Chapter 3 – Fabrication and attachment of prosthetics

Associate Professor of Department of Crown and Bridge, The Nippon Dental University School of Life Dentistry at Tokyo
Harunori Gomi

I. Fabrication of prosthesis

A. Temporary prosthesis and immediate loading

AQB implant is a type of artificial tooth that is formed of commercially pure titanium, thinly coated with recrystallized hydroxyapatite, and has been characterized with the ability to rapidly induce osteogenesis with its surrounding structures. In the past, removable-type dentures were usually adopted as the temporary prosthesis after a given consolidation period in which to achieve osseointegration with osteoinducing-type implants since the emphasis had been placed on leaving the fixture to remain at rest as much as possible. The concept of immediate loading in which the abutment is placed once establishing osseointegration was not even considered as an option.

The impression taking for AQB implant is conducted roughly two to three months later regardless of the type of the implant used. In other words, the final superstructure is not placed intraorally for at least three months. Factors such as the degree of applied forces or how much the application of forces have been relieved during the period from operation till the implant fusing with the bone, largely influences the treatment prognosis. Fundamentally with the two-piece type, the fixture of both one-stage and two-stage types are not exposed (Fig. 4-3-1). In adopting the two-piece type to implant one to two into the anterior region, the esthetics during the treatment can be achieved with the immediate attachment of removable denture or the direct bonding of temporary crown to the neighboring teeth. However, occlusal forces cannot be avoided if using the one-piece or one-piece T-type in which the abutment is exposed from the time of completing the operation (Fig. 4-3-2).

There is often a requirement for the temporary crown to be attached to the implant bodies in the frontal region. It is important here to avoid occlusal contact as much as possible, particularly the lateral forces by employing the tapping technique.

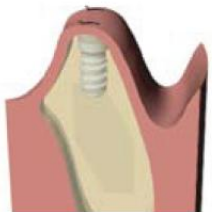

Fig. 4-3-1 Image of implanted AQB two-piece type

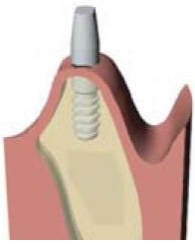

Fig. 4-3-2 Image of implanted AQB one-piece type

B. Points to consider for reconstruction and precaution

1. AQB one-piece type

The occlusion with the superstructure for the AQB one-piece must be conducted preoperatively using the set-up model since its body is a seamless spiral cylinder. For this reason, the implantation position and orientations become vital. The impression taking (refer to the previous chapter for further details) should

be conducted by the method used for the natural teeth once the implant body has been installed at the correct location and osseointegration has been achieved. The diagnostic wax-up and fabrication of prosthesis can be conducted on the plaster working model therefore problems that may arise can be expected and prevented.

2. One piece T-type

The fabrication of the prosthesis can be done in the same way as with the one-piece type, but due to the taper added onto the axial plane and rounded edges on the one-piece type, it is less likely for the air bubbles to enter at the time of impression taking or pouring in the plaster. The construction is therefore easier with the T-type.

3. Two-piece type

The main application of the two-piece is to the single or multiple implantation cases where due to extreme alveolar bone resorptions, the implant bodies cannot be placed at the ideal locations and with correct orientations. In the multiple implant cases, the superstructures are likely to be connected. For the fabrication of such type of prosthesis, multi-abutment and pick-up coping are employed at the final impression taking and its formation on the working model. The superstructure body is finally formed on the working cast with artificial gum.

a. Straight abutment, angle abutment (Fig. 4-3-3 to 8)

Place the multi-abutment on the working cast to confirm its parallel nature, the depth of subgingival margin, clearance with opposing teeth to select a suitable abutment (straight or angled). The parallel nature of the implant body is important particularly when connecting superstructure for a case of multiple implantation. This can be established to some extent with the abutment, but the use of angled type should reduce the need to mill down the abutment to gain parallel bearing.

For a cast crown, diagnostic wax-up is conducted directly onto the prepared abutment. The facing cast crown is prepared accordingly with the design of the final superstructure. First coping with pattern resin is formed on the spacer, and wax-up on the final structural form with the usual method, and then cutback the teeth before applying the wax. The facing process is conducted by applying tooth color materials onto the metal coping.

Fig. 4-3-3 The use of angled abutment can help achieve parallelism of implant bodies

Fig. 4-3-4 Changes in mechanical strength should be considered when customizing the abutment

Fig. 4-3-5 Construct coping with the pattern resin by controlling the spacer accordingly with the final prosthetic design

Fig. 4-3-6 Wax-up with the usual procedure

Fig. 4-3-7 Cast with the usual procedure

Fig. 4-3-8 Fitting

b. Application of overdenture abutment (Fig 4-3-9 to 20)

There are A- and B-types to overdenture (OD) abutment that consists of magnetic attachment system. The A-type OD abutment is one where the base is attached to the fixture with OD screw, is often applied to cases where the thickness of the gingivae is limited. It can accommodate the change in the design, since the screw can simply be loosened to remove the abutment.

Type-B, on the other hand, is one that is attached to the fixture by its base, without the use of OD screw. The intraoral operation is simple but modification of the design at the later stages is difficult.

There are two methods to connect the keeper onto the magnetic attachment, wax-up on the OD abutment for casting, and modification to the OD abutment is done directly. The magnet housing is fabricated in the same way to the usual magnetic attachment denture after the attachment of the keeper to the casting material.

Fig. 4-3-9 OD abutment A (left) and OD abutment B (right)

Fig. 4-3-10 Implanting OD abutment

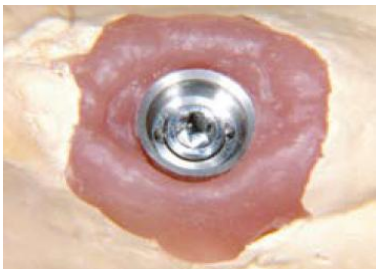

Fig. 4-3-11 Insertion should be done after a suitable surface treatment

Fig. 4-3-12 Wax-up to the OD abutment

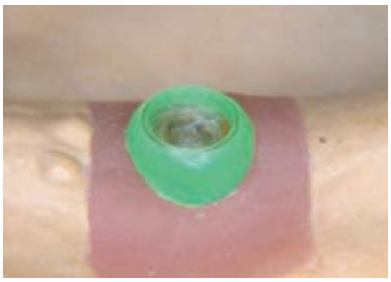

Fig. 4-3-13 Producing the designed wax pattern

Fig. 4-3-14 Casting with the usual method for finish

Fig. 4-3-15 To the keeper and the keeper attachment surface of the casting material should be sandblasted

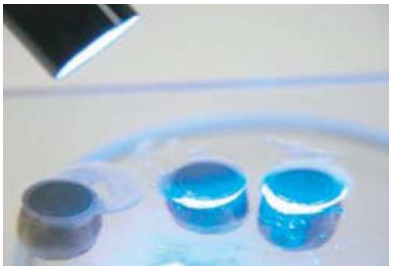

Fig. 4-3-16 Fuse the casting material and keeper together with resin-based bonding material

Fig. 4-3-17 Attachment with the OD abutment base

Fig. 4-3-18 Placing the prosthesis on the model. Except to the keeper attachment surface, the magnet surfaces are sandblasted

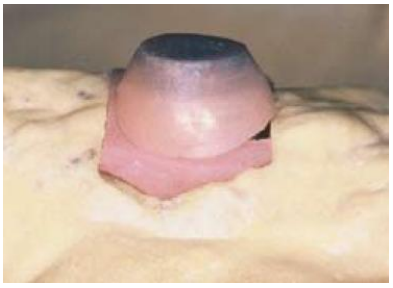

Fig. 4-3-19 Magnet housing is produced with the resin used for attachment, and cured.

Fig. 4-3-20 Attachment in the oral cavity

C. Confirming and assigning the occlusal form

The means by which the occlusal relationship is verified intraorally and on the model is the same as that for a typical clinical prosthodontics. The cantilever design should be avoided ideally as the implant body should only experiences axial forces. For the single tooth cases, where the occlusal guidance has been led by the region that has not been implanted, it is important to place the point of contact at the centric occlusion, and avoid it being set on the eccentric positions.

D. Determining the superstructure form

To enable attachment of implant superstructure that meets both the esthetics and the functional requirements, the simulation of final prosthesis before surgery should be conducted by producing a set-up model from the study model. The implant parameters should be determined by paying particular considerations to the actual alveolar bone width to which it will be inserted; the clearance between the implant abutment and the opposing teeth; and selecting implants with consideration to the mesiodistal width in the anterior region as well as the buccolingual width for the molar region. For cases of multiple implantations, two-piece type should be selected to accommodate superstructures that are connected, with a suitable abutment to fabricate the final prosthesis.

The structural form of the superstructure for the anterior teeth should be as close to the original shape as possible for estheticism, but the same considerations as to the pressure applied with the pontic bridge prosthesis sregarding factors such as buccolingual width to be made smaller for the molars to prevent the exertion of lateral forces applied to the molar regions.

Metals have been classically utilized in full cast crowns and facing cast crowns structures, but this does not necessarily mean that they cannot be produced metal-free. The factor that needs to be considered carefully is the hardness of porcelain if the natural tooth is on the opposite side to avoid attrition that can result if the hardness is extremely different from each other.

II. Points to consider and precaution for bonding

A. Fundamentals of the bonding method

The attachment of superstructure should be trialed in the same way as with the normal prosthetics. First confirm and adjust the point of contact with the adjacent teeth, then, check the fitting with the abutment. Confirm that it can be inserted into the margin and adjust if necessary. Provisional restoration must be inserted having adjusted the occlusion. Least amount of material should be used, and monitor for a week. Check the occlusal form again, for the final placement and bonding. The upmost care should be paid to through removal of cement that may be left remaining on the subgingival margin, but there are no particular cautionary points needed for the adhesion.

B. Connecting with the natural teeth

The connected superstructures are often adopted for AQB implant in which the basic concept is one-implant installation for each tooth loss. Cantilever form should be avoided to prevent excessive force being exerted onto the interacting surface of the implant and the bone.

The implant structure resides in the bone through fusing with the bone, whereas the natural teeth are connected via the periodontal ligament that acts as the periodontal membrane. The implant bodies

connected to natural teeth should be avoided as much as possible due to the difference in their respective movements. Under the clinical settings where the implant is connected to natural teeth, the occlusal force should be evenly distributed by forming connection to as many natural teeth as possible. Further, accurate superstructures with the incorporation of stress breaker to the connecting joint should be fabricated paying full considerations to the occlusal relationship.

Fig.4-3-21 Connecting implants and natural teeth

References

1) Akagawa Y, Takamori H, Nakamura T. Osseointegrated implant. Dental Outlook Separate volume. Tokyo. Ishiyaku Pub, Inc. 1993. (in Japanese)

2) Carl E. Misch. Dental implant prosthetics. Tokyo. Nagasue Shoten, Ltd. 2007. (in Japanese)