

Chapter 3 - Possible solutions to problems encountered at maintenance stage-2.

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I. Solutions to screw loosening and fractures

The screw that joins the fixture to the abutment is an indispensable component for the two-piece type, and the loosening of the screw is an issue throughout whole of the implant systems. All surgeons who have implanted two-piece type will have experienced screws becoming loose, at least once in their practice. Under the clinical settings, the screwing process is complicated by the invasion of soft tissues and blood into the connecting point, and the difficulty in gaining a direct view in the molar region therefore it is easier to feel the pressure and unease. Thus a more simplified screw system while still retaining the necessary strength is in demand. At the same time, we, as a surgeon, have to always have in mind the possibility of screw loosening and fracture, and be prepared to treat these problems accordingly.

A. Connective forms of abutment

To the abutment screws, there is the external joint type, in which the connection is formed on the external surface of the implant body, and the internal joint type that contains the joint within the implant body. The internal joint is further divided into a butt joint and a slip joint. The external joint is disadvantageous due to the effect it has on the surrounding alveolar bone structure. This is because a part of the alveolar bone has to be milled for the abutment placement; or the connection is located very close to the periosteum that is considered to easily lead to downgrowth, and consequently providing favorable conditions in which to develop peri-implantitis. The vast majority of implant systems have adopted the internal type, and so has AQB two-piece type.

The internal joint of the AQB two-piece type has been characterized by an octagonal butt joint, referred to as SOL system (Fig. 5-3-1). It adopts a unique shape, with an ability to disperse the stress, and with strong interlocking force. In the bending stress test, the two-piece type showed the ability to withstand higher amount of stress in comparison to the one-piece type (Fig. 5-3-2, 3). In order to maximize this property of the system, there are two main points that have to be taken into account.

1. Ensure complete removal of soft tissues and bone to enable full placement of the abutment

A secure connection cannot be made where soft tissues are present in between the fixture and the abutment, regardless of the joint types. It is therefore imperative to remove the surrounding soft tissues or bone that could become included in the joint. In situations where partial augmentation of the bone has developed on the implant root after GBR (Fig.5-3-4), these should be removed with a bone profiler (Fig. 5-3-5). The steps to completely exclude the surrounding soft tissues, and hemostasis should not be neglected.

2. Secure the screw with a driver equipped with control setting with torque force of 25 to 30 N

The force applied to tightening the screw with the hand is often below 25 N, which has often been

insufficient, resulting in its loosening. On the contrary, application of forces above 30 N should also be done cautiously when exchanging the abutment, since the implant body can also rotate.



Fig. 5-3-1 SOL system

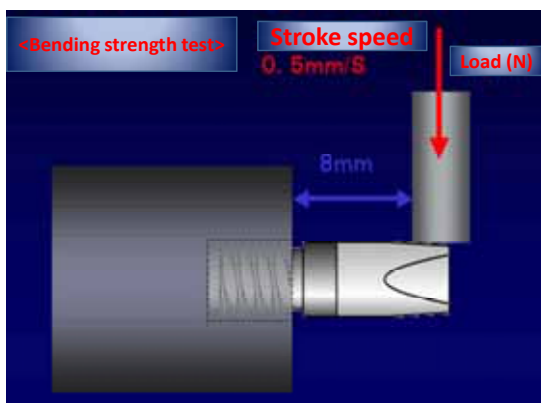


Fig. 5-3-2 The differences in strength of the two-piece type and previous types

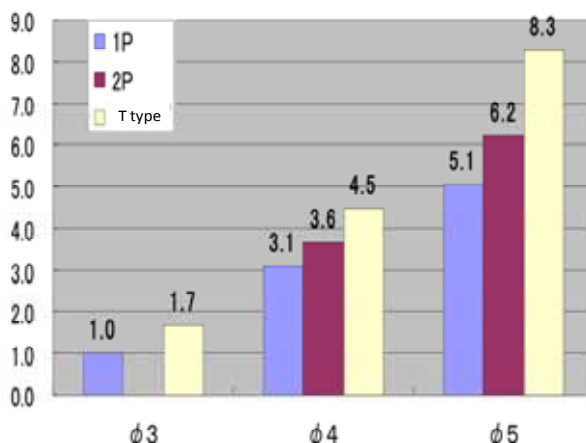


Fig. 5-3-3 The results of bending strength test when the strength of 3 mm diameter one-piece



Fig. 5-3-4 Partial bone augmentation to the top surface of the fixture



Fig. 5-3-5 Bone profilers



Fig. 5-3-6 Torque control

B. The basic techniques of abutment attachment

The abutment placement procedure

Anesthesia, gingival incision, detachment (Fig. 5-3-7-a,b)

Inspect the state of the fixture (Fig. 5-3-7-c,d)

Apply temporary suture, and gingival incision with a circular knife (Fig. 5-3-7-e)

Healing cap removal

Adjustment of the surrounding gingivae

Placement of the abutment (use of torque control) (Fig. 5-3-7-f)

Protection of screw (temporary seal, referred to as 'stopping')

Suture (Fig. 5-3-7-g)

Temporary attachment (Fig. 5-3-7-h)

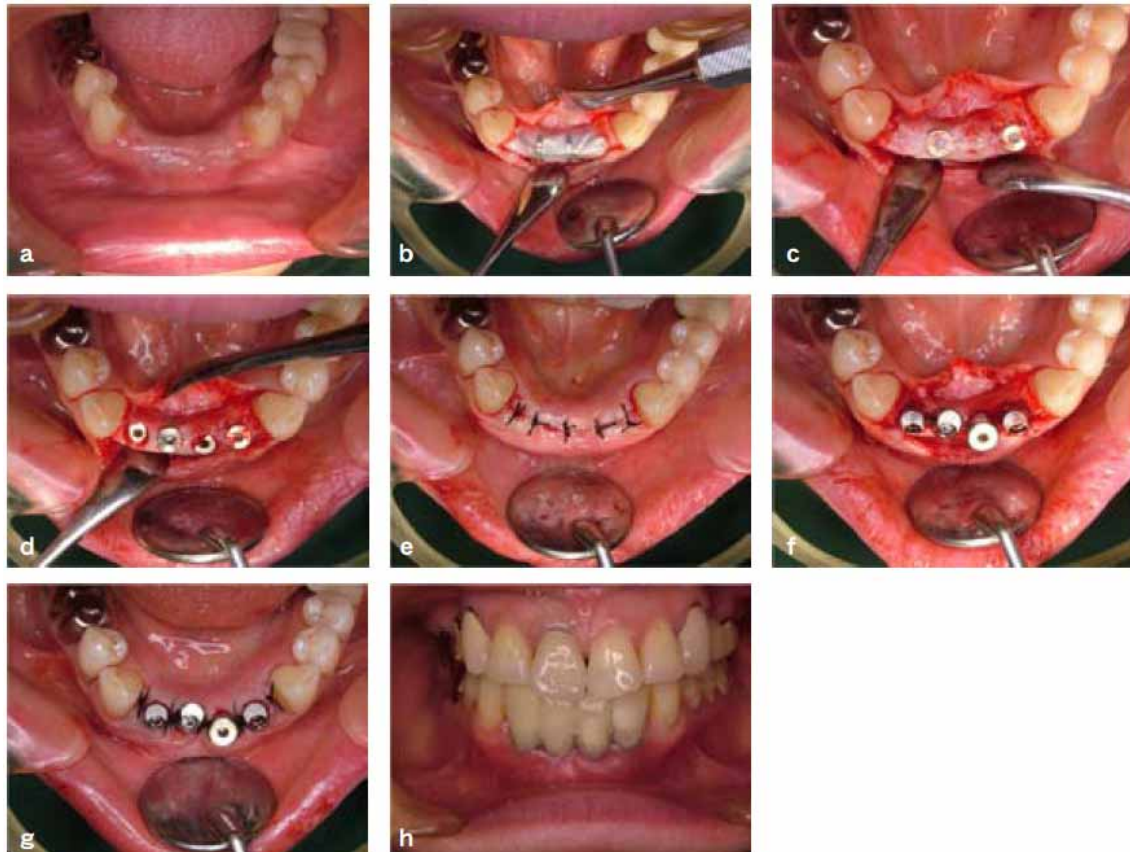


Fig. 5-3-7-a to h

- a. Preoperative image of the oral cavity
- b. Membrane exposed after incising and elevation of the gingivae
- c. The state after the removal of the membrane. New bone formation can be seen on the top of the fixture
- d. Exposing the healing cap by the removal of newly formed bone
- e. Temporary suture, and gingivae incised with circular knife.
- f. Abutment placement. Tighten with 25 N force employing torque control
- g. The state after the suture
- h. Installing false tooth, after the removal of sutures

C. Loosening of abutment

The screw must be securely tightened to ensure that the abutment does not come undone. The loosening of the abutment is induced by an application of external force, and often, with the occlusal force with the temporary crown. It is recommended therefore to inspect its state roughly a week after the placement of the temporary structure. The movement of the abutment can be perceived by the patients that the

implant body itself is becoming loose which can lead to panic. It may be an idea to explain this to the patient beforehand.

The radiograph observation, a week after applying occlusal force with temporary crown (Fig 5-3-8-a) does not show any bone resorption in the implant surroundings, but the loosening and floating up of the abutment can be seen. If the application of occlusal force persists, it can result in damages to the screws thus it is vital to tighten the screw immediately. The state after the screw tightening should be confirmed with a radiograph, as shown in Fig. 5-3-8-b.

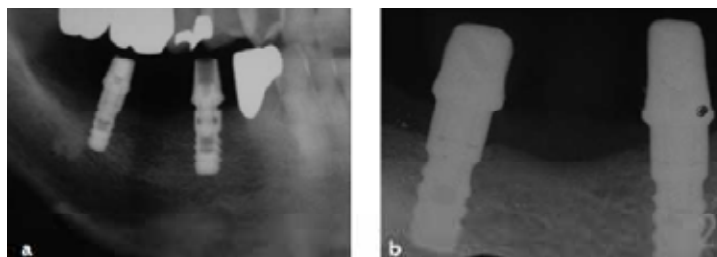


Fig. 5-3-8 A case where the abutment has become loose

a. Radiograph showing the loosening of the abutment

b. Radiograph showing the state directly after the tightening of the abutment

D. Fracturing of abutment

I have not yet experienced abutment fracture with the AQB two-piece type implants. The possible cause of the fracture is at the screws. A tool specific for retraction of the screw is in need to be developed, since complications at the removal of the screws can be anticipated.

II. The criteria to judge whether to remove or preserve the implant

The majority of cases with peri-implantitis are associated with progression of bone resorption. From the previous case examples it has often been found that where the bone resorption has progressed to expose half of the HA-coated portion without treatment, the implant has been observed to fall out within a period of two to three months.

There is no clear line to help decide on whether to remove or retain the implant body. In current practices, the treatment plans and the decisions on the suitability are made solely based on the past experiences of the dental practitioner.

A. A proposed criteria to judge whether to remove or preserve the implant

The treatment for peri-implantitis is often complicated. Particularly with regards to controlling the bacterial infection in the subgingivae, as in the natural teeth, thus, the primary importance is placed on creating an environment where the plaque management can be conducted easily. The regeneration of the bone once resorption has been induced is difficult even with preservation therapy such as laser therapy; therefore the emphasis has been placed on the preventive measures to stop the progression of resorption. The decision as to the extent of bone resorption before intervening is left to each dental practitioner. The criteria that I use to decide when to remove the implant are given below.

1. Bone resorption progressed to over a half of the length of the implant body, with the implant body

movement

The case where bone resorption associated with peri-implantitis is shown in Fig. 5-3-9. PMTC preservation treatments were conducted in this case, but peri-implantitis had nevertheless progressed. A radiograph image after ten months is shown in Fig 5-3-10. The implant was removed due to the progression of the condition. From the past experiences, once the bone resorption has surpassed half of the length of the implant body, reduction in the bone supporting the implant, breakdown of the root to crown ratio and resulting in loosening of the implant body. The preservation of the implant body once it becomes loose is difficult, and further progression of bone resorption without the implant removal can subsequently lead a state where re-insertion of the implant will no longer be possible.

2. Cases where the inflammation of the gingivae surrounding the implant body cannot be controlled
The development of chronic swelling of the gum or fistula can complicate the preservation therapy. The resorption of the surrounding bone is often progressive, and it is recommended to remove the implant body as soon as the symptoms are detected.

3. The absence of anchorage for implant
Where bone graft or artificial bone graft has been conducted to the region of bone resorption for preservation of implant, roughly two months of protected periods are needed. Protection can be achieved with the connection of the adjacent implants or with natural teeth with consideration to avoid application of occlusal force. The presence of anchorage therefore becomes the prime importance.



Fig. 5-3-9



Fig. 5-3-10

A case in which the peri-implantitis has been induced

Fig. 5-3-9 Radiograph in which bone resorption can be observed in the surroundings of implant

Fig. 5-3-10 The radiograph observation of the state (Fig. 5-3-9) 10 months later

III. Implant removal technique

In removing the implant, avoid excessive amount of milling to the surrounding bone and should be conducted with consideration to the possibility of re-implantation. The key is to preserve labial and buccal sides of the alveolar bone as much as possible.

Administration of local anesthetics have been adequate in the past practices, however, other anesthetics should be considered in situations where a significant anxiety is shown by the patient; or where inflammation is present in the neighboring structures such as the maxillary sinus. Intravenous or general anesthesia should be employed in such cases.

A. Extraction of blade-type implants (Fig. 5-3-11).

The extractions of the blade-type implant are generally perceived to be simple, but there are a few points

of caution that have to be taken into account. As displayed by the radiograph (Fig.5-3-11-a) of a blade-type implant affected with peri-implantitis. The soft tissues are usually entangled through the blade holes therefore the initial step should be to detach both sides of the blades free of the soft tissues. Next, using thin burs, such as fissure bur, disconnect the blade in a manner so that the bone can be conserved as much as possible (Fig. 5-3-11-d). The neck has the tendency break off if the blade is pulled out aggressively while the soft tissues are still tangled with the blade. It is often found to have subsided deep in the jaw, therefore the extraction procedure particularly to the lower mandible should be conducted with care to avoid causing damages to the lower alveolar nerve fibers. The soft tissues should be removed completely once finishing the extraction procedure, ready for closing the flap with stitching.

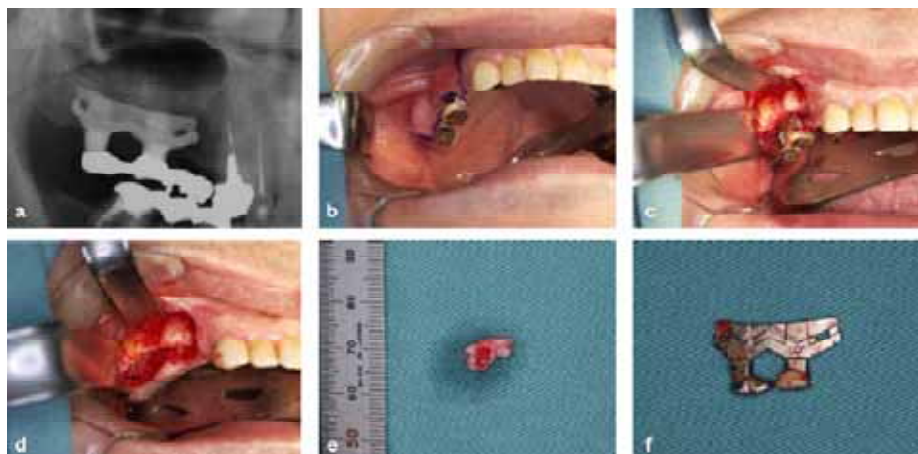


Fig. 5-3-11 A case example of extraction of blade-type implant

- a. Radiograph featuring the peri-implantitis around the blade-type implant.
- b. Oral cavity before the operation, featuring the incision line displayed.
- c. State of alveolar bone inflammation and exposure of blade-type implant.
- d. Once extracting the blade-type implant, conservation of the buccolabial alveolar bone is the key in this step.
- e. Piece of soft tissue that was entangled in the blade hole
- f. Blade implant extracted.

B. Extraction of tooth-root type implant (Fig. 5-3-12)

The difficulty in the extraction of tooth root type varieties depending on the surface material of the implant; whether it is titanium or HA. Both types however, should be extracted with bone-cutting forceps to take hold of the implant firmly (Fig. 5-3-12-d). Here, the practitioners tend to pull and rotate the implant in half-circles in the clockwise direction, but the key is to press and rotate in an anti-clockwise direction (Fig. 5-3-12-e). Once firmly getting hold of the implant body, remember to press before rotating. There is no need to mill down the surrounding bone to the implant base, but aim to grind down a third or a half of the bone quantity for implants with titanium surface, and a third for a HA coated implant. Remove the soft tissues completely after its extraction (Fig. 5-3-12-f). A significant bone resorption on the buccal and labial sides are found in the majority of the cases facing extraction, therefore the dimensions of the implant as well as the need for bone augmentation procedures should be determined at this stage.

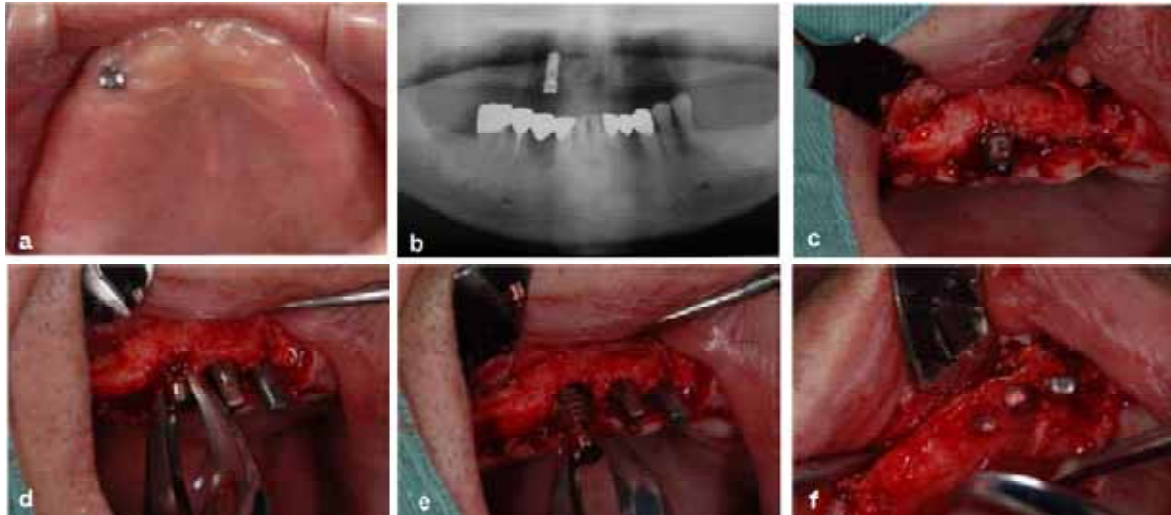


Fig. 5-3-12 A case example of artificial tooth-root type implant

- a. State of oral cavity before operation
- b. Panorama radiograph featuring the state with bone resorption surrounding the implant body.
- c. Mucoperiosteal flap formed to expose the implant body. A significant amount of soft tissues can be found in the surroundings.
- d. Hold the implant body firmly with the bone-cutting forceps.
- e. The implant body rises up by rotating the implant in a half circle while pressing the structure.
- f. Completely remove the soft tissues, once extracting the implant.

C. Extraction of AQB Implant (Fig 5-3-13)

The implant extraction due to complications such as inferior alveolar nerve paralysis, can be done without the need to mill down the bone and just by the anti-clockwise rotating action with the a wrench for roughly up to two weeks after the implantation. The implant can be lifted off easily by pressing down slightly when rotating in the anti-clockwise direction.

If extraction has to be conducted after the two week period, it often requires milling down of the bone. Here, aim to mill down the supporting bone to a third of the HA coating layer (approx. 3 mm). The surrounding bones can be conserved as much as possible by using thin burs, operated in a similar manner to how it is used to shave the HA coating layer.

A case where the AQB one-piece type implant was extracted due to fracture is presented (Fig. 5-3-13). The primary step in the extraction of the fractured implant at the HA coated region is to gain as much space to maximize the visualization of the fractured bodies. This is achieved by forming a large gingival periosteal flap extending towards the buccal and labial directions (Fig. 5-3-13-c). Once exposing the implant body, mill down another layer of the surrounding bone to establish a space needed to insert the hebel or the bone-cutting forceps (Fig. 5-3-13-d). Remember to press before rotating in the anti-clockwise direction to help its removal.

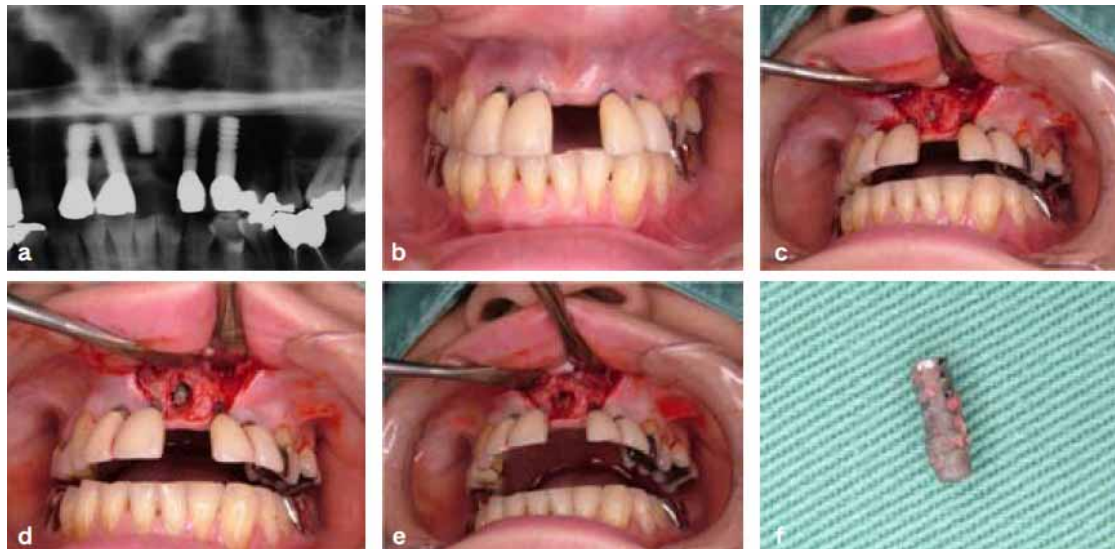


Fig. 5-3-13 A case example of extracting AQB Implant

- a. Preoperative radiograph featuring the state of AQB one-piece type (3 mm diameter) fracture.
- b. State of oral cavity before operation.
- c. Gingival periosteal flap formed to expose a part of fractured implant.
- d. Secure a space around the fracture implant to fit a habel forceps, by using a diamond turbine bur.
- e. State of the oral cavity after the extraction of the fractured implant body.
- f. Fractured implant.

D. Extraction of implant that strayed into the maxillary sinus (Fig. 5-3-14)

The implant body that stray into the sinus must be extracted. If the situation is complicated with the presence of maxillary sinusitis, it should be extracted once the sinus has returned to a state that is as close to its ordinary state as possible, by administering antibiotics to reduce the inflammation. In attempting to extract the implant where the inflammation is present, the search of the implant body can be made difficult, and risk unexpected bleeding.

The extraction technique is shown in Fig. 5-3-14. Administer infiltration anesthesia to the maxillary gingivae before forming mucoperiosteal flap to the buccal side to expose the anterior wall of the maxillary sinus (Fig.5-3-14-b). It should be operated carefully to avoid exposure of infraorbital foramen. The opening of the sinus wall is applied from the canine cavity, and the size of the hole should be roughly 2 cm diameter (Fig. 5-3-14-c). I have employed a small rounded diamond bur to cut into the anterior wall of the maxillary sinus. To gain visual clarity of the sinus interior, head lights or pen lights have been used for clarity, and a thin surgical aspiration tube has been effective for extraction of the implant body (Fig. 5-3-14-e). The sucking action often attracts and effectively attaches the implant body. The implants in the upright position are often found on the maxillary sinus floor, whereas those in sitting position, or lying horizontally are often found at the back wall of the sinus. If the position cannot be determined easily, it should be confirmed by taking another radiograph, or by getting the patient to jump and with bending forwards. The latter method has been effective for the implants to shift closer to the sinus opening, therefore making the search easier. Rinse and restore the mucoperiosteal flap to its original position, upon confirming that the bleeding to have stopped and apply suture. Warn the patient not to blow their nose, or to gurgle in a way that would apply negative pressure to the oral cavity.

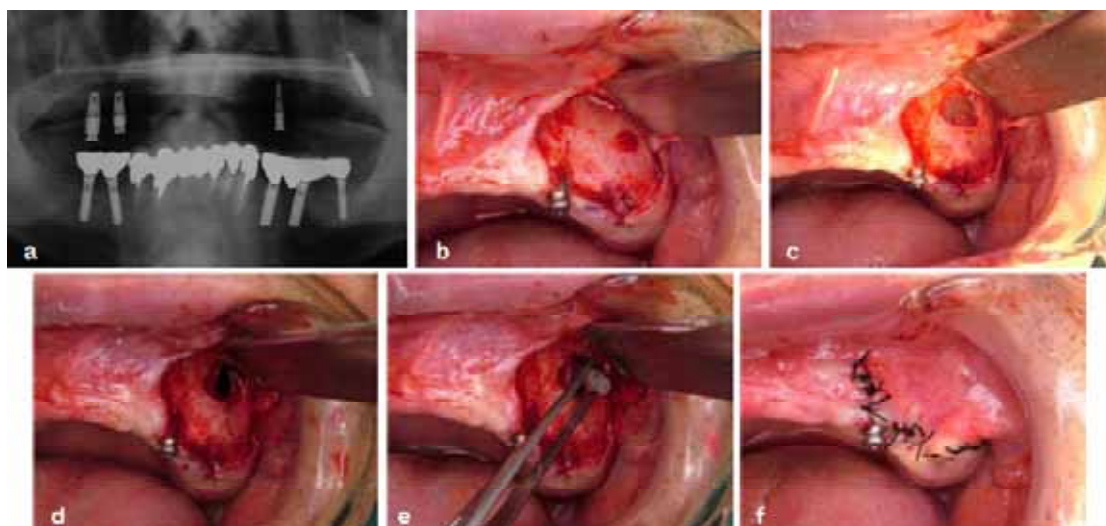


Fig. 5-3-14 A case example of extracting strayed implant from the maxillary sinus

- a. Preoperative panoramic radiograph. Implant strayed into the left maxillary sinus.
- b. Construct mucoperiosteal flap to expose the anterior wall of the maxillary sinus
- c. Open a hole of roughly 2 mm diameter to the bone of the anterior wall of the maxillary sinus. The picture shows the state whereby the sinus wall has been opened while conserving the sinus membrane structure.
- d. Enter into the maxillary sinus, by forming double doors on the sinus membrane.
- e. Extract the implant body with a thin aspiration tube, and holding it with surgical forceps.
- f. After the closure of the flap

IV. Preservation of implant with application of bone graft

The bone graft technique that is applied to overcome the bone resorption issues induced by peri-implantitis will be described. The key is to completely remove the soft tissues that have been affected, and to load the grafts into the area excluding any dead spaces created. Injured soft tissues are likely to be left untouched in the lingual and buccal sides. Therefore the mucoperiosteal flap should be formed ensuring that it reaches to the labial and buccal sides, and achieving full visualization of the implant body.

The case is demonstrated here together with the explanations (Fig.5-3-15). The radiograph featuring the peri-implantitis (Fig. 5-3-15-a) shows bone resorption to affect half the height of the implant as well as those of the adjacent teeth. The image of the oral cavity (Fig. 5-3-15-b) did not show any swelling or exudates in the gingivae. The tapping sound of the implant body was normal, and no looseness was shown.

The mucoperiosteal flap was formed on the buccal side (Fig. 5-3-15-c), where a significant amount of soft tissues were observed in the surroundings of the implant structure. Once extracting the adjacent tooth, the soft tissues surrounding the implants were thoroughly removed (Fig. 5-3-15-d). The formation of the flap on the palatal side is also required for thorough exclusion of the soft tissues at this stage. The bone collected from the maxillary tuberosity was loaded into the area excluding dead space created (Fig.5-3-15-e). Here, the flap was closed and sutured without the application of the membranes (Fig. 5-3-15-f). The radiograph (Fig. 5-3-15-g) shows the state of bone regeneration.



Fig. 5-3-15 A case where the implant was preserved with application of bone graft procedure

- a. Preoperative radiograph
- b. State of the oral cavity before the operation
- c. Formation of mucoperiosteal flap on the buccal side
- d. After the removal of the soft tissues around the implant
- e. Packing the bone collected from the maxillary tuberosity as much as possible.
- f. After suture
- g. Postoperative radiograph

V. Procedure from the extraction to re-implantation

A. Immediate re-implantation, straight after extraction

Several criteria have to be met in order to undergo immediate implantation method. The key is to determine how to regenerate the resorbed bone, surrounding the implant where the bone resorption had partially occurred. The vast majority of the cases encountered in the clinical settings have been resorbed in all aspects of the bone surrounding the implant, therefore limiting the number of cases with which this method can be applied with. The success of this method lies in at least three lateral sides of the supporting bone remaining, and should not be conducted for conditions that are less severe. In particular, the bones to be left remaining on the mesial and distal sides have been shown to be effective.

The bone graft or artificial bone graft have often been chosen to be conducted with hard bones such as cortical bone. This is so that the invasion of the epithelial layer into the bone structure can be avoided as the bone resorption is associated with the loss of periosteum.

A case example is presented where the artificial tooth root implant is extracted (Fig. 5-3-16). Refer to Fig. 5-3-12 for the state before the operation. The installation of AQB T-type implant (4ML) is shown (Fig. 5-3-16-a). A sufficient amount of bone is present to cover the mesial, buccal and distal sides, but not to the palatal side, and the recrystallized HA layer exposed can be seen. The cortical bone collected from the alveolar bone of the posterior region (Fig. 5-3-16-b) was divided into two, to cover the exposed HA coated layer. The fragments were pressed onto the surface with the tools (Fig. 5-3-16-c). The mucoperiosteal flap was restored in a way to cover the grafted bone, and was sutured (Fig. 5-3-16-d). The radiograph is shown in Fig. 5-3-16-e.

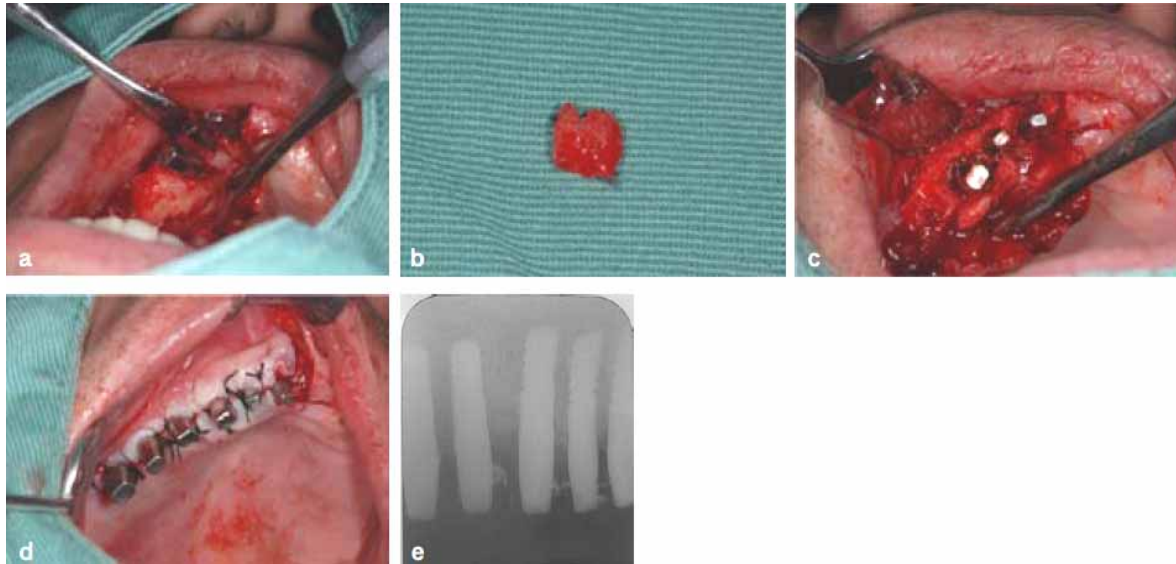


Fig. 5-3-16 Immediate re-implantation straight after the implant extraction.

- a. State of the oral cavity after the implantation
- b. Cortical bone collected from the alveolar region
- c. Grafting bone was divided into two and was pressed fixed to the exposed surface with applying pressure with the hand.
- d. After the suture
- e. Postoperative radiograph

B. Re-implantation with a consolidation period after extraction

This method has been indicated for cases where a significant bone resorption is present and where the disease state of acute inflammation still remains. The issue encountered here is how much consolidation period is required, but 6 months is often employed as the standard. From the past experiences, the bone graft that does not result in bone regeneration after six months is unlikely to ever regenerate. The sign of regeneration of the bone is often seen between three to six months period, therefore six months has been deemed a sufficient amount of time for the radiograph to be used as the determining factor.

A case was presented (Fig. 5-3-17), to which three AQB implants were installed to the right mandibular molars (Fig. 5-3-17-a). After two months, one of the implants was seen to rise up due to bone resorption (Fig. 5-3-17-b). It was extracted having established that it could not be treated to preserve the implant body. A temporary crown was placed onto the right mandibular implanting region, to establish vertical occlusion on the right (Fig. 5-3-17-c). The bone regeneration could not be detected at this stage therefore two AQB one-piece type implants were installed to the left mandibular molars (Fig. 5-3-17-d). Temporary crown was placed onto the implants to establish vertical occlusal in the molar region on both sides. The bone regeneration was detected 14 months after the extraction of implant, and was then re-implanted. The radiograph of the state two years later, showed satisfactory progress to have been made (Fig. 5-3-17-e).

C. A case where the re-implantation is complicated after the extraction

There are cases where bone regeneration would not be able to be achieved due to the severity of the state of bone resorption, particularly where all four sides of the supporting bone to have been affected. In such cases, re-implantation may need to be done to the places next to the original cavity.

A case example is presented (Fig. 5-3-18) affected by peri-implantitis (Fig. 5-3-18-a). The bone

regeneration at this location was unsuccessful, therefore re-implantation was done to distally to the extracted cavity (Fig.5-3-18-b). The bone regeneration in the extracted location can be observed, but has not been restored back to its original quantity.

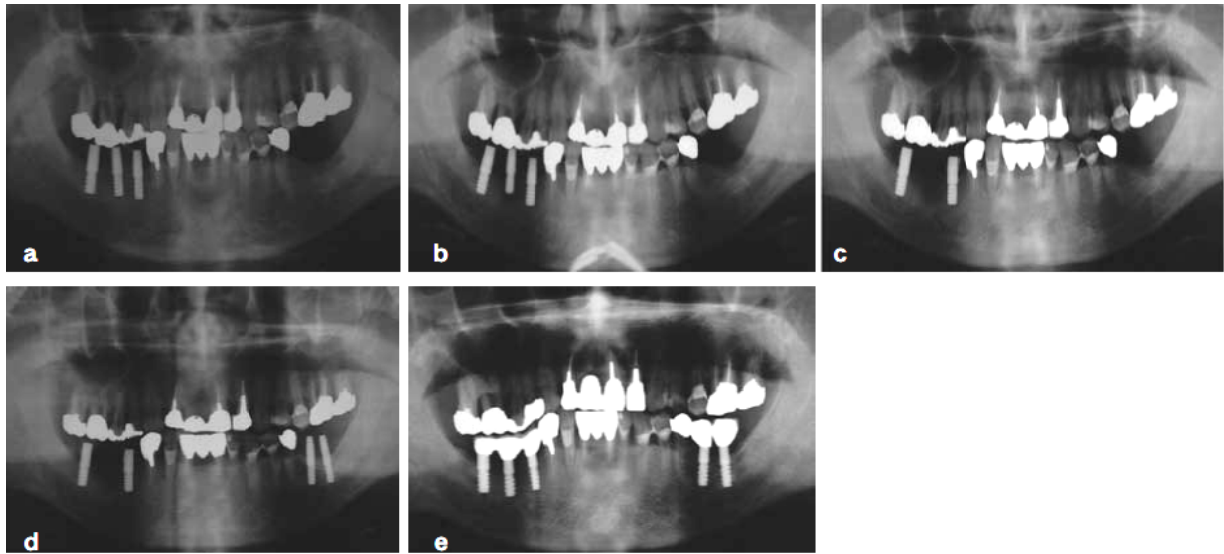


Fig. 5-3-17 A case of re-implantation with a consolidation period after extraction

- a. Three AQB one piece type implants were installed to the right mandibular molar region
- b. One of the implants was shown to be lifted after two months due to bone resorption
- c. Extracted this implant, and was capped with a temporary crown
- d. Two AQB implants were installed to the left mandibular molars,
- e. Radiograph taken two years after the re-implantation shows favorable progress

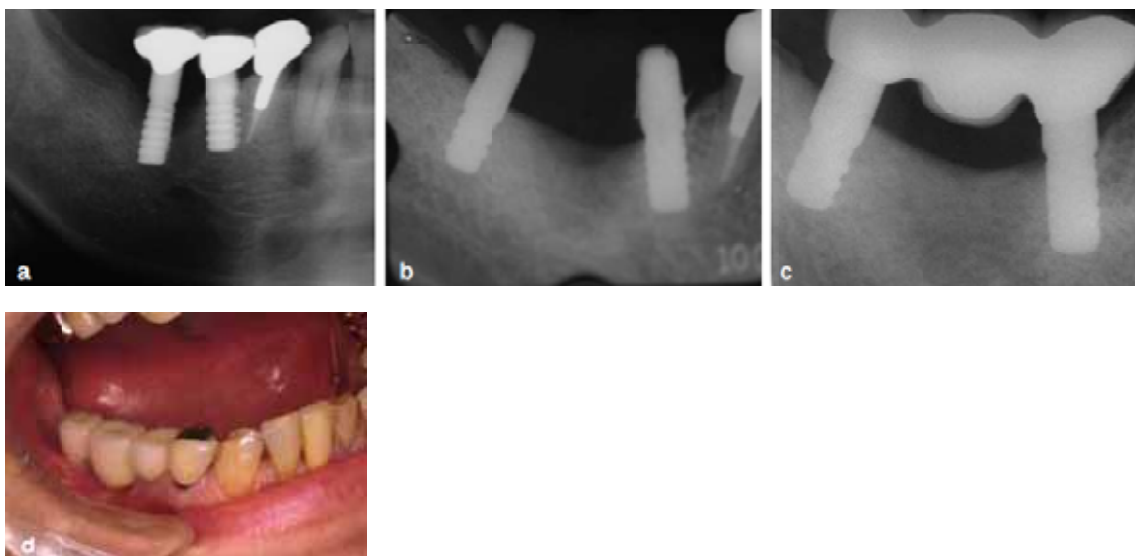


Fig. 5-3-18 A case where the re-implantation is complicated after the extraction

- a. Radiograph featuring the state of peri-implantitis.
- b. Re-implantation distal to the extraction cavity.
- c. Radiograph featuring the state two years after the re-implantation.
- d. State of the oral cavity two years after the re-implantation.

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