

IMPLANT TREATMENT IN AN URBAN GENERAL DENTISTRY RESIDENCY PROGRAM: A 4-YEAR RETROSPECTIVE STUDY

Mohamed A. Maksoud, DMD
Clifford B. Starr, DMD

KEY WORDS

Dental implants
General dentistry resident
education
Survival rates

Little data have been published on the survival rates of implants placed in dental residency programs. This study reports on the outcome of dental implants placed by first-year general dentistry residents in the University of Florida College of Dentistry–Jacksonville Clinic. The patients for this study received both surgical and restorative implant therapy from 1998 to 2002. A total of 108 patients (62 women, 46 men) were treated with dental implants. On average, a patient was 52.9 years old and received 2.6 implants. A variety of simple and complex restorative procedures were performed. Advanced general dentistry residents in conjunction with supervisory faculty treated all cases. The cumulative implant survival was 98.2%. Follow-up varied from 6 months to 4 years after placement. Cases included implants not yet loaded as well as implants loaded for 3 years or more. The findings of this study compare favorably with published studies and were unexpected in light of the residents' limited clinical experience.

INTRODUCTION

Public awareness of dental implant treatment has become commonly accepted at a fast pace. With the advancement of technology and the current accessibility to a global field of information, the general public is able to research, visualize, and understand the advantages of dental implant treatment. The American Dental Association has reported "the average survival rates of multiple implant designs

placed in various clinical situations are more than 90%."¹ According to The National Institutes of Health, the number of dental implants placed in the United States increased fourfold between 1983 and 1987² and increased an additional 73% between 1986 and 1990.³ In 1992, US dentists placed more than 300 000 dental implants and spent more than \$175 million to purchase dental implant products.^{4,5} Implants are a part of everyday dental medicine, with 65% of general dentists using implants in their routine practi-

Mohamed A. Maksoud, DMD, is an adjunct clinical assistant professor, and Clifford B. Starr, DMD, is a clinical associate professor at the University of Florida College of Dentistry, Jacksonville Clinic, Jacksonville, Fla. Address correspondence to Dr Starr at 2028 Boulevard, Jacksonville, FL 32206 (e-mail: cstarr@dental.ufl.edu).

ces.^{4,5} Patients select implant dentistry to help correct ill-fitting dentures, address limitations associated with removable partial dentures, and support single crowns that will provide function and acceptable esthetics.

This increased demand for dental implants is the result of a combination of factors, including age, tooth loss, poor performance of conventional prostheses, patients' expectations, endorsement by dentists and dental hygienists, and increasing predictability of implant-supported restorations.⁶ The American Dental Association (ADA) recently reported findings likely to speed the integration of dental implants into routine dental practice when they stated that implants may provide a "more predictable outcome" than alternative therapies.¹ Furthermore, the ADA reported that "mandibular [implant] overdenture therapy is highly predictable," and that implants used to replace single posterior missing teeth "without the need for partial or full coverage restorations on the adjacent teeth provide the highest quality of care for patients."¹

Survival rates of multiple implant designs placed in various clinical situations average more than 90%.¹ Implant success increases with surgical experience of the operator. For example, cumulative implant survival rates have been reported to increase from 94% to 97% after the operator has completed 9 cases,⁷ and cumulative implant survival rates as high as 96% have been reported for implants placed by periodontic, prosthodontic, and oral surgical resident-faculty teams.⁸ However, little has been published about the results of implant training at the postgraduate general dentistry level. This study describes the preliminary results of implants placed by

dental residents in their first year of advanced general dentistry training.

MATERIALS AND METHODS

This study analyzes and categorizes the implant experiences of patients treated at the University of Florida College of Dentistry—Jacksonville Clinic (UFCD-J) in a 1-year advanced general dentistry residency program. Eight dental residents received training in all areas of general dentistry, including prosthodontics, oral surgery, orthodontics, periodontics, and implant dentistry in a supervised clinic. A total of 108 patients who received 279 dental implants in the clinic between 1998 and 2002 were included in this study. Study subjects were existing patients who received all treatment in the UFCD-J clinic. All patients received a comprehensive evaluation and treatment plan by general dentistry residents in consultation with UFCD-J faculty. Some patients presented to the clinic seeking implant dentistry, but in most cases the treating dental residents recommended dental implant treatment.

Data were collected from the UFCD-J administrative database. A spreadsheet (Microsoft Excel 2002, Microsoft Corp, Redmond, Wash) was developed to record relevant patient information onto a desktop computer. The information was sorted by gender, age, implant system, number of implants per patient, restorative plan, case cost, surgical characteristics, and implant health status.

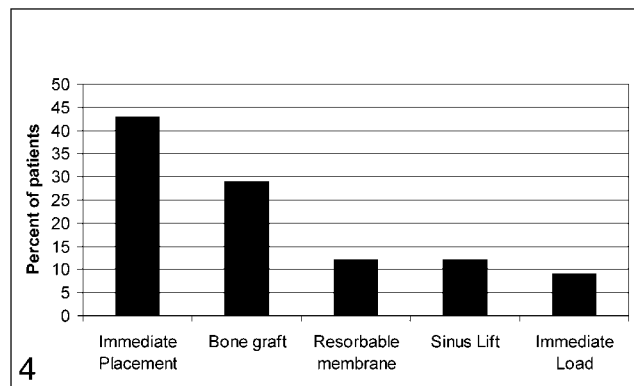
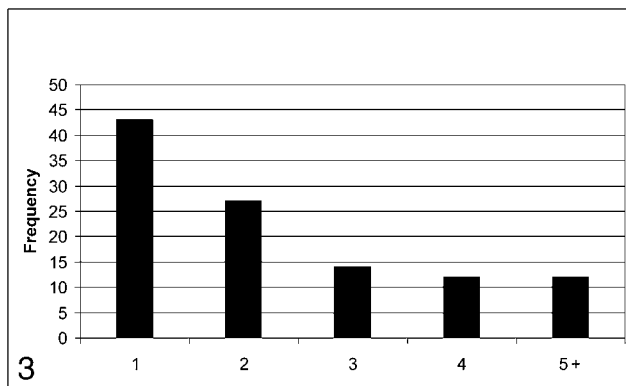
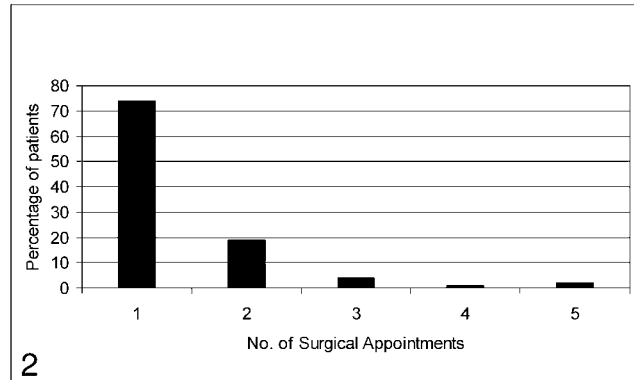
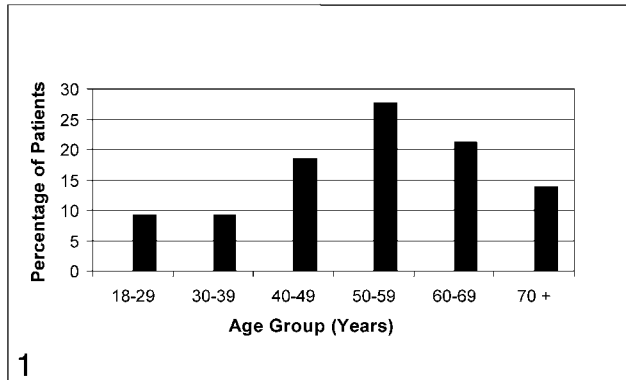
RESULTS

The study population was 57% women ($n = 62$) and 43% men

($n = 46$). The patients were categorized into 6 age groups (Figure 1). The highest percentage of patients (28%) was between the ages of 50 and 59. The 2 youngest age groups (18–29 and 30–39) were tied with the lowest percentage of patients (9%). Although 4 different implant systems—SteriOss (Nobel Biocare, Yorba Linda, Calif), Branemark NOVUM (Nobel Biocare), Taper-Lock (Zimmer Dental, Carlsbad, Calif), and ITI (Strauman, Waltham, Mass)—were used, 94% of the patients received 1 implant system (SteriOss). Most patients (74%) had their implants placed in 1 surgical appointment, whereas 19% had multiple implants placed in 2 surgical appointments and 6% required 3 or more surgical appointments (Figure 2). Single implants were placed in 40% of the patients, 2 implants in were placed in 25% of the patients, and 3 to 15 implants were placed in the remaining 35% of the patients (Figure 3).

Figure 4 represents surgical information. Nearly half of the patients (43%) had implants placed at the time of extraction, and 9% had implants immediately loaded at the time of the implant placement. Bone grafts for the purpose of ridge augmentation or to fill in the void between the implant body fixture and the walls of the extraction socket were placed in 29% of the patients. Resorbable membranes, Biomend Extend, (Zimmer Dental), either separate from or in addition to bone grafts, were placed in 12% of the patients. Twelve percent of the patients had closed sinus lifts to allow implant placement.

A total of 279 dental implants were placed in 108 patients. Five implants failed and had to be removed. Twelve implants suffered bone loss and required treatment.



FIGURES 1–4. FIGURE 1. Patient age at surgery. FIGURE 2. Surgical appointments per patient. FIGURE 3. Number of implants per patient. FIGURE 4. Surgical information.

The cumulative implant survival rate was 98.2%. Follow-up varied from 6 months to 4 years after placement. All 5 implants were lost before they could be restored. In 4 cases, the implants were removed and replaced with successful implants. In the remaining case, the site received a bone graft, and an implant will be placed after suitable maturation of the graft has occurred.

The distribution of bone loss is reported in Figure 5. Fewer than 5% of the patients lost 1 or 2 implants because of bone loss. An additional 11% had bone loss that was successfully halted or reversed with combinations of implant detoxification, bone grafting, and resorbable membranes. Women were 4 times as likely (16%) to suffer reversible bone loss, as an implant complication, than were males (4%).

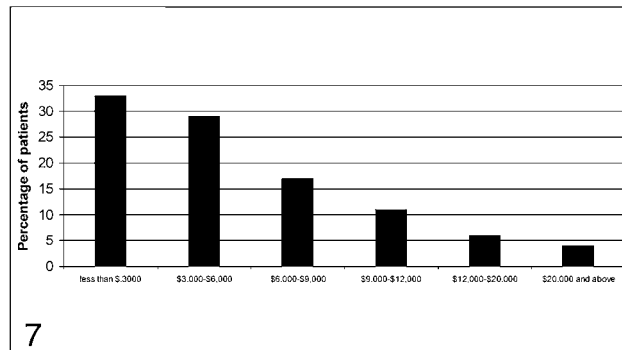
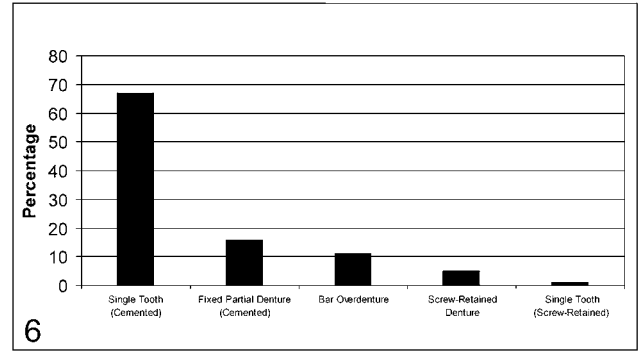
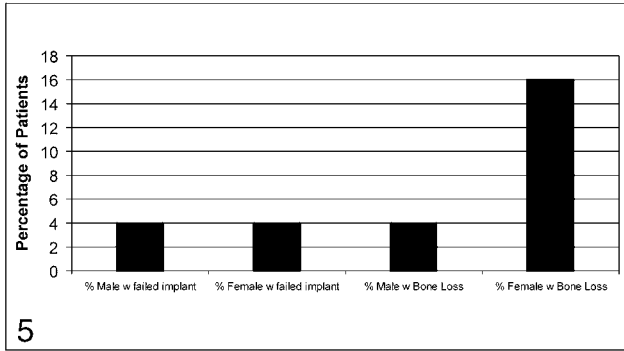
Figure 6 shows the distribution of implant restorations. The largest group (67%) included cemented single-tooth restorations, followed by cemented, fixed partial denture restorations (16%). The remaining 17% included fixed screw-retained prostheses (5%), screw-retained single-tooth restorations (1%), and complete dentures supported by a screw-retained bar attached to multiple implants [11%]. To date, 9% of the patients in this study (4 men, 6 women) have not had their implants restored.

The average cost of treatment was \$6161, with a range of \$1000 to \$30 000. This information provides some insight to the surgical and restorative complexity of the cases included in the study. Although some cases were quite complex, others were relatively simple. Figure 7 shows that the

highest percentage of patients, approximately 33%, spent less than \$3000 for the total cost of the surgical and prosthodontic treatment. Additionally, another 29% of the patients spent between \$3000 and \$6000. Only 4% of the patients spent more than \$20 000.

DISCUSSION

One significant finding is that women were 4 times as likely to experience excessive marginal bone loss around implants than were men. Sixteen percent of the women who received implants had excessive bone loss that required surgical intervention, compared with 4% of the men (Figure 5). Further studies are necessary to determine if this finding is widespread or limited to this particular patient population.



FIGURES 5–7. FIGURE 5. Ailing or failed implants. FIGURE 6. Implant-restoration types. FIGURE 7. Cost per patient.

A survey conducted by the National Institute of Dental Research and the National Institutes of Health revealed that Americans have a better chance today of retaining their dentition later into their lives than they had in previous years.⁹ This is mainly due to increased awareness of dental and periodontal disease among the population. It may also be due to advancements in dental technology. Other studies have reported the prevalence of tooth loss did not dramatically change with age: tooth loss was slight in younger individuals, slowly increased up to middle age, and remained fairly constant after the age of 55. Gender was not related to tooth loss.^{10,11}

Patient demand for implant dentistry varies by location, patient age, and gender. In a Dutch study of 64 patients who were edentulous and between the ages of 42 and 84, patients were questioned regarding their intent to

improve ill-fitting complete dentures.¹² The older individuals in this group were more reluctant to pursue implants because of the expected pain and discomfort.¹² On the other hand, a Swedish and Danish study conducted on patients between the ages of 55 and 79 showed increased age was associated with a higher, self-identified need for implant treatment.¹³ Women also showed a more significant desire for implant treatment than did men.¹³ These findings, coupled with the ADA implant status report,¹ suggest that the demand for implant therapy will continue to increase as it becomes the standard of care for patients who are edentulous or partially edentulous.

CONCLUSION

In this study, implants placed by advanced general dentistry residents achieved cumulative survival rates as high as those

reported for experienced clinicians.

REFERENCES

- Stanford C, Rubenstein J. Dental endosseous implants—an update. ADA Council on Scientific Affairs. *J Am Dent Assoc.* 2004;135:92–95.
- National Institutes of Health. Consensus development conference statement on dental implants. *J Dent Educ.* 1988;52:686–691.
- Stilman N, Douglas CW. Developing market for dental implants. *J Am Dent Assoc.* 1993;124:51–56.
- Watson MT. Specialist role in implant dentistry rooted in history. A survey on periodontists and maxillofacial surgeons. *Dent Prod Rep.* 1997;14–18.
- Watson MT. Implant dentistry: a 10-year retrospective report. *Dent Prod Rep.* 1996;26–32.
- Muller F, Wahl G, Fuhr K. Age-related satisfaction with complete dentures, desire for improvement and attitude to implant treatment. *Gerodontology.* 1994;11:7–12.

7. Lambert P, Morris H, Ochi S. Positive effect of surgical experience with implants on second-stage implant survival. *J Oral Maxillofac Surg.* 1997;55:12–18.
8. Kohavi D, Azran G, Shapira L, Casap N. Retrospective clinical review of dental implants placed in a university training program. *J Oral Implantol.* 2004;30:23–29.
9. US Department of Health and Human Services. Oral health of US adults, national findings. National Institutes of Health; 1997:28–68. NIH publication 87.
10. Marcus SE, Drury JF, Brown LS. Tooth retention and tooth loss in the permanent dentition of adults: United States. *J Dent Res.* 1996;75:684–695.
11. Meskin LH, Brown LJ. Prevalence and patterns of tooth loss in the US employed adult and senior population. *J Dent Educ.* 1988;52:686–691.
12. Cune MS, de Putter C, Hoogstraten J. Treatment outcome with implant-retained overdentures: part II—patient satisfaction and predictability of subjective treatment outcome. *J Prosthet Dent.* 1994;72:152–158.
13. Kronstrom M, Palmqvist M, Soderfeldt B, Vigild M. Subjective need for implant treatment among middle-aged people in Sweden and Denmark. *Clin Implant Dent Relat Res.* 2002;4:11–15.