Chapter 2 – Possible solutions to problems encountered at maintenance stage - 1

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I. Treating peri-implantitis

There are significant amounts of bacteria residing in the oral cavity. It is said to accommodate over 300 different species, and amount to 10^8 per milliliter of saliva. The causative organisms of dental diseases are included within, attached to the dentin or the periodontal tissues. The typical agents are *Porphyromonas gingivalis*, *Actinobacillus actinomycetemcomitans* or *Treponema denticola.*

These organisms attaching to the implant body and induce inflammation of the tissues surrounding the implant by the accumulation of plaque or tartar. If plaque is left resting for a long time, it can induce peri-implantitis that is associated with alveolar bone resorption (Fig.5-2-1). The auxiliary factors that accelerate the disease state include, heat-induced bone injury induced from the use of high speed rotating device; insufficient blood supply to the bone due to smoking; presence of immune compromising disease conditions such as diabetes; or lack of bone quantity surrounding the implant.

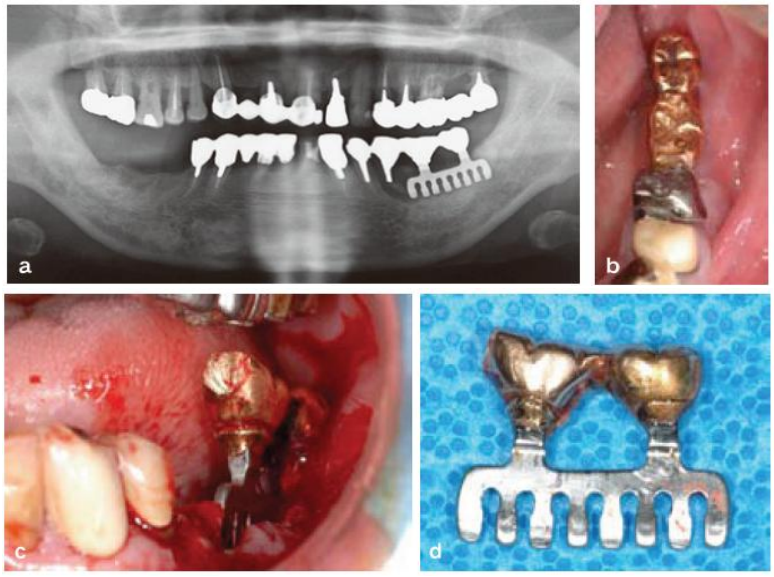

Fig. 5-2-1

a. Panorama radiograph featuring the state of bone resorption in the surroundings of blade implant inserted into the left mandibular molars
b. Abscess was found from No. 29 to No. 30 teeth on the buccal side
c. No. 29 tooth was extracted, and implants at No. 30 and 31 positions were surgically removed. The gingivae surrounding the implants had become covered with abnormal granulation tissues.
d. The removed implant and superstructure (Picture was donated by Dr Masao Matsuhara from Fukuoka Dental College).

The rate of bone resorption in the implant surroundings under normal physiological conditions are said to be on average, 0.1 mm per annum. This was thought to be largely dependent on the surface properties of the implant body. This idea, has become disregarded however even though there have been reports of a slight variation in the amount of bone resorption with a variety of implants that are currently in use, such as, HA coating, calcium phosphate blast treated surface, and TPS coating. Provided the condition has been suitably maintained, the implant surface should not act as the main factor in accelerating the rate of resorption. Once contracting bacterial infection, a chronically infected state is created progressing to bone absorption (Fig. 5-2-2).

In healthy tissues, the keratinized gingivae are tightly adhered to the implant and the gingival groove

surrounding the implant with the presence of functional attachment between the soft tissues and the implant body. This barrier function is lost with the accumulation of bacterial plaque on the implant surface, as this induces a significant inflammation enabling cell infiltration into the submucosal connective tissue, and resulting in ulceration and sores on the epithelial cells. Furthermore, the intercellular adhesion becomes rough and edema-like, creating a state where the plaque can easily invade closer to the root apex. The symptoms of destruction to the osseous tissue begin to be featured on radiographs. This type of inflammation in implant surroundings are significantly faster than those around natural teeth due to differences in factors such as reduced blood vessels, the collagen fiber arrangement, barrier functions of the gingival groove (Fig.5-2-3).

The cytological modifications of the surrounding tissues of implants are similar to those seen in the gingival groove of natural teeth, and the quantity of causative agents of periodontal diseases in the gingival margins are thought to be higher in those with partial loss of teeth than with edentulous patients.

The inducing factors of bone resorption in the implant surroundings are divided into that from peri-implantitis and biomechanical factors in which the implant body cannot bear the load exerted. Regardless of the cause, since secondary infection is associated with most of the disease states, the treatment plan for these can be expected to be the same. The best solution for implant treatment, as with the rest of the medical treatments, is preventative medicine. This is an important factor that must be understood by the patient, and to be able to manage by themselves as much as possible.

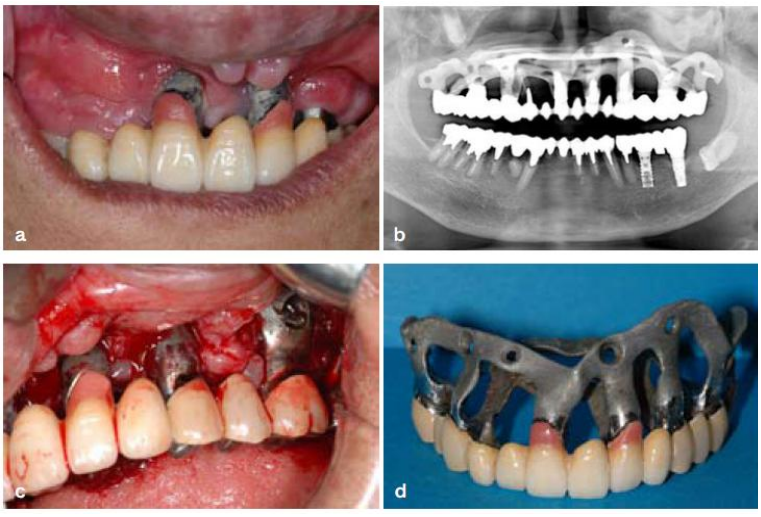

Fig. 5-2-2

a. A case in which subperiosteal implant was inserted into maxillary edentulous jaw. The superstructure was showing loose motion, and abscess was present on full length of the jaw. Pus discharge present in the anterior region.
b. Panoramic radiograph of the condition. A broad bone resorption from No. 2 to No. 15 can be observed.
c. The gum facing the abutment was covered with granulation tissues, observed at the time of extraction.
d. The subperiosteal implant and the superstructure, taken out (Picture donated by Masao Matsuura, Fukuoka Dental College).

However, in the cases where peri-implantitis presents, the primary importance becomes an early recognition by the surgeon and a rapid treatment.

The degree of peri-implant pocket, as well as the method with which to arrange the implant fixture and the solutions to the problem is primarily dependent on the speed of progression. The accurate diagnosis must be derived by considering factors such as the degree of clinical mobility, pain, swelling,

superstructure compatibility, and distribution of occlusal force.

Uninvasive method is the initial stage of therapy for peri-implantitis, classically conducted in accordance with the periodontal disease treatment. The plaque control, oral hygiene instructions with rubber cup, and scaling are the first steps. In addition, factors such as the occlusal state of the superstructure, the ability of the patient in cleaning the abutment teeth, and for the suitability and the shape of the superstructures have to be closely inspected for correct diagnosis and management.

Generally, the pharmacological agents used in treating periodontal diseases have also shown efficacy for peri-implantitis. Chlorhexidine gluconate and stannous fluoride are employed for controlling the microbes in the localized area such as those in the subgingival margin. Citric acid and sodium hypochlorite, on the contrary are used for removal of bacterial endotoxin.

These agents employed in the removal of bacterial endotoxins have also shown efficacy in detoxifying the polluted surfaces of HA-coated implants. Typically, 0.12 % Chlorhexidine gluconate solution is thought to be effective for use on the surface of the bone and the soft tissues, while citric acid for the implant surfaces.

Peri-implantitis can be treated by washing with the aforementioned pharmacological agents and sufficient curettage of granulation tissues, given that the affected area is limited to relatively shallow region. However a surgical intervention is required to regenerate the area of bone loss where the bone resorption has progressed to more than a third of the original height. This should be conducted by, first form a flap on the area affected, reverse it, carefully remove all the granulation tissues with curettage, and then wash with 0.12 % Chlorhexidine gluconate solution. Next, having cleaned the HA-coated surface layer of the implant with plastic scaler mechanically, wipe the implant surface cautiously with cotton wool immersed in citric acid with. Fill the deficient area of the bone with filling materials such as hydroxyapatite granule and β - TCP, place the barrier membrane before finally closing the flap by stitching. If necessary, apply pharmacological agent in periodontal pack.

In cases where faced with more severe conditions such as where the movement of the fixture is considered to be clinically large, or the bone resorption has progressed to more than half the height of the implant body, the implant should be removed, and may need to consider secondary implant surgery as an alternative.

Recent development of a method to apply β -TCP granules onto the surface of the implant body from a nozzle to clean the surface by an air-abrasion technique, which has shown good clinical efficacy.

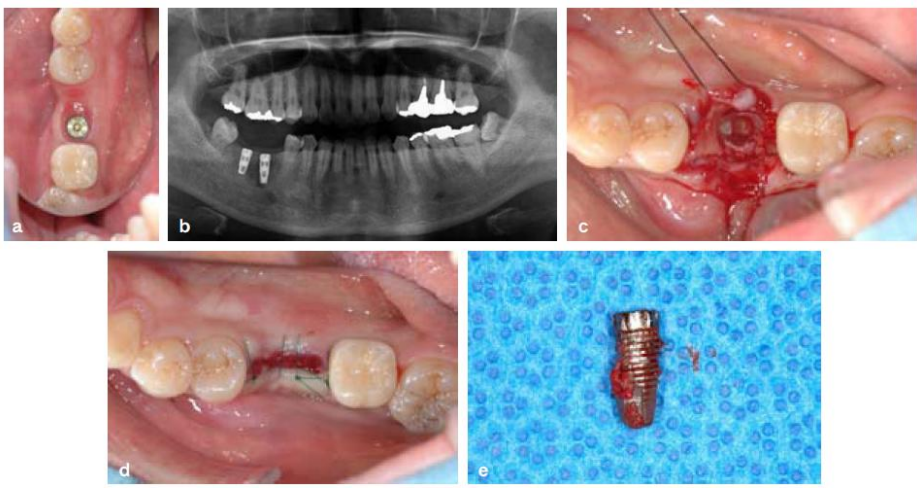

Fig. 5-2-3

a. Implant inserted into the No. 18 and 19 positions. Pus discharge on the distal side of No. 20 observed
b. Panorama X-ray featuring the state of bone resorption in the surroundings of implant at the No. 19 position

c. No. 19 implant was extracted, and the infected granulation tissues carefully removed by curettage
d. The oral cavity state after extraction of implant
e. The extracted implant body, attached with granulation tissues (the pictures were donated by Prof. Masarou Matsuura, Fukuoka Dental College)

II. Solution to the fracture of superstructure and implant body.

If a continuous load is exerted on the implant body concentrated stress is applied on the bone supporting the implant, particularly on the implant-bone interface in the alveolar region.
The reason for this is either because of the poor installation; unsuitability in the orientation of the implant; insufficient number of implants and therefore not being able to transmit the occlusal force ideally in the direction of axial plane of the implant; patients with bruxism, and too strong an occlusal force; or unsuitable fitting of the superstructure is not fitted to the implant body. Problems of damages to the superstructure, loosening of abutment screws in two-piece type; or fracture of implant fixture can arise before bone resorption (Fig. 5-2-4). To avoid loosening of the abutment screw, a driver that is equipped with the ability to regulate the torque force should be employed, with around 30 Ncm^{-1} instead of tightening with just the hands.
In the case of abutment screw fractures, the remaining pieces of screws should be removed with a probe by forming a groove with tools such as carbide bur. If this is insufficient, the remainder of the screw should be carefully cut out with a small carbide bur. This process should be conducted carefully to avoid any damages to be caused on the screw groove. If the screw cannot be removed, the options are to either extract the implant body all together, or leave the body unattached with the superstructure, in a state referred to as 'sleeping'.
The worst case scenario of implant body fracture can result if a correct treatment is not conducted upon recognizing the signs. The best solution is to remove the implant body, and then re-implant. It should be extracted using a trephine bur that is slightly bigger than the diameter of the implant body to remove the surrounding bone all together.
The majority of the superstructure fractures are with the porcelain type. The superstructure should be removed, and fixed accordingly to the situation, either by refabrication or repair. The porcelain crowns to the regions of the last molar, some adjustments such as exposing the metal on the occlusal plane may be required. As an adjunct, night-guard may be employed.

Fig. 5-2-4 Deformed state of a platform of an implant body that had been fitted with a unsuitable superstructure (Picture was donated by Prof. Masarou Matsuura, Fukuoka Dental College)

References

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2) Akagawa Y, Matsuura M, Yatani H, Watanabe F. Fundamental concepts and techniques of oral implant. Tokyo. Ishiyaku Pub, Inc. 2005; 227-231. (in Japanese)