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Retrospective Clinical Study on Flapless Implant Placement

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Purpose: The purpose of this study was to evaluate the prognosis (clinical outcomes) of one-stage flapless implant surgery based on success and survival rate and marginal alveolar bone loss.

Materials and Methods: Ninety dental implants were placed according flapless surgical procedure in forty-one patients at Hospital between April 2004 and May 2009. The mean age of the patients was 54, and the patients were comprised of 24 men and 17 women. Each patient was investigated radiographically and clinically being with average follow up 49.7 period.

Result: Average healing period is 4.45 month (maxilla: 5.31 month, mandible: 3.20 month) after installation and survival rate is 95.7% in this period. The survival rate and success rate at 1 year after function (prosthodontics setting) are 92.4% and 88.0%. At final observation, the survival rate and success rate are 90.2% (maxilla: 89.1%, mandible: 92.9%) and 84.8% (maxilla: 82.8%, mandible: 89.3%). The mean residual alveolar bone resorption at 1-year after function and final observation are 0.8 mm and 1.07 mm.

Conclusion: Our study suggest that if appropriate surgical technique with proper patients selection, flapless implants surgery is predictable simple and safety technique.

Key Words: Bone loss; Dental implants; Flapless; Success rate; Survival rate

Introduction

Implant surgery to restore tooth loss has improved drastically, and there is a trend of reducing the inconvenience of the patient after surgery by decreasing invasiveness. Implant placement using the flapless method is easy to perform, with various advantages such as less inconvenience after surgery and fast recovery. In fact, flapless implant placement can reportedly improve the distribution

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of blood vessels in the mucous membrane around the implant, increase the osseointegration rate, and decrease bone resorption than flap surgery, which lifts the mucoperiosteum[1-3]. It can also preserve the soft tissues around the implant and shorten the surgery time[4].

We investigated the prognosis of implant and resorption of residual alveolar bone in patients who underwent flapless implant placement.

Materials and Methods

1. Subjects and Methods

A total of 41 patients who underwent flapless implant placement were studied during the follow-up period, and clinical and radiological examination was conducted based on medical records.

A total of 90 implants were placed; 24 patients were male, and 17 patients were female. The average age of patients was 54. Out of the 90 implants that were initially placed, 17 were placed immediately after extraction; 8 implants were placed in the maxillary anterior, and 3, in the maxillary posterior, mandibular anterior, and mandibular posterior.

The placed implants were Implantium® (Dentium, Suwon, Korea), XIVE® (Dentply-Friadent, Mannheim, Germany), Frialit-2® (Dentply-Friadent), Branemark TiUnite 4® (Nobel Biocare, Zürich-Flughafen, Switzerland), SS II® (Osstem, Busan, Korea), US II® (Osstem), Osseotite NT® (3I/implant Innovations, Palm Beach, FL, USA), Oneplant® (Warantec, Seoul, Korea), and ITI esthetic plus® (Straumann, Waldenburg, Switzerland). The average diameter of implants used was 4.27 mm (2.5~5.5 mm), and the average length was 11.94 mm (8.5~15 mm).

The average recovery period from the placement of implant to prosthetic treatment was 4.45 months (2~12 months). The average recovery period of 62 maxillary implants was 5.31 months, and that of 28 mandibular implants was 3.20 months. The average examination period after the completion of prosthetic appliance was 49.7 months (7~79 months). During the period, we reviewed patients' medical records to survey the complications and result of implant and measured the resorption of marginal bone around the implant based on radiographs and panoramic photographs of the dental root taken after 1 year of prosthetic treatment and final examination.

2. Flapless Surgical Procedure

After local anesthesia was administered, the thickness of gums in the surgery site was measured using a periodontal probe. Acrylic resin stent made from a model before the surgery was applied, with the operator performing the initial drilling through the trans-crestal gingival tissue. Drilling was performed gradually up to the sum of the length of the implant to be placed and the thickness of gum. After placing the final implant, a healing abutment was connected, and the surgery was finished. For cases wherein the implant was placed after the extraction of tooth, extraction was carried out using periotome or small elevator while minimizing surgical damage to the surrounding alveolar bone. In some cases, the tooth root was cut by surgical bur to extract a tooth. After removing all granulation tissues in the extracted socket, drilling was done manually, with the final implant placed. If the gap between the extracted socket and implant was more than 2 mm, or in case of dehiscence, bone graft was performed, and healing abutment was connected. Suture was not done.

3. Measurement of Marginal Bone Loss

The mesiodistal average was measured based on the number of threads from the implant's mesiodistal shoulder to the top of the joint between the implant fixture and alveolar bone as expressed in radiographs and panoramic photographs of dental root taken using the paralleling technique. The length of each product was calculated based on

the distance between threads. We then compared the difference between the radiographs taken immediately after the placement of implant, 1 year after the prosthetic treatment, and at the final examination.

Result

The average recovery period from the placement of implant to prosthetic treatment was 4.45 months, and osseointegration failed in 4 out of 90 implants. Two of them were not placed again after removal, whereas the other two were placed again immediately after removal. The survival rate of the implant prior to prosthetic treatment was 95.7%. Prosthetic treatment was done on 88 implants - including implants placed again - for 40 patients.

With respect to the prosthetic appliance, 51.1% were single prosthodontics, 46.6% were fixed prosthodontics, and 2.3% were overdenture. The incidence rate of complication after prosthetic treatment was 9.1%. There were screw loosening, odontoclasis, defluvium of resin hole, mesial contact opening, and Porcelain chipping.

For 1 year after the prosthetic treatment, 3 implants were removed; the implant survival rate was 92.4%. The survival rate of implants with bone resorption wider than 2 mm was 88.0%. After total prosthetic treatment lasting for an average of 49.7 months, 5 implants were removed; the survival rate of the implant was 90.2%, and the success rate was 84.8%. With respect to maxillary implants, the survival rate was 89.1%, and the success rate was 82.8%. In terms of mandibular implants, the survival rate was 92.9%, and the success rate was 89.3% (Table 1). After 1 year of prosthetic treatment, the average marginal bone resorption was 0.8 mm (0~3.2 mm); the average marginal bone resorption until the final examination was 1.07 mm (0~3.6 mm) (Table 2).

Table 1. Summary of installed implants

	Mx. ant.	Mx. post.	Mn. ant.	Mn. post.
Initial installation	17	45	5	23
Removal before function	1	3		
Re-installation	1	1		
Survival at 1 year after function	17	42	4	22
Survival at final observation	17	40	4	22
Success at 1 year after function	14	41	4	22
Success at final observation	14	39	4	21

Mx.: maxilla, ant.: anterior, Mn.: mandible, post.: posterior.

Discussion

Two stage protocol (submerged surgical procedure) is a surgery that lifts the valve and exposes bony tissues in the lower part to place the implant. Usually, it is combined with bone graft, etc. After a certain recovery period, fixture and abutment are connected, and prosthetic treatment is carried out in the 2nd surgery. On the other hand, 1-stage protocol (non-submerged surgical procedure) places the implant, exposes the structure into the mouth, and connects the healing abutment. It does not require a 2nd surgery. Although surgery can be performed after lifting the valve, flapless surgery may be done instead[5].

Implant surgery can be divided into flap surgery and flapless surgery based on the existence of valve lifting. Flap surgery lifts the mucoperiosteum after incision. It can place the implant after identifying the correct shape of the bone, but severe damage of soft tissues and insufficient joining of wound may affect the aesthetics. Moreover, some researchers report that it reduces blood supply to soft tissues

Table 2. Marginal bone loss

Marginal bone loss	<1 mm	1~2 mm	>2 mm
At 1 year after function	61	26	1
At final observation	49	37	2

around the implant[1-4].

If there is a tooth, blood supply in the surrounding alveolar bone is carried out from the periodontal ligament, connective tissue of the periodontal tissue, and inside the bone. If a tooth is lost, blood supply from the periodontal ligament is stopped, and blood will be supplied from soft tissue and bone. When placing an implant using flap surgery, blood supply from soft tissue to the alveolar bone is stopped, and alveolar bone can receive blood only from the inside of bone. Such may be the cause of alveolar bone resorption during the initial recovery[2,6,7]. Flapless implant surgery can prevent alveolar bone resorption by minimizing damage to soft tissues to minimize the suspension of blood supply.

Flapless surgery has many advantages in terms of aesthetics and recovery of soft tissue. It is a surgery involving punch surgery of soft tissue or direct drilling for soft tissue, placement of fixture, and immediate connection of abutment. It can facilitate recovery by shortening the surgery time, preserving soft tissue, and minimizing wounds[1,4]. In addition, in valve-lifting surgery, alveolar bone is reportedly resorbed in various degrees during the initial stage of the recovery period[8]. On the other hand, flapless implant surgery shows high level of osseointegration and low level of crestal bone loss[2]. Becker et al.[9] reported that, after examining the prognosis of 79 flapless implant surgeries for 2 years, the average alveolar bone resorption was 0.7~0.8 mm. This study obtained similar results, i.e., average marginal bone resorption after 1 year of prosthetic treatment was 0.8 mm, and average marginal bone resorption until the final examination was 1.07 mm.

Flapless implant surgery can secure aesthetics, take less time, reduce bleeding, and place the implant in the correct location. Moreover, by not lifting the valve, both the operator and patient can enjoy various advantages because it guarantees good blood supply around the implant, preserves soft and hard tissues, and forgoes the need for suture[2,3,9,10].

According to the Pisa Consensus Conference of the International Congress of Oral Implantologists in 2008, a successful implant must free from pain, tenderness, or mobility, and bone resorption in the radiograph must be less than 2 mm without exudation[11]. On the other hand, the survival rate is the rate of implants that are not removed or whose removal is decided after a certain time[12,13].

The success rate of flapless implant was 74.1% in the 1990s and 100% in 2000[10]. Another researcher reported that the success rate of 79 implants placed using flapless surgery was[9], and that the 1-year survival rate of computer-guided flapless implant surgery was 97.2% in the maxillary area and 100% in the mandibular area or 97.8% on the average[14]. In this study, 1 year after the final prosthetic treatment, the survival rate was 92.4%, and the success rate was 88.0%. After 49.7 months on the average from the prosthetic treatment, the final survival rate was 90.2%, and the success rate was 84.8%. In the case of maxillary implants, the survival rate was 89.1%, and the success rate was 82.8%. In the case of mandibular implants, the survival rate was 92.9%, and the success rate was 89.3%. These results are relatively lower compared to existing research.

Although flapless surgery has many advantages, the operator must have correct anatomical knowledge, consider the soft tissues around the implant, and plan the treatment carefully. Given the difficulty of finding the correct location only with radiograph, finding the correct location with conebeam computed tomography and using preoperative try-in of the surgical template are recommended. The operator must also adjust the keratinized tissues properly[15].

Flapless implant surgery can be expected to yield stable and good success rate[9,10]. In addition, patients reportedly experience less tension and pain during surgery, and pain after surgery is said to subside faster[16]. Note, however, that flapless

implant surgery may generate bone dehiscence or fenestration caused by the malpositioning of fixture and labial perforation. This possibility may increase in free-handed flapless surgery, and insufficient bone support may cause an aesthetic problem and affect implant stability[17]. Flapless implant surgery is "blind" surgery; thus requiring correct access angle of bur and proper selection of patient[9,10]. It is difficult to evaluate the relationship between implant shoulder and crestal bone when the operator performs drilling. As a result, implants are often placed in coronal or apical position.

In this study, the clinical results of flapless surgery are no better than other research studies. Moreover, the recovery period was not shortened, and progressive bone resorption was identified in some cases. A possible reason is the improper selection of case owing to the absence of careful diagnosis and treatment plan in advance using computed tomography (CT). In addition, in all cases, free-handed flapless surgery was performed using conventional template. The reason for excessive marginal bone resorption may be overheating caused by drilling, over-compression generated during implant placement, or overload of prosthetic treatment, but the exact reason has yet to be identified. All implants that failed after prosthetic treatment were single implant prosthesis, and overload of prosthetic treatment was assumed to have had an indirect effect. This retrospective clinical study has insufficient basis, and variables such as various implant systems and bone graft material give rise to many problems; hence the need for more standardized retrospective clinical studies.

Conclusion

Flapless implant placement is known to be a very stable surgery with less trauma on the surgery site, but careless surgery may yield a poor result. It may be good to perform surgery carefully by diagnosing the status of the maxillary bone before the surgery using CT only for diseases for which medicine is efficacious.

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