Chapter 2 Implant and oral surgery

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I. Basic concept of oral surgery for implant treatment

A.Concept of safe and secure implant treatment

Since implant treatment has been incorporated into the dental practice, technological advances in the areas of dental engineering on implant material and form, dental radiology on imaging analysis, oral pathology on implant surrounding tissue, oral surgery on operation method and postoperative management, and periodontology have made a substantial progress. A high success rate of implant treatment has been achieved by updating each implant system in incorporating these progresses.

There has been an increase in demand for minimal invasive methods in the clinical settings and the practice of safe and secure treatments is becoming an essential requirement. Yet the implant treatments often remain associated with complications such as postoperative bleeding and infection. Thus it is crucial to be faithful to the basics techniques and safe and accurate practice of oral surgery in order to prevent complications, and increase the success rate of implant treatments.

B. Preoperative plan for implant treatment.

Before surgery, it is essential to clarify the problems gathered from the medical consultations and examinations. By acquiring appropriate data of the patient, such as their mental, systemic and localized states, the treatment strategies can be planned in accordance with each issue unique to each case.

1. Collection and analysis of data

It is essential to evaluate the patient's condition by conducting medical interviews, oral examinations, model testing and with X-ray radiography, and if necessary, blood test, computed tomography (CT scan) and consulting medical doctor about the patient's medical history.

Blood test should be carried out appropriately for each patient condition. In particular, with diabetic patients, their haemoglobin A_{1c} values as well as the fasting sugar levels should be noted.

Should maxillary sinus base or the outer lines not appear on ortho-pantomogram, CT scan should be conducted to confirm the presence of sinusitis. In addition, where the outline of mandibular canal is vague, a CT scan should be necessary to note the position of the mandibular canal and the accurate distance between the mandibular canal and the alveolar bone. Consultations with the doctor in charge in patients concurrently taking anticoagulants or anti-platelet agents are required to inform them of the patient undergoing implant treatment, and seek advice whether to continue with the medication

2. Adaptive criteria of implant treatment

The suitability of implant treatment should be judged carefully by considering the medical examinations, as stated above, or if necessary consider other tests or seek secondary opinions from organizations that specialize in implants.

Patients with systemic conditions such as bacterial endocarditis; patients undergoing dialysis treatments; patient who has had radiation therapy for cervical malignant cancer; or diabetic patient who are taking bisphosphonates will need to consult their physician. Careful planning and a standardized

protocol should be outlined for implant treatments. In the cases where there is a possibility of localized infection to arise from the monitoring period, the standards of higher risk patients will need to be followed.

With the development in the surgical techniques relating to surgery, clear standards for the localized conditions have since disappeared. Standard has been established for those simple implant treatments not facilitated with the GBR and sinus lift techniques. The standards vary with different implant systems, but for AQB implants, the implant with 4 mm diameter, and length of over 8 mm to the root (part of HA) should be chosen.

3. Plan for implant treatment

First of all, the presence of occlusion at the posterior end of the mouth needs to be verified. Without the occlusion, this should be corrected by replacement with full, partial dentures or false teeth to establish vertical occlusion at the molar region. The priority lies in the correction of the posterior discrepancies before the frontal teeth, and should be treated one side at a time. In particular with AQB one-piece implant, even if the primary stability has been achieved, the biological interaction with the bone takes a long time, therefore it is essential to leave one of the sides to sustain all of the pressure until the correct vertical occlusion has been established on one side.

Planting to the anterior region should only be done once the posterior vertical occlusion has been established. The pressure exerted on the implant inserted into the anterior part of the mouth, before establishing posterior occlusion on both sides, would be too excessive for the anterior jaw to bear. It is imperative to avoid exertion of any pressure until the biological interaction has been established, as the anterior maxilla is less dense, and therefore much softer.

The localized plan for AQB implant treatment should follow the statements below:

1) Principally, one implant for one tooth
2) If for any financial reasons the above cannot be complied with, an intermediary tooth bridge can be fabricated instead of a extended bridge form
3) Avoid insertion of implants of 3 mm diameter, or root length (HA coated part) of 6 mm by itself. If these types have to be used, plant a few and connect them with the use of superstructures.
4) In applying over-denture for an edentulous patient, more than four implants should be established to provide support, in principle.

Furthermore, at the time of implantation, the factors below have to be considered:

Firstly, the size of the implant. Excess width of 1 mm is required on both buccal and labial sides of the implant body therefore indicating the jaw bone width to be 2 mm excess of the implant diameter. For example, the application of implant 4 mm in diameter should be planted into the bone that is over six millimeter width. If this is not possible, either change its diameter, or consider two-piece type in conjunction with GBR technique.

Regarding the plantation into a part of maxillary molars, the vertical length of the bone has to be known. If this is less than 8 mm, methods to augment the maxilla such as sinus-lift or socket-lift should be considered.

Once the treatment plan and the number of implants have been determined, patient consultation should be the next step. As well as oral explanatinon, information leaflet and patient consent forms should be

given. It is essential to form a relationship of trust and understanding before conducting implant surgery. If the patient has previously undergone implant treatment, the practitioner should gather information as to the treatment details, the implant system, and any aftereffects. The treatment plan should be finalized by incorporating the data and the views of the patient. The practitioner should be careful of criticizing the implant systems or the methods of the previous treatments since it can lead to medical lawsuit.

C. Understanding the efficiency and strong point of a implant

Various implant systems have been developed, but the characteristics and features are different for each. Therefore in constructing the treatment plans suitable for each implant system, it is important to incorporate the characteristics and features of each implant system.

The main characteristics of AQB implant is that the recrystallized hydroxyapatite (HA) coating the implant surface bonds rapidly with the jaw bone; and titanium surface containing calcium phosphate attaches firmly with the gingivae. In order to maximize the use of these characteristics, the implantation procedure should be conducted to enable full insertion of the implant fixture so that the HA coating is buried within the bone, and avoid over-tightening of the gingivae at the time of closing the gingival flap.

II. Basic surgical procedures for implant treatment

A. Creation of an ideal environment

1. Isolating the operation room

The ideal setting for an implant treatment, which requires sterile conditions, would be an isolated room that is cut off from the surrounding environment. However, in private practice, ensuring that there is an isolated room for operations is often difficult. In these circumstances, it is important to take the following into consideration:

1) Maintain separation from other patients. If this is not possible, suspend treatment of other patients and concentrate on the implant treatment alone.

2) Secure a space that is sufficient to avoid contamination of the surgical apparatus.

3) Provide appropriate air-conditioning.

2. Provision of adequate lighting (Fig. 3-2-1)

Securing sufficient lighting is essential for efficiency and to facilitate perform correct surgical procedures. Provision of several light sources may be necessary in some cases, to gain the required amount of light. During surgery, the light could be blocked off by the patient or the head of the first assistant, so in such situations, the operator will need to obtain the required illumination from sources such as a headlamp.

Fig.3-2-1 Obtaining sufficient amount of lighting

3. Methods of aspiration of blood and saliva

Aspiration of blood and saliva is required during implant surgery to secure the operation area, and leads to shortening of operation times. The usual aspirators used in dentistry are often ineffective in more confined areas; in which case, use a narrower tip on the aspiration tube. In implant surgery, bone fragments are also aspirated, along with blood and saliva, often resulting in blockage of tubes. Therefore, preparation of several aspiration tubes may be useful.

B. Team composition and roles during implant surgery

1. Team composition for implant surgery

A standard team for implant surgery is composed of four members, the surgeon, a first assistant, a second assistant, and a supporting staff member ('supporter'). If all are not available, the team will consist of a surgeon, a first assistant and a supporter. In this case, the surgeon will have to prepare the surgical tools himself/herself, increasing the number of roles that he/she has to play, and increasing the duration of the operation.

2. Roles of participants

The role of the first assistant is to secure a clear area for surgery, to instruct the patient appropriately, and maintain situational awareness. The patient should be instructed appropriately in synchrony with the intentions of the surgeon. Patient anxiety can lead to their breathing becoming more labored, which can lead to hyperventilation, therefore, control of breathing should be guided by the assistant to prevent this from happening.

The role of the second assistant is to pass surgical instruments appropriately, to put the instruments in order, and, in addition, the bone fragments that become attached to the drill should be secured and saved by the second assistant.

The role of the supporter tends to be neglected, but this role is vital, and includes maintenance of the supply of surgical apparatus (tools, gauze, thread, saline solution etc.), keeping a record of surgery (recording the starting and finishing times for surgery, and the size and the type of implant that was used) and aftercare of the patient (precautions, guidance to the radiography area).

C. Preparation and sterilization for implant surgery

1. Preparation of the surgical apparatus

The surgical apparatus required for implant surgery is shown in Fig. 3-2-2. These tools should be laid out in order of use, on top of the sterilized material.

Fig.3-2-3
Place surgical tools (Fig. 3-2-2) on the sterilized cloth

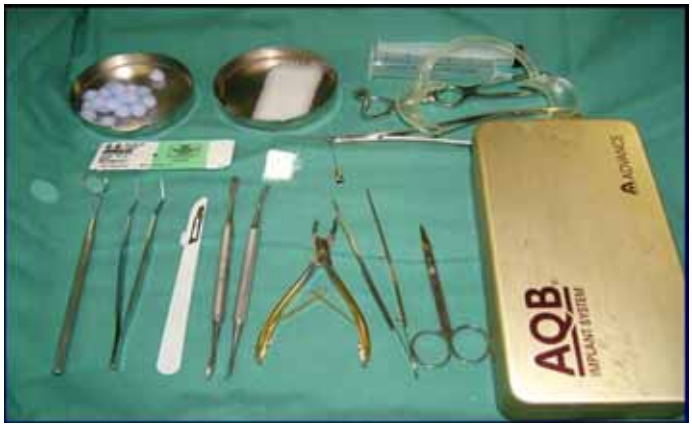

Fig. 3-2-2
Necessary surgical tools for implant operation

2. Sterilization of the surgical apparatus

Usually, the surgical apparatus is sterilized by exposure to 121 °C in an autoclave for 20 - 30 min, but for devices that cannot withstand heat, gas sterilization or chemical sterilization techniques are used.

3. Hand hygiene

All unnecessary clothing and attachments should be removed, and a surgical cap, mask and goggles put on in preparation for surgery, prior to disinfecting the hands. Scrubbing with 4% chlorhexidine surgical scrub (for external application) is used.

First, wet the hands, fingers and wrists. Then put 5 ml of the scrub solution into the palm of one hand and wash for a minute before rinsing with water. Apply another 5 ml of the solution and wash for two minutes before rinsing. The fingers should always be held in an upright position, and the water rinsed off towards the elbows. Wipe with sterile towels, and put on sterilized gloves (Fig. 3-2-4 a,b)

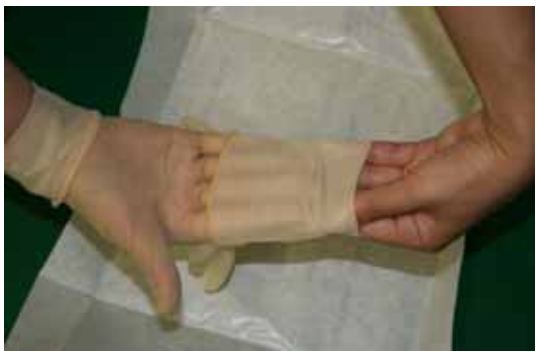

Fig. 3-2-4-a Fig. 3-2-4-b

Fig. 3-2-4-a,b Wear sterilized rubber gloves

4. Ensuring tidiness in the operation area

First loosen the patient's belt and/or tie to allow relaxation. Next, remove any dentures from the mouth, and brush the teeth. Disinfect any uncovered area around the mouth within the aperture of the drape. Cover the sterilized surroundings of the mouth, to secure a clear area for surgery. Some individuals become frightened when their eyes are covered by the drapes. A clean environment is necessary before the operation, and this should be explained as the rationale for use of the sterilized drape. Regions that are often touched by the surgeon or the first assistant during the surgery, such as the handles of the surgical lamps, suction aspirator, and contraheads should be covered with sterilized towels or Stockinette to avoid

contamination (Fig. 3-2-6-a,b,c).

Fig. 3-2-5
Cover the area surrounding the oral cavity with sterilized cloth with a hole to preserve clean operating area

Fig. 3-2-6-a

Fig. 3-2-6-b

Fig. 3-2-6-c

Fig. 3-2-6-a,b,c Cover the handle of shadowless lamp (a), contra head (b), absorption tool (c) etc. with sterilized towel or stockinette to prevent contamination.

D. Points for anesthesia and other concerns

Local anesthesia is generally used for implant surgery, however, for patients who are anxious about the surgery, intravenous sedation can be considered. Use of general anesthesia is considered for methods where the bone is extracted from elsewhere in the body such as the ilium.

1. Choice of anesthetic blocks and infiltration

Use of infiltration anesthesia should be the standard. Use of anesthetic blocks can be considered in cases where the plan is to insert a number of implants to replace the mandibular molars, or infiltrative anesthesia is inadequate, but this is not a common occurrence. Anesthetic blocks of the infra-orbital nerve and greater palatine nerve for maxillary implants are also rarely required.

2. Points to consider for infiltrative anesthesia

It is important to avoid excess injection of the local anesthetic into the alveolar mucosa. The anesthetic procedure starts with application of anesthetic to the alveolar mucosa, with application in small amounts to avoid any swelling of the mucosal membrane. A point to consider that can be applied throughout the process of oral surgery is that if one starts in the region that is most accessible to the surgeon, this is the most efficient approach in avoiding unnecessary steps. This can also be applied to infiltrative anesthesia. Infiltrative anesthesia is generally performed in a mesial to distal direction, and in a buccolingual direction. A small amount of subperiosteal anesthetic should be infiltrated once the anesthetic agent starts to take effect. Infiltration of anesthetic agent into the subperiosteum will ease its detachment later

in the procedure. Surgery should not be started immediately after infiltration, but the condition of the patient should be observed for a while. The effects of the epinephrine contained in the local anesthetic require stabilization, including restoration of a normal heart rate, and absorption of epinephrine into the tissues so that hemostasis becomes more effective.

E. Points to consider regarding incision

1. Knowledge of the properties of surgical scalpels (Fig. 3-2-7- a,b)

In order to maximize the effective use of each scalpel, the surgeon should be familiar with the sharpest points of each. The cutting ability of the No. 15 blade is greatest in its mid-portion, therefore, tilting at an angle of 30 to 40 degrees to the membrane is best. If this blade is used in its upright position, the surface of the mucosa is often incised without any effect on the periosteum. In contrast, the No. 12 blade is sharpest at its tip, and is thus best positioned perpendicular to the plane. The mesial and distal sides of the teeth should be cut with the No.12 blade in its upright position to ensure a neat incision, down to the periosteum.

Fig.3-2-7-a
Apply the No. 15 surgical scalpel at 30-40 degree angle on the mucous membrane

Fig.3-2-7-b
Apply the No. 12 scalpel at 90 degrees angle

2. Fundamentals for determining the line of incision

A vertical incision should not reach the alveolar mucosa when inserting implants that replace the mandibular molars.

1) Fundamentals of creating incisions

The cavity of the lost tooth can reopen, even if the gingival membranes have been tightly sewn together. This is often due to the absence of healthy bone underneath the wound. Therefore, an incision must only be made over a healthy bone structure. With the general one-piece type of implant, in principle, an incision should be made into the alveolar crest and the surroundings of the tooth.

2) Incision around the tooth circumference (Fig. 3-2-8)

In order to form a neat mucoperiosteal flap, a clear incision should be made to the mesiodistal side and into the tough periodontal ligaments at the beginning, when the blade is at its sharpest.

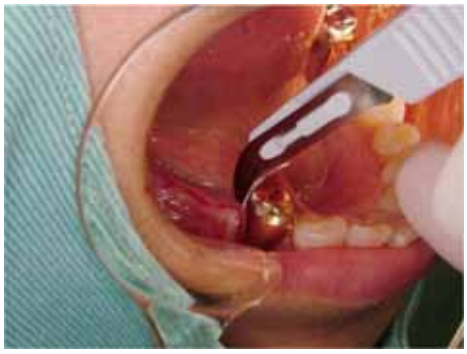

Fig.3-2-8
Stand No.12 scalpel to incise into the centrifugal side of the tooth

3) Additional vertical incision

If a clear view cannot be obtained, a vertical incision may also be necessary. Care should be taken to avoid extending the incision beyond the alveolar mucosa.

4) Warning

When cutting into the mandibular molar for implants in this region, the lingual nerve can be present in the retromolar trigone, so any incision in this part must be avoided. If clear visualization cannot be established, stop the incision immediately before the trigone, and set up an incision line at a 45° angle (Fig. 3-2-9 a,b)

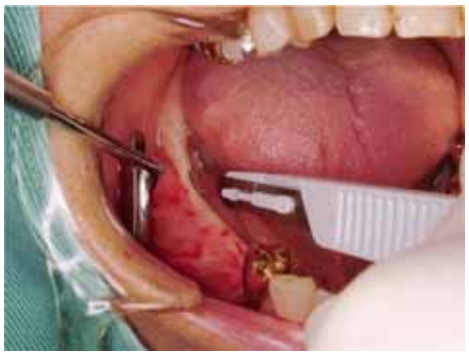

Fig.3-2-9-a
For the extraction of the wisdom tooth, the incision should be added at 45 degree angle from the distal corner of No. 7 tooth.

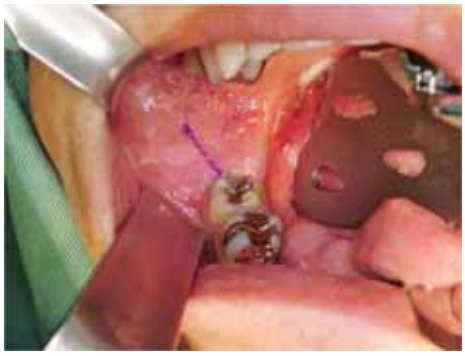

Fig.3-2-9-b
It is important to stop the incision before reaching the retromolar trigone

The vertical incision should not reach the alveolar mucosa when replacing a mandibular molar with an implant. Furthermore, accessory nerves have been found to accompany the mental nerve, so care should be taken to not incise beyond a circle about the mental foramen of circumference 5 mm.

3. Incision

The scalpel should be positioned perpendicular to the plane of the mucous membrane, at the point of incision. If a diagonal cut is made, attachment at the time of suturing can be adversely affected resulting in a wound with a defect. It is vital first to pull the region of incision to make an incision under tension.

F. Points to consider for detachment

1. Using the correct type of raspatory (Fig., 3-2-10, a,b,c)

The prime objective of using a raspatory is to neatly detach the gum from the teeth as a mucoperiosteal flap. There are periosteal, gingival and mucosal elevators, each with their respective purposes. Problems can occur if any of these is used without due regard for its purpose, for example a residual part of the periosteum remains attached, or the mucoperiosteal flap is torn off.

Fig.3-2-10-a
Periosteum elevator

Fig.3-2-10-b
Gingival raspatory

Fig.3-2-10-c
Mucosal elevator

2. Handling the raspatory (Fig. 3-2-11-a,b)

The raspatory should be handled with due regard for the shape of its tip, particularly how the curve of the tip should be placed so as to enable a neat flap to be detached. Periosteal and gingival raspatories both have two ends — one end always has a large curved tip, and the other end always has a small curved tip. The smaller end should be used at the beginning, changing to the larger tip once an opening has been made, to permit effective detachment. For effective detachment, use the curved surface of the raspatory at the buccal and labial sides and use the surface opposing the curved surface at the lingual and palatal. I would recommend holding a raspatory in each hand. Use the right raspatory to detach, while holding the mucoperiosteal flap in an opposite direction with the left. The detachment should be done in small portions to open the aperture up completely, with no deep detachment at any one position.

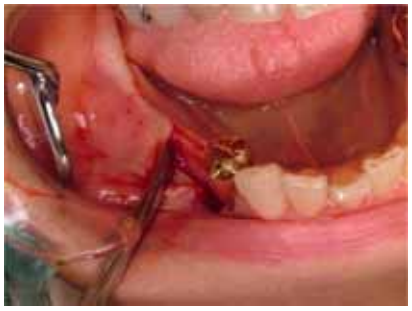

Fig.3-2-11-a
Apply the curved side on the buccal and lingual side of the bone for detachment.

3. Points to consider during detachment (Fig. 2-3-12-a,b)

In order to completely lift the mucoperiosteal flap from the subperiosteal region, start the detachment from the initial positioning of the scalpel. Achieving complete detachment becomes complicated if the flap is torn or detached from the periosteum. If this happens, stop the detachment and start again from the incision. The attached gingiva is closely attached to the periosteal mucosa. In contrast, the periosteum at the alveolar mucosa is often attached less closely. Ensuring controlled detachment should be imperative

to avoid over-detachment. If detachment is made beyond the alveolar mucosa, it can subsequently lead to an increase in post-surgical swelling. In the lower jaw, detachment can easily reach deep into the floor of the mouth; careful detachment will therefore be necessary to limit the size of the opening. As regards detachment around the mental foramen, there are conflicting views as to whether the mental nerve should be left covered or exposed to protect it properly. In order to leave the nerve covered, the area surrounding the foramen, within a radius of 5 mm, should be left untouched. Be aware that if one holds the raspatory in the left hand at the time of drilling the implant cavity, the mucoperiosteal flap could become further detached.

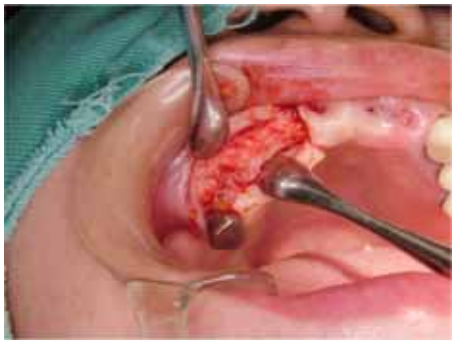

Fig.3-2-12-a,b

The detachment should be limited as much as possible and it is vital for it to be held in this manner.

G. Cavity formation and points of insertion

1. The most important complication that can arise when drilling a hole to install the implant is burning of the bone, which may significantly affect the prognosis of the implant treatment. In order to avoid this, use of copious amounts of water while drilling, and washing the hole becomes important. At the time of drilling, it is imperative to ensure that water is applied to the surface of the bone that is being drilled. Application of water from the side by the first assistant should be considered when drilling in positions that are more difficult to reach, such as for the installation of molars. The standard drilling moment and frequency should be set to: 20 Nm of torque and around 600 rpm (revolutions per minute), respectively. Eight hundred rpm should be the maximum, even if the bone is extremely difficult to drill into. Rinse after each step of hole formation, aiming to completely remove any bone fragments left inside the hole (Fig. 3-2-13).

Fig.3-2-13

Remaining bone removal with cleaning the implant cavity, and cooling

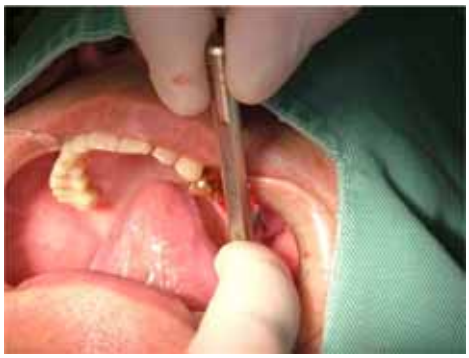

Fig.3-2-14

The implant should be installed with the use of the wrench by pressing the implant body into the drilled hole with the left hand using the, while screwing with appropriate force with the right

2. Controlling the drilling force

Bone resorption can arise as a result of exerting too much pressure on the bone at the time of drilling. Care must be therefore taken to avoid this. Immediately after implant insertion, firmer initial stability can be established by screwing in the implant body more tightly. Problems however arise a fortnight later when bone resorption starts and the tooth becomes loose. The implant should be installed by pressing the implant body into the drilled hole with the left hand, while screwing with appropriate force with the right (Fig. 3-2-14).

3. Complete insertion of the HA-coated layer into the jawbone (Fig. 3-2-15- a,b,c,d)

To maximize the beneficial properties of the HA coating, the coated layer should be buried completely within the jaw bone. To ensure this, a hole should be made that is one grade above the size of the implant. More specifically, for an S (8mm) size fixture, a hole should be drilled that is an M (10 mm) size, and +2 mm in length. Check from four different directions that the HA coating layer has been embedded completely. In clinical practice, exposure of one side of the HA-coated layer is often encountered. In such cases, use a spiral drill or end mill reamers to transplant extracted bone. Here, care should be taken to avoid formation of a dead space in the transplanted bone by applying light pressure and by covering the surface of the grafted bone with periosteum that is sutured in place. The HA-coated layer should not be scratched with a burr, as this delicate layer can come off easily.

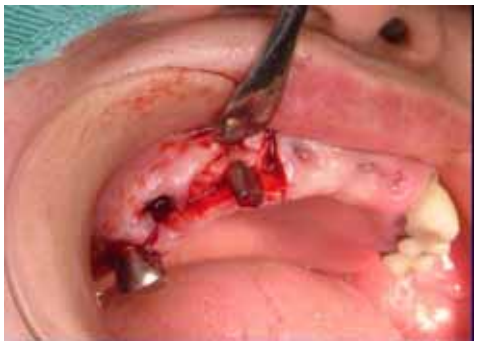

Fig.3-2-15-a
It is important that the HA coated layer is fully implanted into the jawbone

Fig. 3-2-15-b
The exposure of HA coated layer on the buccal side

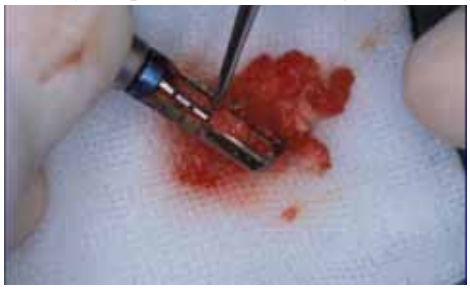

Fig. 3-2-15-c
The bones extracted with the use of spiral drill and end-mill reamer should be preserved for later use

Fig. 3-2-15-d
The bone graft should be conducted by pressing the bone slightly to avoid the dead space to be formed. The suturing should ensure full coverage of the grafted bone with the periosteum

Check occlusion once a one-piece implant has been installed. If the implant is in contact with the opposing tooth, abrade the tip of the crown to adjust occlusion. Next, check the primary stability of the fixture for any loosening or whether any lingual pressure is applied. If any of these findings is observed, the implant body should be fixated to the neighboring teeth, etc.

The patients should be warned not to chew using the implanted part of the mouth for one to two months after implantation. Additionally, the patient should be counseled on their medication regimen.

H. Points to consider during suturing

The main consideration in suturing is to close the aperture completely by applying adequate pressure while making sure that the mucoperiosteal flap does not rise with the implant. It is vital that all the layers are included in the suturing, and also to take great care to control the force applied. A loose suture can cause post-surgical bleeding or infection in the cavity; conversely, if it is too tight, this can result in gingival necrosis (cell death) (Fig. 3-2-16).

Fig.3-2-16
An excessive tightening of the suture can result in gingival necrosis (cell death)

1. Choice of a suitable suture needle

Needles can be grouped according to their shape of the tip, round or cutting (a regular triangle, or an inverted triangle) needle. The cutting needle has the advantage of cutting through easily, but consequently, it can lead to ripping of the tissues; a round needle is therefore preferred for sutures in oral cavity. The needles come in size Nos. 0, 1, 2, 3, with No. 3 the largest. In implant surgery, No. 1 is used as the standard, but No. 0 is used for particularly small mucoperiosteal flaps. No injuries to the tissues should occur with these needles.

2. Choice of appropriate suture types

Nylon and silk threads are the two types used in dental surgery, and are chosen with respect to each of their properties. Silk thread has the advantage of tighter closure, but consequently can lead to excessive tightening or unsanitary conditions if food becomes trapped. By contrast, the nylon thread is less inclined to cause a tissue reaction and is less likely to become unsanitary. However, threads often loosen, and the knot must therefore be tied at least three times. The thickness of the needle decreases from 1-0, 2-0, 3-0 to 4-0; 4-0 is used for closing the gingival mucosa around the implant.

3. The process of suturing

It is essential to pass the needle through all three layers, the epithelial layer, the lamina propria mucosa, and the periosteal mucosa (mucosa). Technically, first insert the needle perpendicularly into the mucosa (Fig. 3-2-17). Next, ensure that needle has passed through all three layers under vision. The needle should go through the mucoperiosteal flap completely before passing through the flap on the opposite side. When apposing the two sides, suture so that each cross-section meets the other. The suture should not be

pulled so tightly as to result in a raised conformation. If the needle is not taken through one mucoperiosteal flap completely, including passage through the epithelial layer, before inserting it into the other layer, the periosteal mucosa may be missed (Fig. 3-2-18). This can cause necrosis and pooling of fluid that may both result in infection.

The type of suture used should not be continuous but interrupted, with a knot made after each stitch. There are three kinds of knot: square, double, and surgical knots. These three types should be formed in any order, (square, double, surgical or surgical double, square etc.) to ensure that the knot does not loosen. Each stitch should be closed with more than three knots.

If implants are placed within five to ten millimeters of each other, one set of stitches is in principle sufficient. If more than one set of stitches is required between the implants, tight closure should be avoided as this can result in treatment failure due to conditions such as ischemia in the tissues that surround the implant (Fig. 3-2-19-a,b,c,d).

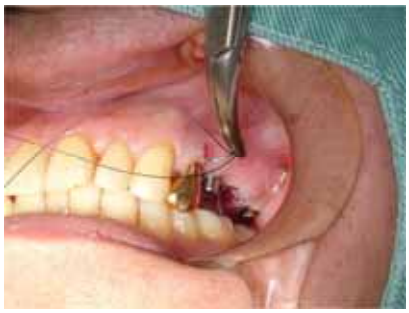

Fig. 3-2-17
Bear in mind to insert the needle perpendicularly into the periosteum when suturing

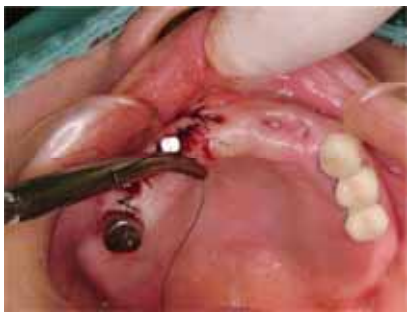

Fig. 3-2-18
If the needle is not taken through one mucoperiosteal flap completely, including passage through the epithelial layer, before inserting it into the other layer, the needle may not have passed through the periosteal mucosa

Fig. 3-2-19-a

Fig. 3-2-10-b

Fig. 3-2-19-c

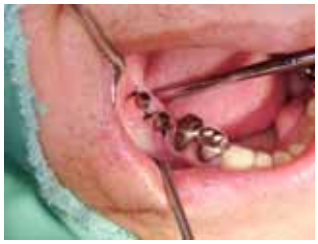

Fig. 3-2-19-d

Fig. 3-2-19-a,b,c,d
Pass the needle through all of the layers completely, one suture at a time in a manner that is neither too loose nor too tight.

4. When to remove stitches

The stitches should be removed after seven days, as a general principle, but this period should be changed in accordance with the condition of the gingivae. Appearance of dark circles around the implant three days after surgery can be an indication that a suture has been too tight; after seven days this will often

appear white in color, indicating that necrosis has occurred. If this is observed, the stitches should be removed after 5 days, and the incised gingivae should be protected with plaster or putty and a periodontal pack.

I. Postoperative management

The week after implant installation is a vital period that determines the outcome of treatment. Post-operative observation should be made with consideration of the points stated below.

1. Prevention of infection

It is an impossible task to avoid the entry of both resident and external microorganisms into the hole of the implant, therefore, antibiotic cover is vital for preventing the spread of infection. Implant surgery is considered closed wound surgery, and therefore the primary choice would be an agent that can also cover anaerobic bacteria. Typically, variants of oral cephalosporins are used, but not all oral cephalosporins cover anaerobes, therefore, the choice should be made with care. Patients who are allergic to both penicillins and cephalosporins should be prescribed a macrolide. As a general guide, antibiotics should be administered for the duration of the course until the stitching has been removed, but any presence of symptoms such as redness, swelling, or pain in the gingivae should be checked to verify the effectiveness of the antibiotics. If infection is suspected, consider changing to another antibiotic. The patient should avoid brushing the teeth around the implant area until the stitches have been removed.

2. Pain management

If post-surgical pain has not been appropriately controlled, patients tend to touch the implant body with their tongue. This can exert pressure on the implant body, preventing primary stability being achieved. Analgesics should be taken to help with the pain. A suggested regimen for pain management is regular administration for the first three days and then taking medication as required for pain thereafter. Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly the first line choice as analgesics. These drugs have a fast therapeutic onset, and are effective for pain management; however, they are contraindicated in asthmatics and those taking fluoroquinolone agents (Fig. 3-2-20). Acetoaminophen should be used as an alternative for those who cannot be given NSAIDs, although it is not as effective as NSAIDs. For patients with systemic diseases, consultation with their doctors may be required in order to choose the most appropriate type of analgesic.

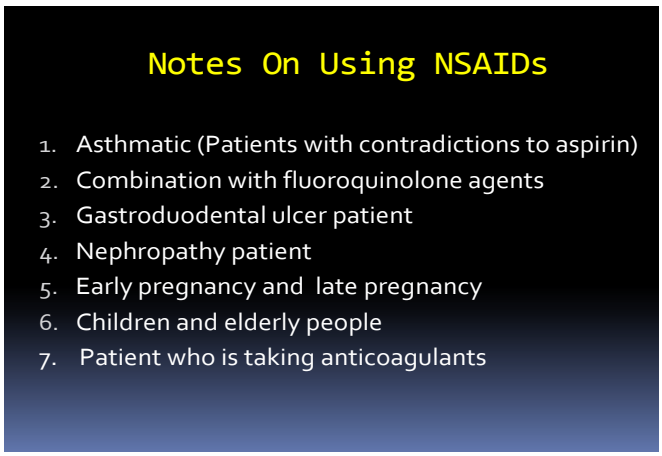

Fig. 3-2-20
Important points to consider when using NSAIDs

3. Management of post-operative bleeding

Control of post-surgical bleeding should be achieved after establishing the source of the bleeding and whether it is from the gingivae or bone. Use of epinephrine is effective for determining the location. If the bleeding stops with the administration of epinephrine, one can suspect the gingivae to be the source. This can be managed by re-stitching to close the gap between the gingivae and the implant more tightly than usual. If the bleeding does not stop, suspect the source to be the bone or its surroundings. If this is the case, construct a plaster and periodontal pack as shown in Fig. 3-2-21 a and b, and stop the bleeding by applying pressure, with placement of the periodontal pack on top of the plaster for two to three days. Intra-oral bleeding is usually mixed with saliva and can be perceived to be more severe than it actually is. The patient may become concerned because of this; therefore, the clinician should inform the patient of the situation and reassure them that the bleeding is much less than it appears to be.

4. Management of neuroplegia of the inferior alveolar nerve and mental nerve

If any of the following symptoms appear in the lower lip or involving the skin of the chin the day after the surgery, suspect neuroplegia of the alveolar nerve or the mental nerve — numbness, paralysis and tingling.

A record of the affected region, including the type and the degree of the symptoms, should be accurately noted to permit subsequent assessment of the effectiveness of treatment.

Using x-ray, determine the distance of the bottom of the implant from the mandibular canal or the mental foramen, and ascertain whether a distance of more than 2 mm from the mandibular canal or 5 mm from the mental foramen is available. Where these measures are not complied with, the implant body should be extracted or twisted inversely to lift it, in order to remove the pressure exerted on the nerves.

The recovery period and its management are dependent on the degree of damage to the nerves. In the case of neurotmesis (division of the nerve), the recovery is often complicated, and surgical anastomosis of the nerves may need to be considered. Conservative therapy is recommended where there is damage to local nerve fibers that is not accompanied by myelin sheath rupture. There are various conservative methods of treatment that include administration of Vitamin B_{12} or ATP formulations, laser therapy, and acupuncture. However, disadvantages of these treatment methods are that recovery takes at least six months if the patient is fortunate, and otherwise a matter of years is required for full recovery. The neuropraxia may be lifelong in some cases.

This matter can become a point of conflict between the patient and the surgeon, and can result in medicolegal action, therefore, early consultation with a specialist is recommended to arrive at suitable therapeutic management.

Fig.3-2-21-a

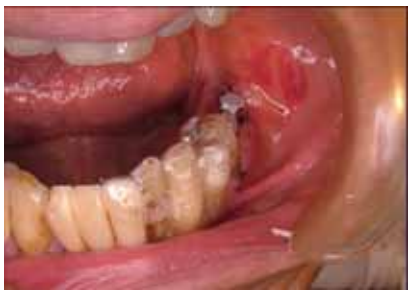

Fig. 3-2-21-b

Fig. 3-2-21-a,b When bleeding or bleeding tendency can be suspected to be from the bone, hemostatic

plaster should be fabricated, and apply pressure with the hemostatic plaster and periodontal pack.

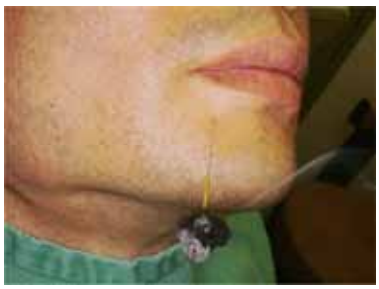

Fig. 3-2-22
Acupuncture, one of the conservative therapies

J. Bony reactions and their management

Although rare, complications typically arise two weeks after implantation, manifesting as pain, inflammation in the surrounding gingivae and movement of the implant body. Subsequently, the implant body is naturally expelled in the fourth week. This has often been reported to be a result of implant rejection by the bone due to infection in the surrounding tissues. Force-induced, heat-induced bone rejection, or down-growth of the gingival epithelium have been noted as possible reasons for this reaction. The likely clinical symptoms that can manifest at the onset of bone rejection are shown in Fig. 3-2-23.

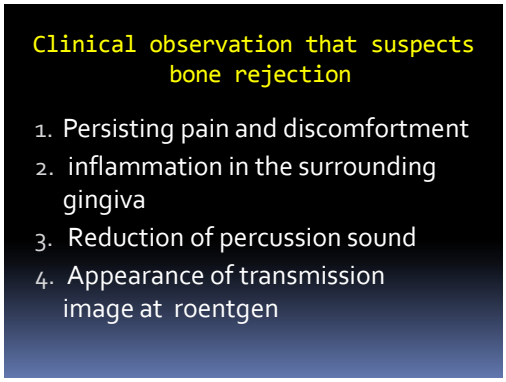

Fig. 3-2-23
Clinical observations that can be suspected of bone rejection

These conditions typically appear during the second to the fourth week after insertion, and the implant will fall out if not suitably treated. The best way to deal with this problem would be to detect the symptoms early on in the course, and manage it by reinforcing stability, and administration of antibiotics.

1. Force-induced rejection (Fig. 3-2-24)

Rejection of the implant can occur as a result of exertion of force at the time of implantation or related to biting. Radiography shows that bone resorption occurs from the excess force applied, resulting in bone resorption from the implant abutment in the shape of an inverted triangle. To stop force-induced complications from occurring, the final step of formation of the implant hole with the reamer should be done with precision. Exertion of a large occlusal force can be avoided by ensuring that the buccal-lingual length of the abutment does not exceed three times the diameter of the implant body. As regards molar implants, in addition to accurate occlusion, it is also important to avoid occlusion at ”Point A,” and secure anterior occlusion.

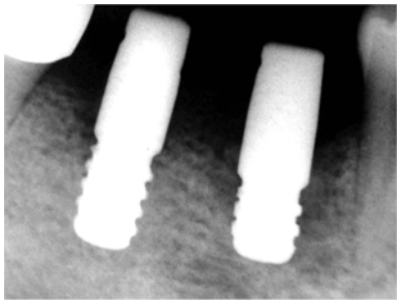

Fig. 3-2-24
Force-induced rejection

2. Heat-induced rejection (Fig. 3-2-25)

Burning of the bone at the time of drilling acts as the stimulus for implant rejection. Radiography is an effective method used to distinguish this cause from other stimuli. First, the image shows bone resorption all around the implant body, and second, in contrast with force-induced bone resorption, the inverted triangle is absent.

To avoid thermal trauma, the following three points must be adhered to during formation of the implant hole. Drilling must be performed under water with a torque of 200 Nm, the drill speed should be 600 revolutions per minute as a standard, and the hole should be washed after each step.

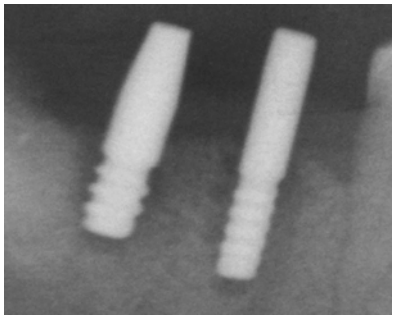

Fig. 3-2-25
Heat-induced rejection

3. Downgrowth (Fig. 3-2-26)

Downgrowth is a complication in which the epithelial layer or the soft tissues at the implant-tissue interface start to infiltrate the bone. This is caused by the application of occlusal force before the biological bond has been established. If masticatory force is applied within a month of placement of the implant, downgrowth is reported to occur; therefore a vital requirement for a successful outcome of treatment is an explanation to the patient, who should not chew on this region.

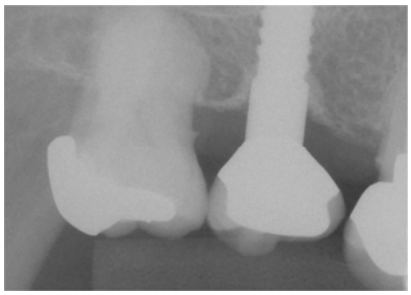

Fig. 3-2-26
Downgrowth induced resorption

4. Managing bony reactions

As mentioned before, the progress of bone resorption is rapid. Therefore it is imperative to recognize

symptoms early on in the course, tightly fixate the implant body and administer antibiotics as soon as possible.

There are numerous methods of stabilization, but the Super-Bond® method is mentioned here, as follows:

1) Fixate the implant body by covering it with Super-Bond®

2) Provide a space in the neck of implant to facilitate cleanliness

3) Allow two months for primary stabilization, and continually monitor the setting of the fixture during this period.

4) Maintain sufficient distancing with respect to the opposing dental arch, and inform the patient of the importance of not chewing on this region.

5) Fixate the implant body to the adjacent natural tooth to an extent within physiological tooth mobility.

Fig. 3-2-27-a

Fig. 3-2-27-b

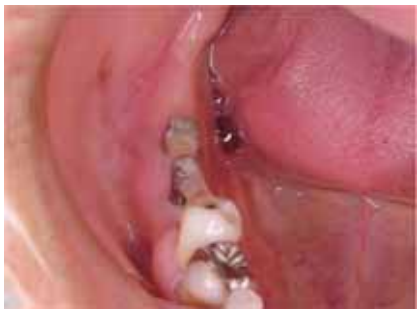

Fig. 3-2-27-c

Fig. 3-2-27-a,b,c
Clinical examples of fixation methods with super bond

Administer antibiotics in the case that the any of the symptoms for bone rejection has manifested. In the administration, the points below should be considered,

1)Start the antibiotics at the same time as the stabilization

2)Administer an agent that is different from that initially used for prevention. Perform a cell culture test to determine an effective antibiotic agent.

3)Continue the course for a week, but longer if inflammation still persists

We present here case studies of a recovery from both bone rejection from force-induced and heat-induced examples.Fig.3-2-24 shows the X-ray photograph at the time of the bone resorption resulting from exertion of excess pressure on the implant body. After further anchorage period of four months, the bone surrounding the implant showed a recovery. Fig.3-2-28 shows the picture after one year of implantation. The bone resorption shown in Fig. 3-2-25 as a result of thermal trauma, underwent a stabilization period of two months. Fig. 3-2-29 shows the image after two years from the time of implant, and a full recovery of the surrounding bone close to the implant abutment can be seen.

Fig. 3-2-28
The observation of Fig. 3-2-24, a year later

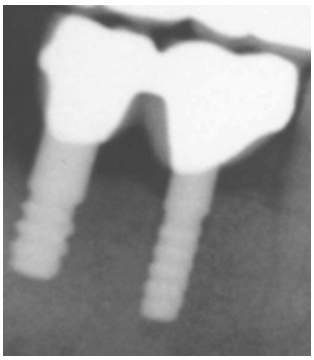

Fig. 3-2-25
The observation of Fig. 3-2-24, two year later

K. Improving techniques for palatal surgical procedures

The success of the implant is fully dependent on the success of implant surgery. Therefore the practice of principle intraoral surgical techniques cannot go neglected. Clinicians have the duty to comply with the principles of surgery, and continue practicing surgical techniques to improve to the next level. Various techniques have been reported, but the fundamentals are the same. Acquire relevant techniques, and perform surgery under a clear sight. Appreciate each property of the surgical tools and use them to maximize their characteristics in procedure. Understand your limits in capability and not go overboard.

In order to improve your skills in incision, dissection, and suture, it is important to practice them everyday. Once a month would not be sufficient for improvement. Using the practicing tools, repeat them everyday. Keeping a record is also effective. Video recording is the best for not only realizing the weaknesses in the techniques but also the progress in the skills is made clear. Clearly observe your own surgery. In improving your techniques, so will the complications such as pain or inflammations will decline, a benefit that will be appreciated by the patient.

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