

ความสำเร็จของการรักษาด้วยรากฟันเทียมยึดครอบฟันติดแน่น ณ ศูนย์ความเป็นเลิศทางทันตกรรมรากเทียม มหาวิทยาลัยเชียงใหม่

Clinical Results of Implant Treatment in a Center of Excellence for Implantology Clinic: A Retrospective Clinical Study

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บทคัดย่อ

ที่มา: จากผลสำเร็จที่สูงของรากฟันเทียม จึงมีการนำรากฟันเทียมมาใช้เป็นทางเลือกในการรักษาผู้ป่วยที่มีการสูญเสียฟันธรรมชาติ

วัตถุประสงค์: เพื่อประเมินผลการรักษาทางคลินิกของผู้ป่วยที่ได้รับการรักษาด้วยรากฟันเทียมเพื่อยึดครอบฟันติดแน่น ณ ศูนย์ความเป็นเลิศทางทันตกรรมรากเทียม คณะทันตแพทยศาสตร์ มหาวิทยาลัยเชียงใหม่ ในระหว่างเดือนมกราคม 2556 ถึงธันวาคม 2557

วิธีการ: ทำการเก็บข้อมูลผู้ป่วยที่ได้รับการรักษาด้วยรากฟันเทียม ระหว่างเดือนมกราคม 2556 ถึงธันวาคม 2557 จากบัตรบันทึกประวัติการรักษา ผู้ป่วยทุกคนจะถูก

Abstract

Background: Dental implant treatment has been gradually considered as the treatment of choice for patients with tooth loss, due to its very high success rate.

Aim: To evaluate the clinical treatment outcome and complications found in patients who received implant supported and fixed restorations at the Center of Excellence for Dental Implantology clinic between January 2012 and December 2013.

Materials and methods: Data from implant treatment records between January 2012 and De-

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เรียกกลับมาติดตามผลการรักษาหลังจากใช้งานรากฟันเทียมไปแล้วอย่างน้อย 1 ปี โดยเกณฑ์ที่ใช้ประเมินความสำเร็จของรากฟันเทียมพิจารณาจากรากเทียมนั้นสามารถคงสภาพอยู่ในช่องปากได้โดยไม่ต้องมีการนำรากเทียมออกโดยการประเมินลักษณะทางคลินิกของรากเทียมอ้างอิงโดยข้อตกลงปิซ่า รวมทั้งทำการเก็บข้อมูลของภาวะแทรกซ้อนที่เกิดขึ้น

ผลการศึกษา: ในช่วงระหว่างเดือนมกราคม 2556 ถึง ธันวาคม 2557 มีผู้ป่วยจำนวน 98 คน 156 รากได้รับการรักษาด้วยรากฟันเทียมยึดครอบฟันติดแน่น โดยจากกลุ่มผู้ป่วย 98 คน สามารถเรียกกลับมาเพื่อติดตามผลการรักษาได้ทั้งสิ้น 60 คน รวม 110 ราก โดยพบว่าจากจำนวนนี้ มีรากเทียมที่ล้มเหลวไปทั้งสิ้น 3 ตัว คิดเป็นร้อยละ 2.73 อัตราความสำเร็จของรากเทียมจึงอยู่ที่ร้อยละ 97.27 ส่วนภาวะแทรกซ้อนที่พบบ่อยที่สุดคือการเกิดกระดูกหักยึดรากเทียมหลวม ร้อยละ 15.45 การละลายของกระดูกที่เกิดขึ้นรอบๆ รากเทียมส่วนใหญ่เป็นรูปแบบแนวอนและไม่เกิน 1 มิลลิเมตร

สรุปและอภิปรายผล: จากผลการศึกษาพบว่าการใช้รากฟันเทียมเพื่อยึดครอบฟันติดแน่นมีอัตราความสำเร็จที่สูงถึงร้อยละ 97.27 ซึ่งสอดคล้องกับการศึกษาที่ผ่านการเกิดกระดูกยึดหลักรากเทียมหลวมเป็นภาวะที่เกิดขึ้นสูงที่สุดร้อยละ 15.45 ดังนั้นการเรียกผู้ป่วยเพื่อกลับมาติดตามผลการรักษาจะช่วยในการลดการเกิดภาวะแทรกซ้อนต่างๆ ของรากเทียมได้

คำสำคัญ: รากฟันเทียม ภาวะแทรกซ้อนจากการทำรากฟันเทียม ความสำเร็จของการทำรากฟันเทียม การใส่ฟันเทียมชนิดติดแน่น

September 2013 were obtained. The patients were recalled for clinical follow-up after 1 year of loading. The term of the implant success was defined related to the implant is still physically in the mouth. Clinical indices were evaluated followed by criteria of the International Congress of Oral Implantologists (Pisa Consensus).

Results: Ninety eight patients with 156 implants were treated with fixed restorations on implants, 17 patients with 34 implants received implant-retained overdenture treatment. Of 98 patients, 60 patients with 110 implants were able to come for clinical follow-up. The total survival rate of the implants with fixed restoration treatment was 97.27% (3 implants failed). The most frequent complication found in the study was abutment screw loosening (15.45%). Marginal bone resorption was found mostly in a horizontal bone loss pattern; the horizontal loss was less than 1 mm.

Conclusions: This study showed survival rate of implant treatment was 97.27% and comparable to the findings of other studies. Abutment screw loosening was the most common complication (15.45%). Regular recall of patients is strongly suggested to reduce this complication.

Keywords: Dental implant, Implant complications, Implant survival, Fixed restorations

Introduction

The term osseointegration was defined by Brånemark to describe a direct connection between artificial implants and living bone without ingrowth of fibrous tissue at the interface.⁽¹⁾ In modern dentistry, dental implants are considered as the best option for missing tooth replacement. Long-term studies have demonstrated a successful, long-lasting, and natural looking outcome of implant treatment.

In a retrospective study, Jang⁽³⁾ placed 6385 dental implants in 3755 patients from January 2000 to December 2009. One hundred and eight implants failed and the survival rate was 96.33%. In this study, implant success rate is influenced by various factors such as age, implant type, length, location and prosthesis type.

A systematic review to assess the five-year survival rate of 2126 implants showed that the estimated rate for single implants amounted to 96.9%.⁽⁴⁾

Piek et al.⁽⁵⁾ revealed implant survival rates from 92% to 98.6% in 460 implants supported single crown in 141 patients, with varied loading and insertion protocols. Total survival rate after one year was 97.4%.

Despite the high survival rate of implant-supported prostheses and substantial improvements within implant dentistry over time, complications are still frequent. These complications can be classified into:⁽¹⁾ Biologic complications related to the biological process, bone loss of more than 2 mm with soft tissue recession.⁽²⁾ Technical complications are mostly related to the materials and the design of the components, such as abutment fracture, abutment screw fracture, abutment screw loosening, misfit at the implant- abutment junction, fracture of the implant prosthesis, chipping of the veneering ceramic and⁽³⁾ esthetic complications related to soft tissue discoloration and other esthetic problems.⁽⁶⁾

Different factors may cause failures in implant treatment. However, most implant failures have a multi-factorial background, such as poor bone quality and quantity, oral and general health, and the patient's oral habits.^(7,8) Systemic diseases may have an adverse effect to the prognosis of oral implants, especially autoimmune diseases and chronic oral diseases, such as erosive lichen planus, Sjogren's syndrome, leukoplakia, stomatitis, aphthous ulceration, lupus erythematosus, and diabetes mellitus.⁽⁹⁻¹¹⁾ The other variables that are within the control of the clinician and potentiate the success or failure of dental implant placement, include case selection, site selection, design of prosthesis and recall protocol. The experience and surgical skill of the clinician also play a significant role in the success rate of dental implants.⁽¹²⁾

Implant success is as difficult to describe as the success criteria required for a tooth that most commonly reported in term of the survival rate which was defined related to the implant is still physically in the place mouth or has been removed.⁽¹³⁾

On 5th October, 2007, at Pisa, Italy, a Consensus Conference modified the James-Misch Health Scale approved periodontal indices that are used for the evaluation of dental implant (Table 1). The primary indices are pain, mobility and probing depth. Marginal bone loss are measured on periapical radiographs which assess the mesial and distal marginal bone next to the implant.⁽¹⁴⁾

In addition, failure is divided into early (prior to prosthetic treatment) or late (after after the implant receives occlusal load) failure. Early failure is when osseointegration fails. Such failure is due to bone necrosis, surgical trauma, bacterial infection, inadequate initial stability or early occlusal loading.⁽¹⁵⁾

Late failure is failure that occurs after the implant receives occlusal load. It occurs because of

Table 1 Health scale for dental implants from Pisa, a Consensus Conference 2007.

ตารางที่ 1 แสดงเกณฑ์ความสำเร็จของรากเทียม ตามข้อตกลงที่ปิส่า ปี 2007

Health scale for dental implants	
implant quality scale group	clinical conditions
I. Success (Optimum health)	a) No pain or tenderness upon function b) 0 mobility c) <2 mm radiographic bone loss from initial surgery d) No exudate history
II. Satisfactory Survival	a) No pain on function b) 0 mobility c) 2-4 mm radiographic bone loss d) No exudate history
III. Compromised Survival	a) May have sensitivity on function b) No mobility c) Radiographic bone loss > 4 mm (less than 1/2 of implant body) d) Probing depth >7 mm e) May have exudate history
IV. Failure (Clinical or absolute failure)	Any of the following a) Pain on function b) Mobility c) Radiographic bone loss > 1/2 length of implant d) Uncontrolled exudates e) No longer in mouth

infection or excessive loading.⁽¹⁶⁾

Radiographs play an important role in routine clinical practice and also used for evaluating dental implant success. The initial bone loss of bone-implant interface normally starts at the crestal region, especially after the first year of prosthesis loading. Pattern of crestal bone loss to the first thread was characterized by “saucerization”, which could be often found radiographically around implant.⁽¹⁷⁾ An average of 1.5 mm of marginal bone loss from the first thread was observed during healing and during the first year after loading.⁽¹⁸⁾ In contrast, there was an average of only 0.1 mm bone lost annually thereafter.

The purpose of this study was to evaluate the clinical outcome of fixed restorations on dental implants at the Center of Excellence for Dental Implan-

tology, Faculty of Dentistry, Chiang Mai University, between January 2012 and December 2013.

Materials and methods

1. Patient Selection

A total of 190 implants were inserted in 115 patients who were referred to the Center of Excellence for Dental Implantology, Faculty of Dentistry, Chiang Mai University, between January 2012 and December 2013. Of these, 156 Implants (98 patients) were implant-supported fixed restorations.

2. Surgical Procedures

Surgical procedures were carried out under local anesthesia. The dental implant system (PW+ Dental Implant System, Thailand) was used in the study has been introduced to the market since 2007. Various sizes of implants were employed (lengths of

8, 10, 12 or 14 mm and diameters of 3.3, 3.75, 4.2 or 5.0 mm). All implants were placed by a total of six different surgeons: two experienced senior surgeons and four master degree students in oral implantology. Experienced senior surgeons assisted at each surgery performed by a master degree student for quality assurance purposes. After surgery, oral antibiotics, oral analgesics and an antiseptic mouth rinse were prescribed. The wound healing was observed seven days after surgery, then the sutures were removed.

A one-stage surgical protocol was applied in most cases, except for surgical implant placement with bone grafting or sinus floor elevation, when a two-stage surgical protocol was applied. The duration of the healing period was selected according to the surgical protocol, a minimum of 12 weeks for implants placed without simultaneous bone grafting or sinus floor elevation procedures, and a minimum of 24 weeks for implants placed with simultaneous bone grafting or sinus floor elevation procedures and also according to the patients' availability.

3. Prosthesis procedure

If the clinical status of implants were stable i.e., no detectable mobility and no sign of peri-implant infection, the prosthetic abutments for single crown were inserted. The prostheses were delivered using mostly cemented prostheses and other with screw type. Following the prosthetic treatment, all patients were in a maintenance program with recall visits at three-month intervals. After 12 months following implantation, all patients were recalled for annual examinations. The following parameters were assessed by a dentist in the following sequence.

4. Descriptive Analysis

All data used for the retrospective analysis were collected from patient records of the Center of Excellence for Dental Implantology clinic. The following parameters were recorded for the primary outcomes:

- Demographics of the patients: age and sex
- Distribution of implants and fixed restoration according to diameter and length
- Presence of systemic conditions
- Location of implant placement: anterior maxilla, posterior maxilla, anterior and posterior mandible
- Surgical procedure: Surgical procedures were: Standard implant placement (implant placement without bone grafting procedures)

Implant placement with bone grafting procedure
Implant placement with sinus floor elevation procedure (either by a simultaneous or staged lateral window technique or simultaneous osteotome technique)
The patients were appointed for follow-up evaluation (clinical and radiographic examination) of their dental implants. Clinical examination included assessment of pain, mobility and probing depths. Periapical radiographs using the paralleling technique were recorded to evaluate crestal bone loss (determined in relation to the 3-mm length microthread.

Results

Descriptive Analysis

Patient Pool. During the period from 2012 to 2013, a total of 98 patients received 156 implant-supported fixed restorations. There were slightly more women (52, 53.06%) than men (46, 46.96%), the mean age was 54.1 years (median, 55.0 years; range, 16 to 85 years) . Fifty-nine patients (61.19%) were between 41 and 60 years old (Table 2).

Indications for implant placement. The single-tooth gap was the most frequent indication when combining indications in the maxilla and mandible, accounting for 90 implants (57.70%), followed by extended edentulous spaces, 43 implants (27.56%) and distal extensions, 23 implants (14.74%) (Table 3).

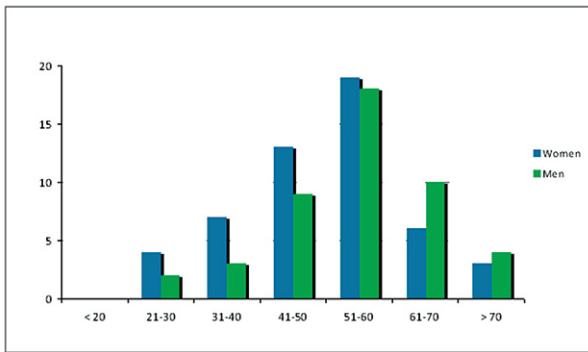


Table 2 Age and sex distribution of the patients receiving dental implants

ตารางที่ 2 ผู้ป่วยที่ได้รับการฝังรากเทียมแยกตามเพศ และอายุ

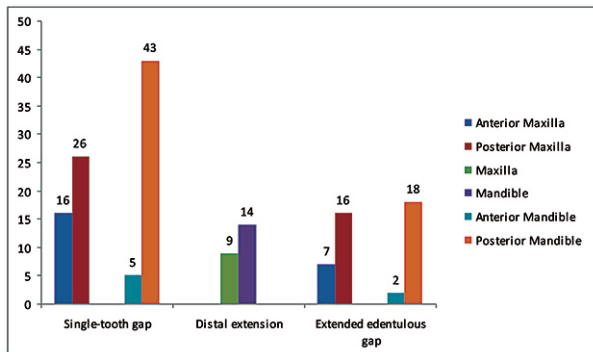


Table 3 Distribution of implants according to indication.

ตารางที่ 3 จำนวนรากเทียมที่ใช้ตามข้อบ่งชี้

Diameters and Lengths of Implants. A diameter of 3.75 mm (32.69%) and length of 12 mm (53.84%) were the most common dimensions for the implants placed. Diameter of 3.75 mm. and 4.2 mm. were the most placed up to 101 implants (64.71%) (Table 4).

Locations of implant placement. There were slightly more implant treatments in the mandible (82 implants, 52.55%) compared to the maxilla (74 implants, 47.45%). About half of the implants (48.07%) were placed in the posterior mandible (Table 5).

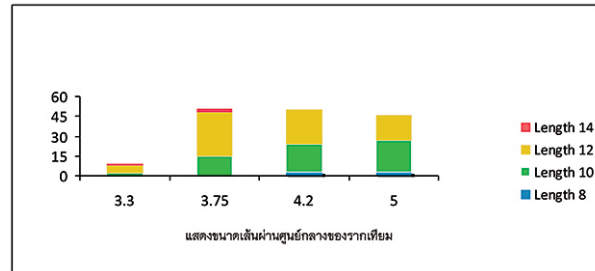


Table 4 Distribution of implants according to diameter and length.

ตารางที่ 4 แสดงจำนวนรากเทียมที่ใช้ตามขนาดของรากเทียม

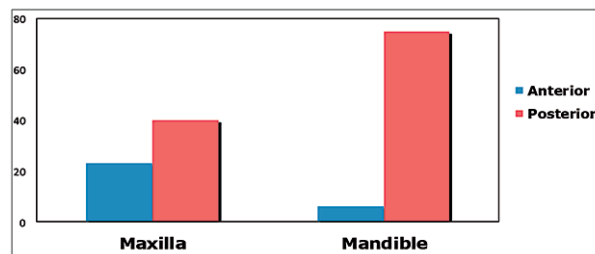


Table 5 Distribution of implants according to Location.

ตารางที่ 5 จำนวนรากเทียมที่ใช้ตามตำแหน่งที่ฝัง

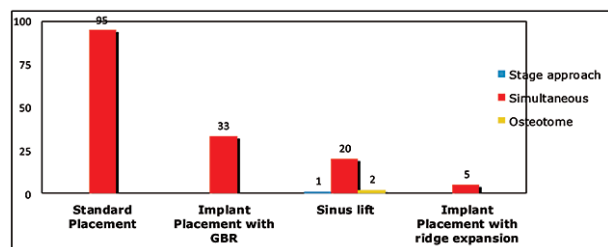


Table 6 Distribution of implants according to surgical procedure.

ตารางที่ 6 จำนวนรากเทียมที่ใช้ตามเทคนิคที่ใช้ในการฝัง

Surgical Procedures. A total of 95 implants (60.89%) were conventional, simple implant placements. Implants inserted with bone grafting technique accounted for 33 implants (21.15%) and with sinus floor elevation procedure, 23 implants (14.74%). Lateral windows with simultaneous placement were

more frequent than other techniques (12.82%) (Table 6).

Type of fixation. Most dental implants used in the Center were cement-retained (92.30%)(Table 7). Of 98 patients, 60 patients (61.22%) with 110 implants (70.51%) were able to return for follow-up.

Table 7 Distribution of implants according to type of fixation.

ตารางที่ 7 จำนวนรากเทียมที่ใช้ตามชนิดของการยึดครอบฟัน

Type of Fixation	No. Implant (%)
Cement-Type	144 (92.30)
Screw-Type	12 (7.70)
Total	156 (100)

Survival. Of 110 implants, three failed and needed to be removed. Two failed in osseointegration which one placed simultaneously with lateral window sinus and the other one in simple implant placement. One implant failed from implant fracture after six months of functional loading (Figure 1). Survival rate was 97.27% (Table 8).

Complications. The most frequent complication was abutment screw loosening, 17 implants (15.45%) in 11 patients. One patient had three loose abutment screws of six implants placed. All cases with abutment screw loosening were corrected with rescrowing with the proper torque value according to the manufacturer’s recommendations (Figure 2).

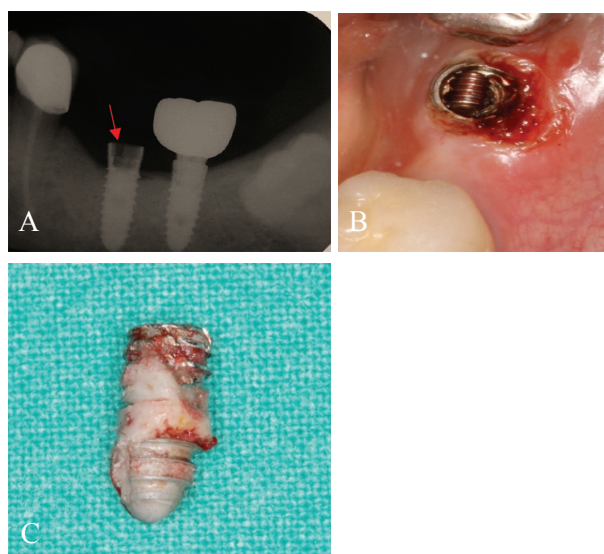


Figure 1 A. Periapical radiograph showing signs of implant fracture (red arrow), B. The clinical status revealing implant fracture, C. The fractured implant.

รูปที่ 1 A. ภาพรังสีปลายรากแสดงถึงการหักของรากเทียม (ลูกศรสีแดง), B. ลักษณะทางคลินิกแสดงถึงการหักของรากเทียม, C. รากเทียมที่หักและนำออกมา

Peri-implant mucositis was observed in two implants (1.81%) from two patients. One loose abutment screw resulted in plaque accumulation, another had excessive cement around the implant. The total number of complications in this study was 19 implants (17.09%).

Radiography. Radiographs were obtained of 110 implants in 60 patients. The radiographs of two

Table 8 Distribution of implant failures after one-year follow-up

ตารางที่ 8 รายละเอียดของรากเทียมที่ล้มเหลวภายหลังระยะเวลาติดตามผลหนึ่งปี

Distribution of implant failure after one-year follow-up							
Reason for failure	Failure time	Sex	Smoking	Location	Diameter	Length	Surgical procedure
1. Disintegration	Early	M	No	26	4.2	10	Sinus lift
2. Disintegration	Early	F	No	36	5.0	10	Standard
3. Implant fracture	Late	M	Yes	46	4.2	10	Standard

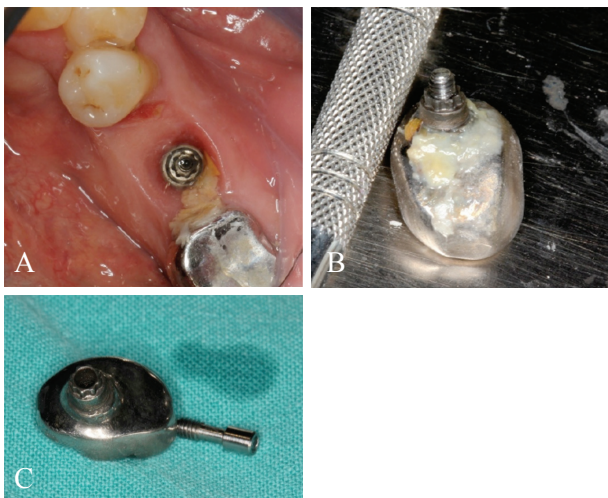


Figure 2 A, B. Clinical signs show gingival inflammation and plaque accumulation around implant and crown due to screw loosening. C. Crown and screw after cleaning.

รูปที่ 2 A, B. ลักษณะทางคลินิกแสดงการอักเสบของเหงือกและการสะสมของจุลินทรีย์รอบรากเทียมและครอบฟันที่เกิดสกรูหลวม C. ครอบฟันและสกรูหลังการทำความสะอาด

implants could not be analyzed because a problem with the x-ray machine occurred. Thus, 108 implants were evaluated. Changes in marginal bone level were measured at mesial and distal bone next to the implant. In the study, marginal bone loss was mostly found between 0-1 mm in 69 implants (63.88%) (Not over 1/3 of the microthread). The most common pattern of bone loss was of the horizontal pattern (83.33%) (Table 9).

Discussion

Dental implants are considered as the treatment of choice for missing teeth in modern dentistry. Highly successful treatment results have been shown in many studies.

According to the success criteria of the ICOI Pisa consensus 2007,⁽¹⁴⁾ the primary criteria for assessing implant quality are pain and mobility. The

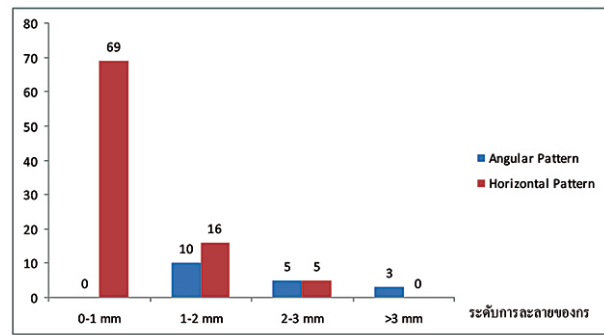


Table 9 Pattern of crestal bone resorption from radiographic evaluation.

ตารางที่ 9 รูปแบบการละลายของกระดูกรอบ ๆ รากเทียม

presence of either one greatly compromises the implant.

Implant failure is more simple to describe than implant success or survival. A variety of factors, such as any pain, vertical mobility, or uncontrolled progressive bone loss, usually contribute to the failure of a dental implant.

The total survival rate for implants in this study was 97.27%, a rate comparable to the rates reported in earlier studies in the dental literature. A systematic review of the survival rate of single implant abutments supporting fixed prostheses with five-year implant survival rates for single implants amounted to 96.9%.⁽⁴⁾ Similar data were reported in a retrospective study of patients receiving 6385 dental implants placed from January 2000 to December 2009; the survival rate was 96.33%.⁽³⁾ In a one-year prospective clinical study by Piek et al.⁽⁵⁾ evaluating 460 implants, the total survival rate after one year was 97.4% .

While the survival rate of implants in this study was similar to earlier studies although the amount of dental implants and follow-up time were less in our study. Commonly, many failures of dental implants develop before loading time, which is 2-3 month after placement. So the number of failures after this

time shows less affect to the result of survival rate, only few failures are expected to occur.

A systematic review of the complications of implant abutments supporting fixed prostheses by Zembic et al.⁽⁴⁾ identified total complications of 19.10%. The most common complication was abutment screw loosening, which ranged between 0.97% and 17.25%. The complication rate was similar to that in this study (17.26% vs 19.10%), but abutment screw loosening was higher.

We concluded that the rate of abutments screw loosening was higher than in prior studies because the protocol for screw tightening was different. An earlier protocol was performed only one time with 30 N-cm and this may lead to the abutment screw loosening due to settling effects. Whereas using the protocol used in 2013, the abutment screw tightening was performed twice, with the abutment screw being tightened, first with 30N-cm , then after 10 min, the screw was tightened again to reduce the settling effects.

Adell et al.⁽¹⁸⁾ reported an average amount of crestal bone loss of 1.5 mm from the first thread during healing and during the first year after loading. In contrast, there was an average of only 0.1 mm bone lost annually thereafter. The marginal bone loss obtained in this study showed that 63.88 % of all implants examined had ≤ 1.0 mm of bone loss over this observation period, which is lower crestal bone loss than the findings in Adell's study.

This may be caused by the use of a platform switching implant, which enhance the long-term bone conservation around implants. The concept that platform switching help preserve bone resorption by its connection, which moves the perimeter of implant-abutment junction (IAJ) toward the center of implant axis. Thus, bacteria are brought out more inwardly and away from the bone crest.^(19,20) The

platform switching also has biomechanical advantages as it is designed to move the stress area centrally to the perimeter of implant, in which the tension force is distributed along the axis of the implants and the shear force loaded on the cortical bone is lower than conventional design.⁽²¹⁾ In conclusion, dental implant in our study using platform switching model resulted in a decrease in crestal bone loss in a horizontal pattern.

Three cases had angular bone loss of more than 3 mm. One of them was an immediate placement, another one had excessive cement around the implant. The last one was in a patient with poor oral hygiene due to loss of follow-up.

Conclusions

In 60 patients with 110 implants, the accumulated survival rate was 97.27%, which is comparable to earlier studies. Within the conditions of this study, the follow-up period and the samples, the survival rate of the PW+ dental implant system was considered a satisfactory finding.

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