Original article

Dental Implant Treatment at The Faculty of Dentistry Chulalongkorn University: 5-year Data Analysis

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Abstract

The aim of this study was to analyze the dental implant treatment data at the Faculty of Dentistry, Chulalongkorn University (FDCU) for the past 5 years. The treatment records of patients who had implants placed during 2014-2018 were retrieved from the FDCU electronic patient database. Patient information; sex, age, region, implant number and complications, and patient's follow-up were collected. The data were analyzed by descriptive statistics using IBM SPSS Statistics software. We found that among 4,111 records, 2,734 records with 4,279 implants met the study criteria. The number of implant patients increased approximately 10 % each year. The average patients' age was 55.9 years old (range 15-89 years). Sixty percent of the patients were 50 - 69 years old, female, and had one implant placed. Seventy-one percent of the implants were placed in the posterior region. Among the 1,967 patients who had complete implant restoration for at least six months, 1,245 (63.3 %) followed the maintenance recall schedule. Complications were detected in 288 implants and 76 implants were eliminated. Seven departments/clinics at FDCU provided implant treatment. However, missing implant details and illegible handwriting were found in many records. In conclusion, the number of dental patients at FDCU is increasing. Most patients were 50-69 years old, with the majority of the implants placed in the posterior region. Although half of the patients followed the first-year maintenance recall schedule, the number decreased over time. Few complications were noted. One third of the records was incomplete resulting in less data to be analyzed.

Keywords: dental implant, maintenance, patient database, recall, treatment record

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Introduction

A dental implant is an artificial tooth root, and is widely used as a replacement for a missing tooth as a single-tooth implant or an implant-supported overdenture.[1] Several implant designs have been developed and used in clinical dentistry. Implant treatment has become increasingly popular because it results in marked improvement in appearance, speech, chewing, comfort, and quality of life without harming the natural teeth and have an almost 100 % success rate.[2]

The number of dental implant patients in Thailand has rapidly increased over the last few decades not only in dental schools, such as the Faculty of Dentistry, Chulalongkorn University (FDCU), but also at private dental clinics. To evaluate the trend and success of implant treatment in Thailand, baseline statistical data is needed. However, there is no statistical report of the dental implant treatment in Thailand. Unfortunately, it would be a very hard and time-consuming work to collect the country's data since no official registrar for dental implant treatment is set. The data collection in a well-known organization like a dental school could be a pioneering effort. The aim of this study was to gather and analyze the dental implant treatment data at FDCU.

Materials and methods

The protocol for this study was approved by the Human Ethics Committee, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand (HREC-DCU 2019-039). The treatment records of dental implant patients who received dental implant placement and restoration at FDCU from January 2014 to December 2018 were retrieved from the hospital electronic database using the treatment fee codes. Demographic data; including age, sex, implant number, location, diameter, and length, and soft or hard tissue graft were collected. The department providing treatment, follow-up period, and complications were also collected.

Descriptive statistical analyses were performed using IBM SPSS Statistics version 22 software (SPSS Inc., Illinois, USA).

Results

Dental implant patient demographic data

The electronic database search resulted in 4,111 patients who received dental implants during January 2014 to December 2018; however, dental implant treatment was confirmed in only 2,734 patient records with a total of 4,279 dental implants. The patients comprised of 1,102 men (40.3 %) and 1,632 women (59.7 %) with a mean age of 55.9 years old (range 15 - 89 years old), 60 % were in the 50-69-year age group. Sixty-three percent (1,719 patients) received one implant and the remaining patients received two or more. Of the 4,279 implants, 1,984 (46.4 %), 178 (4.1 %), and 128 (3 %) implants involved bone grafting, soft tissue grafting, and both bone and soft tissue grafting, respectively (Table 1).

Table 1 Number of implants based on the details of the implant

	Number of implants Total = 4,279 (%)
Brand	
Identifiable	4,254 (99.2)
N/A*	34 (0.8)
Location	
Anterior esthetic zone	
Maxilla	915 (21.4)
Mandible	308 (7.2)
Posterior zone	
Maxilla	1,001 (23.4)
Mandible	2,041 (47.7)
N/A*	14 (0.3)
Diameter	
Narrow (<3.75 mm)	594 (13.9)
Standard (3.75 to 5 mm)	3,607 (84.3)
Wide (>5 mm)	51 (1.2)
N/A*	27 (0.6)

Table 1 *Number of implants based on the details of the implant (cont.)*

	Number of implants Total = 4,279 (%)
Length	
Short (≤8 mm)	853 (19.9)
Standard (>8 mm)	3,402 (79.5)
N/A*	24 (0.6)
Bone & soft tissue graft	
Bone grafting	1,984 (46.4)
Soft tissue grafting	178 (4.1)
Both	128 (3.0)
None	1,989 (46.5)
Type of restoration	
Crown	2,563 (59.9)
Bridge	221 (5.2)
Overdenture	148 (3.4)
N/A*	1347 (31.5)
Amount of implant placement	**Number of patients** Total = 2,734 (%)
1	1,719 (62.9)
>1	1,015 (37.1)

*not available due to unclear data record

Dental implant characteristics

The number of patients and implants increased approximately 10 % each year (Fig. 1). The majority of the implants placed at FDCU were Straumann (2,866 implants, 67.0 %) followed by Astra Tech (1,141 implants, 26.7 %). Most of the implants had a standard diameter (3.75 - 5 mm, 3,607 implants, 84.3 %) and length (>8 mm, 3,402 implants, 79.5 %). A single crown was the most common restoration (2,563 implants, 59.9 %), and the remaining consisted of bridges and implant-retained removable dentures (Table 1).

Implant location

The implants were more commonly placed in the mandible compared with the maxilla (2,349 and 1,916 implants, respectively), and more prevalent in the posterior than the anterior esthetic region (3,042 and 1,223 implants, respectively) (Table 1). The most common location was the mandibular first molar (1,199 implants, 28.1 %), followed by the maxillary first molar (527 implants, 12.4 %), and the mandibular second molar (500 implants, 11.7 %) (Fig. 2). The distribution of implant size used in each location is seen in Table 2.

Table 2 *Implant size based on anatomical region*

Anatomical region	Number of implants (%)				
	Diameter			Length	
	Narrow <3.75 mm	Standard 3.75 to 5 mm	Wide >5 mm	Short ≤8 mm	Standard >8 mm
Anterior maxilla	350 (38.4)	562 (61.6)	0 (0)	54 (5.9)	859 (94.1)
Posterior maxilla	46 (4.6)	932 (93.7)	17 (1.7)	347 (34.8)	649 (65.2)
Anterior mandible	130 (42.5)	176 (57.5)	0 (0)	19 (6.2)	288 (93.8)
Posterior mandible	67 (3.3)	1,930 (95.0)	34 (1.7)	432 (21.3)	1,595 (78.7)

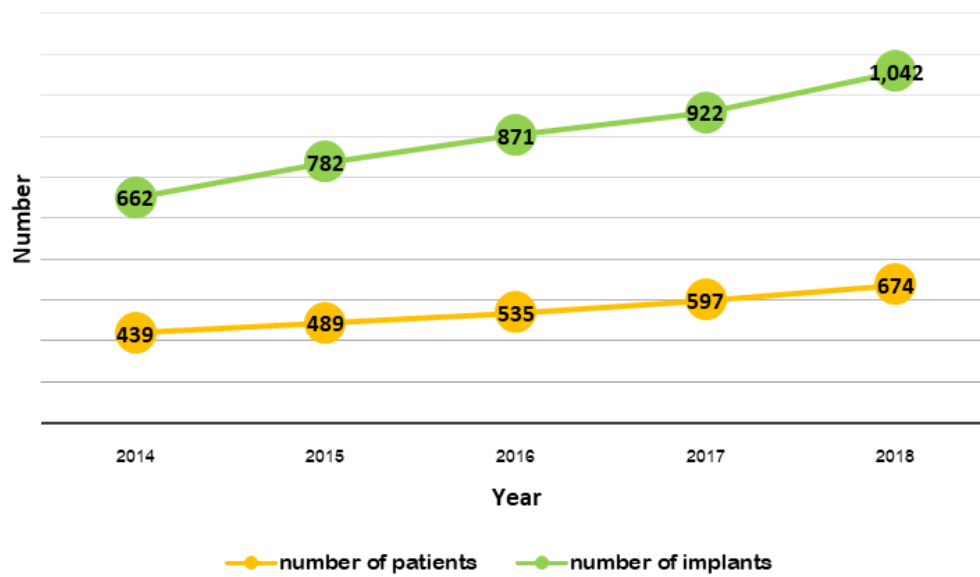*Missing/unclear data were excluded.

Figure 1 Number of patients and implants each year. The number of dental implant patients and placed implants increased ap proximately 10% each year
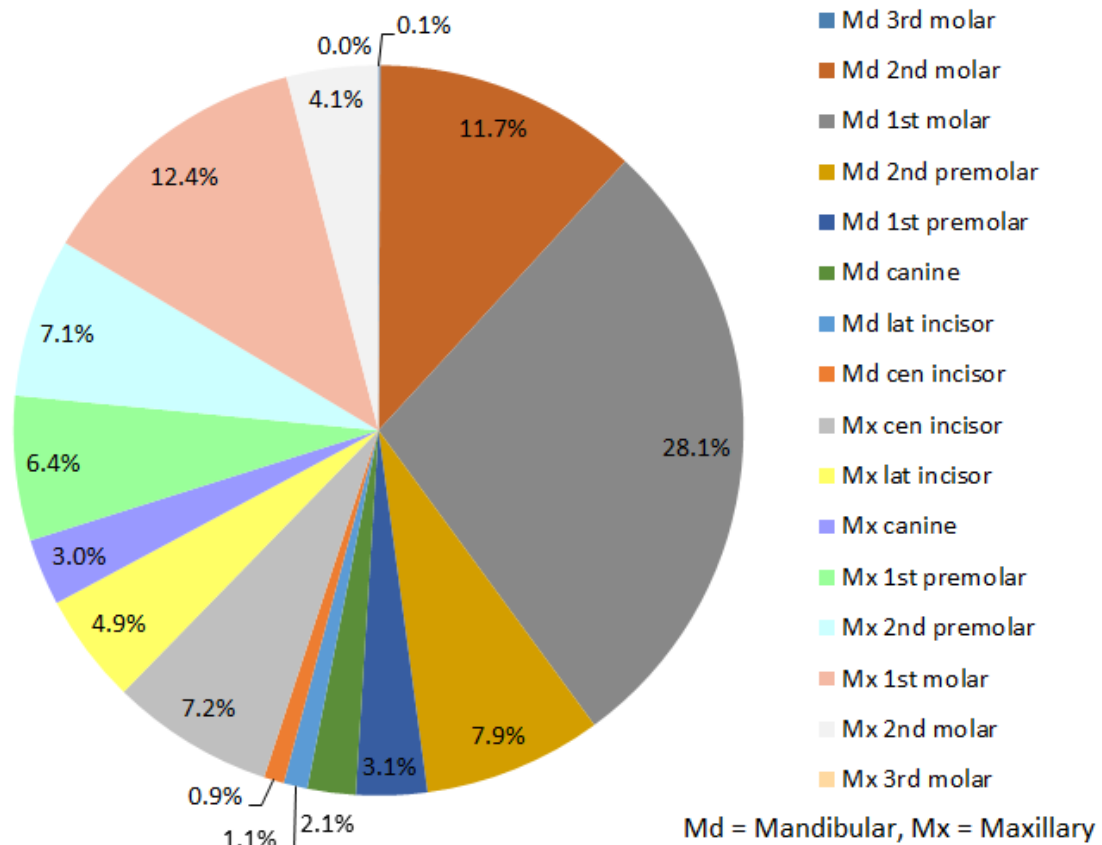

Figure 2 Implant distribution based on location. The mandibular first molar was the most common location of implant placement, followed by the maxillary first molar, and mandibular second molar. No implant was placed at the maxillary third molar location

Departments providing implant treatment

Five departments/clinics provided implant surgery, the Oral and Maxillofacial Surgery (OMFS) department, the Periodontology departments, the Esthetic, the Implant, and the Specialist clinics. The surgical procedures for implant placement were mostly performed at the Specialist clinic (1,652 implants, 38.6 %) and OMFS department (1,570 implants, 36.7 %). The implant restorations were performed at seven departments/clinics, the Prosthodontic department, the Esthetic, the Implant, the Specialist, the Maxillofacial prosthetic, the Geriatric clinics, and the OMFS department. Nearly half of the implant restorations were performed at the Specialist clinic (1,429 implants, 48.0 %), followed by the Prosthodontic clinic (820 implants / 27.3 %) (Table 3).

Table 3 *Distribution of patients and implants based on department/clinic providing surgical and restorative procedures*

	department/clinic providing surgical procedures				
	OMFS	Specialist	Esthetic	Implant	Periodontology
Number of patients	952	1,113	357	1	311
Total = 2,734 (%)	(34.8 %)	(40.7 %)	(13.1 %)	(0.1 %)	(11.3 %)
Number of implants	1,570	1,652	576	3	478
Total = 4,279 (%)	(36.7 %)	(38.6 %)	(13.5 %)	(0.1 %)	(11.1 %)
	department/clinic providing restorative procedures				
	Prosthodontics	Specialist	Esthetic	Implant	Others[c]
Number of patients	508	968	225	240	38
Total = 1,979[a] (%)	(25.7 %)	(48.9 %)	(11.4 %)	(12.1 %)	(1.9 %)
Number of implants	820	1,429	340	338	70
Total = 2,997[b] (%)	(27.3 %)	(47.9 %)	(11.4 %)	(11.2 %)	(2.2 %)

[a]*The number of patients who already had their implant restored.*

[b]*The number of implants restored.*

[c]*Maxillofacial prosthetic, OMFS, and Geriatric clinic.*

Number of implant patients following implant follow-up visit

Among the 2,734 patients (4,279 implants), only 1,967 patients (2,940 implants) had their implant restoration performed at least six months before data acquisition and were included into the follow-up criteria. One thousand two hundred and forty-five patients (1,863 implants) who attended the follow-up visits six months after restoration were identified. The number of patients attending only the first year follow-up was 739 (1,095 implants), while 506 patients attended further follow-ups (768 implants).

Implant follow-up provider

Most of the implant follow-ups were performed by the dentists who placed and restored the implants (704 of 1,245 patients). However, 275 patients had their implants evaluated only by the dentists who provided the restoration and 219 patients by those who placed the implants. The remaining 47 patients had their oral health, including implant follow-up, evaluated by dentists who had performed neither the surgery nor the restoration.

Complications

Complications were noted in 288 implants (6.7 % of all implants placed), including 97 implants with biological complications and 191 implants with technical complications, of which 76 implants were removed. Among the removed implants, 33 failed from biological and ten failed from technical complications; while no records were available of the other 33 failed implants. The biological complications

included peri-implant mucositis, peri-implantitis, disosseointegration, bone graft material leakage, abscess, and fistula. The technical complications included abutment screw loosening, abutment screw fracture, crown dislodgement, crown instability, retrieving screw-hole filling dislodgement, implant body fracture, implant malposition, loose contact, and traumatic occlusion.

Unclear records

Among the 4279 implants, unclear data was found in 1,160 (27.1 %), including 695 implants that were charted by unidentified clinics and the others had illegible handwriting, lacked important information, or were missing scanned treatment records. The records from the Specialist clinic had the greatest number of implants (204 implants) with unclear data.

Discussion

The present study demonstrated that the number of dental implant patients rose approximately 10 % during the five years of data collection. Similarly, dental implant use in the U.S. increased by an average of 14 % per year.[3] The average age of the patients in our study was 55.9 years old, which was similar to other studies.[4,5] Tooth loss is associated with advancing age, including in Thais.[6,7] Therefore, dental substitutes for replacing missing teeth, such as implants, provide a meaningful benefit for older patients. The most common site for implant placement in this study was the posterior mandible, especially the mandibular first molar, corresponding to other studies.[8-10] The reason for the first mandibular molar loss may be due to it being the first erupted permanent tooth and that it has a high risk for dental caries and periodontal disease.[11,12]

We found that standard length and diameter implants were the most commonly used implants. A short implant is typically placed in the posterior mandible and maxilla where the bone quantity is limited and in close proximity to vital structures, such as the maxillary sinus and inferior alveolar nerve.[13-15] Studies have demonstrated that short implants were associated with a lower survival rate.[16,17] In contrast, Annibali et al.,[18] reported that short

implants successfully supported prostheses in patients with an atrophic alveolar ridge. A systematic review and meta-analysis revealed that short implants' survival rate and marginal bone loss were not significantly different compared with standard implants.[19] However, other studies found that short implants were associated with higher prosthetic and biological complications.[20,21] Based on implant diameter, the largest percentage of narrow implants were placed in the anterior maxillary region. This finding may be because narrow diameter implants are typically placed in an alveolar crest with insufficient buccolingual width, resulting in less risk of injury to neighboring teeth and dehiscence defect.[22,23] In the present study, standard diameter implants were mostly used in the posterior region, correlating with other studies.[8,13] The wider diameter implants are associated with greater bone interaction, improved stability due to the increased surface area for osseointegration, more resistant to vertical load, and reducing the stress distributed to the surrounding bone.[17,24,25] Ting et al.,[26] suggested choosing wide diameter implants (>4.7 mm) in the posterior mandibular or maxillary region when there is a limit on implant length due to surrounding vital structures.

Complications were found in 288 of 4,279 implants (6.7 %) during the six months to five years follow-up period, which was lower than that of McDermott et al., who found 13.9 % from 2,379 implants in the 0-7 years follow-up period.[27] The failure rate in the present study may not reflect the actual rate due to missing data and the short follow-up period of five years. The most common biological complication was peri-implant mucositis/peri-implantitis, followed by abscess or fistula. The most common technical complication regarding the fixture was screw loosening followed by implant fracture. Crown or composite dislodgement was the most frequent restoration problem. These complications were similar to other studies.[28-32] It is recommended to systematically collect the implant failure rate and related contributing factors, and analyze these data which will be useful for developing guidelines to prevent failures.

Implant complications and failures are most likely to occur within the first year (3-8 %)[33] and subsequently decrease to approximately 1 %[34]. Several studies have revealed the importance of maintenance recall in relation to dental implant success rates.[35-37] A cohort of patients who frequently attended follow-up visits demonstrated a higher survival rate compared with those who did not.[38] However, the appropriate recall interval has not yet been determined. Monje *et al.,* suggested a follow-up every 3-4 months in the first year and subsequently on an interval based on individual risk factors, periodontal response, and oral hygiene.[37] A recall visit at least once a year was related to a 90 % decrease in treatment failure compared with patients who were lost to follow-up.[36] Therefore, patients who have received their final restoration should attend maintenance visits to prevent postoperative complications. Moreover, implant maintenance schedules should be set for a sustainable implant treatment outcome.

The limitations of this study included short-term data collection and unclear data. Because the data were searched from scanned treatment records in the FDCU electronic database, the missing scanned documents were counted as unclear data. Moreover, illegible handwriting and incomplete information, such as the implant or restoration details, implant location, and the dentist who provided treatment were also counted as unclear data. Biomedical research, including dental research, has evolved to using digital records. The patient-level information can be easily obtained from standardized digital data, and rapidly analyzed to determine trends, risk factors, and treatment outcomes that can guide treatment decisions, research directions, health care promotion, and policy. However, collecting health data from digital systems has some disadvantages when there is no standardized format for capturing data. Using uniform terminology, classification, and data recording templates would greatly promote the completeness of the patient record and subsequently better analysis.[39] Our results suggest an urgent need to develop uniform and fully electronic patient records.

Conclusion

The number of patients receiving dental implants at FDCU is increasing. Most implants were placed in the posterior region and the patients were in middle age and elderly. Sixty percent of the patients attended the first-year recall visit and the number markedly decreased over the long term. Implant complications were noted. Many incomplete and unclear data were found.

Acknowledgements

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