is based on zirconia good mechanical and aesthetic properties [14]. Patient being told to take care her oral cavity hygiene and cleanliness, especially teeth and tissue around implants. Plaque control is very important for the long-term of the whole treatment. Dental floss can be used to clean proximal part of the teeth and routine check every 6 months are being informed to the patient. Zirconia restorations offer sufficient stability and has good clinical performance in terms of fracture resistance, marginal integrity and discoloration, and secondary caries. Restorations made from graded glass-zirconia are more resistant to sliding-contact damage to the current porcelain-veneered zirconia systems, so it will prevent fracture or chipping of porcelain veneer. The graded layer will enhance flexural fracture resistance for zirconia, allowing the application of thin restoration for conservative tooth preservation method [15].

Zirconia restorations showed to have better tissue response. Follow-up on zirconia clinical performance on premolar and molar region showed no fracture or failure [16, 17]. Because of high flexural strength, cementing zirconia does not need any pre-treatment. Since zirconia is not etchable, the material can be cemented by using glass ionomer cement (GIC) and resin-based cements. These 2 materials are primary choices for bonding ceramic restorations to remaining tooth structure and implant abutments, but the most common cement used for zirconia restoration are resin cements [18].

4. Conclusion

This case showed screw-retained implant restoration has become choice on many cases these days to restore missing teeth. The main reason is predictable retention and retrievability for repair of open contacts, fractured porcelain, and treatment of inflamed soft tissue; biological problem associated with residual cement can be avoided; only one margin, at implant/abutment interface, lesser complications; and simpler restoration process. The use of zirconia material for the restoration part show good outcome both mechanical and aesthetic, especially in premolar and molar region.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest.

Statement of ethical approval

The present research work does not contain any studies performed on animal/human subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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