

Predoctoral Dental Implant Education at Creighton University School of Dentistry

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Abstract: The purpose of this report is to describe the dental implant education that predoctoral students receive and to characterize the patient population receiving implants at Creighton University School of Dentistry (CDS). CDS has no postdoctoral residency programs. Therefore, clinical management of diagnosis, treatment planning, surgical aspects, restoration, complications, and maintenance of dental implants requires significant involvement by predoctoral dental students. CDS implant education involves radiology diagnostic assets of the General Dentistry Department (including the use of Cone Beam Computed Tomography), as well as faculty and equipment from the Departments of Oral and Maxillofacial Surgery, Periodontics, and Prosthodontics, with a majority of students satisfied with their didactic preparation for their clinical experiences. Focusing on a three-year window from August 2007 to August 2010 and using electronic health records, this study found that a total of 242 implants were placed, out of which six failed within one year of placement and had to be removed. The average age of the population of 153 patients was found to be 53.3 years, with a range of eighteen to eighty-nine. Treatment outcomes compared very favorably with those published in the literature.

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Since the advent of osseointegrated dental implants in the United States in the mid-1980s, there has been an evolution in dental education involving dental implants.^{1,2} One can follow the development of, and confidence in, dental implant programs in dental schools. With the availability of trained instructors, what was once considered the purview of only postdoctoral oral surgery, periodontal, and prosthodontic programs has now become commonplace education within the curriculum and clinical experience of predoctoral dental students.³ Huebner found that dental students who have received significant dental implant education have a higher probability of performing implant dentistry in their practices after graduation.⁴

Curriculum guidelines for predoctoral implant dentistry were first published in the United States in 1991.⁵ In 2006, a report from the American Dental Education Association (ADEA) Implant Workshop's survey of deans concluded that 1) implant dentistry is commonly taught and clinical experiences are

available for predoctoral students; 2) predoctoral clinical experiences at that time were somewhat restricted to straightforward, uncomplicated cases involving single-tooth implants and implant-retained overdenture prostheses; and 3) generally, implant dentistry was taught by specialty faculty, rather than by the general dentistry faculty.² The purpose of our report is to describe the dental implant education that predoctoral students receive and to characterize the patient population receiving implants at Creighton University School of Dentistry (CDS).

Implant Dentistry Education at Creighton University

Creighton's dental school has a four-year curriculum, with a class size ranging from eighty-two to eighty-nine students over the past ten years. There are

no postdoctoral dental residency programs at CDS; therefore, all treatment rendered is accomplished by predoctoral students with ultimate management by the faculty. Full-time and part-time faculty members, both teaching and clinically supervising implant dentistry, are drawn from the Departments of General Dentistry (radiology diagnostic assets, including Cone-Beam Computed Tomography), Oral and Maxillofacial Surgery, Periodontics, and Prosthodontics. Beginning in the second year of dental school, students take a variety of courses that either focus solely on implant dentistry or incorporate the subject into their course syllabus. The responsibility for those courses lies primarily with the Departments of Oral and Maxillofacial Surgery, Periodontics, and Prosthodontics. In the final semester of the senior year, an advanced implant technique lecture course is offered as an elective through the Department of Periodontics.

Within the Department of Prosthodontics, one board-certified prosthodontist has the title of director of implant dentistry and is the point person for processing all implant patients at CDS. Furthermore, all implant patients undergo an annual record review by the Department of Prosthodontics. Although approximately two-thirds of the dental students are assigned an implant case during their two years of clinical experience, it is unusual for one student to be able to manage a case from diagnostic workup to final crown placement. Due to time constraints, each student can be provided a case to complete that was started by a senior and can begin a case of his or her own with the intent to transfer it to a new senior upon graduating. For the graduating class of 2011, which was comprised of eighty students, fifty-seven of those students were involved as seniors with managing surgical implant placements. A total of 122 implants were placed by those seniors, and seventy-eight implant cases were initiated by them. In general, implant fixtures are placed only by senior students with either a junior or a senior assisting in the procedure and close supervision by a surgical faculty member. As of 2011, there were didactic competencies but no clinical competencies assigned to implant dentistry at CDS. Aside from competencies, the dental students are tested based on written examinations, laboratory projects, and clinical performance.

Most dental implant patients at CDS are derived from the population of patients who utilize CDS as their primary dental treatment facility. The implant protocol for CDS does allow for patients to be referred to the implant program but stipulates that CDS

will accomplish both the surgical and prosthodontic treatment for the patient. Thus, all dental implant treatment for any given patient is accomplished by CDS faculty and students. CDS does not include a formal faculty practice that places implant fixtures or restores implants in the dental school.

Methods and Results

Implant Patients

In the ten-year window from August 2000 to August 2010, the Department of Prosthodontics reported that a total of 931 implant fixtures were placed on 548 patients. Institutional Review Board (IRB) approval was obtained in order to conduct a focused review of the CDS patients' electronic health records (EHRs) in axiUm (Exan Group, Coquitlam, BC, Canada) (IRB #09-15613) for the three-year period from August 2007 to August 2010. For each of the implant cases, a student was assigned to manage the case through the treatment planning, surgical, and prosthodontic phases. The students receive the same supervision for each phase of implant treatment as they would for any other treatment planning, surgical, or prosthodontic procedures. Depending on the experience and proficiency of the student, each assigned student was involved to some degree in the actual delivery of the treatment.

During that three-year period, a total of 242 implants were placed, out of which six failed within one year of placement and had to be removed. This represents a success rate of 97.5 percent, based on the retention of the fixtures, and, by inference, a failure rate of 2.3 percent. The average age of this population was 53.3 years, with a range of eighteen to eighty-nine. There were seventy-seven male and seventy-nine female patients. Nine of the patients were taking bisphosphonates, seven were listed as diabetic (controlled), and seventeen were listed as tobacco smokers (although they had quit by the time of implant placement).

Complications and complaints listed in the treatment notes were assessed and tallied (Table 1). Complications were defined as those faculty- or student-generated observations of unexpected signs and events during healing or during prosthodontic treatment. Complaints were defined as those patient-generated symptoms or signs of unexpected healing or post-healing events causing concern to the patient. Within one year after placement of fixtures and final

prostheses, there were thirteen surgically related complaints. There were thirty-one surgically related complications (found by the student or the instructor). Prosthodontically related complaints totaled five, with thirty-one prosthodontic complications (found by the student or the instructor) within one year, for a complication rate of 20 percent based on the number of patients and 13 percent based on the number of implants.

Dental Student Experiences with Implants

As with all courses at CDS, we were interested in gaining feedback from the dental students regarding their experiences with dental implant education.

Under the same IRB approval, a six-question survey was prepared and distributed to the class of 2012 (senior class) in December 2011 at the end of the academic fall semester. There were no identifying marks on the surveys; therefore, the surveys were completely anonymous, and participation in the study was voluntary. As of December 2011, when this survey was conducted, there were eighty-three students in the senior class. Sixty-one students returned the surveys, for a response rate of 73.5 percent.

Responses to the survey are shown in Table 2. Questions 1 and 2 found that over half of those responding from the senior class had been involved in treatment planning, while roughly 80 percent of that population felt that their didactic courses adequately prepared them for the elements involved

Table 1. Compilation of complications and complaints listed in the treatment notes (total number of patients=153)

	Complaints	Complications
Related to surgical aspects, including osseointegration	13	31 (representing 13% of all implants placed)
Related to postsurgical, prosthodontic aspects	5	31 (representing 13% of all implants placed)

Table 2. Responses to questionnaire distributed to senior class in December 2011 (class size=83; total number of responding students=61)

Question	Number Responding YES	Number Responding NO
Question #1: Have you been involved in actually working up an implant case, including diagnostic radiographs and treatment planning under the supervision of instructors? [For this question, "working up" means you analyzed the diagnostic material yourself, and confirmed it with an instructor.] If "No," please skip to Question #3.	35	26
Question #2: If you have been involved in working up an implant case, did the lectures dealing with implants that you attended in Prosthodontics, Periodontics, and Oral Surgery prepare you for that experience?	28	7
Question #3: Have you been involved in actually surgically placing an implant fixture in alveolar bone, with supervision by an instructor from either Oral Surgery or Periodontics? [For this question, "surgically" means that you either: a) made the incisions, b) drilled the fixture channel, and/or c) drove the fixture into the channel.] Circle all that apply. If "No," please skip to Question #5.	Incisions: 7 Drilled: 7 Placed Fixture: 6	53
Question #4: If you have been involved with the surgical aspect of placing an implant fixture, in your opinion, did the Oral Surgery and Periodontics lectures dealing with the surgical aspect of implants prepare you for that experience?	6	2
Question #5: Have you been involved in actually fabricating a dental implant restoration (crown, denture connector, etc.), with supervision by an instructor from Prosthodontics? If "No," please skip the next question.	30	31
Question #6: If you have been involved with the prosthodontic aspect of placing a supra-gingival prosthesis on an implant fixture, in your opinion, did the Prosthodontic lectures and laboratories that you received over the past three years dealing with such restoration prepare you for that experience?	29	1

in the planning. Questions 3 and 4 found that, at the most, only 13 percent of those responding had actually accomplished a task involved in performing implant surgery, while all of that population felt that their didactic courses had prepared them for the hands-on experience. Questions 5 and 6 found that about half of those responding from the senior class had been involved in the prosthodontic treatment for dental implant patients, while almost all of that population felt that their didactic and laboratory courses had adequately prepared them for that clinical application.

Discussion

The experience of CDS predoctoral dental students with dental implants compares favorably with other published reports. Maalhash-Fard and Nimmo reported that, during an eleven-year period in a predoctoral program, 159 implants were placed in seventy patients, with a failure rate of 6.3 percent.⁶ The minor prosthodontic complication rate was calculated to be less than 5 percent of the patients. Reporting on the failure and complication rate for implants replacing a single molar at a dental school outside the United States, Levin et al. found a failure rate of 7.4 percent and a complication rate of 11.1 percent.⁷ The CDS failure rate for the three-year time period evaluated was 2.5 percent. Since different authors have used varying criteria to define complication rates, it is very difficult to compare such rates among different studies.

Having no residents at CDS implies that there are more patients available for treatment by predoctoral students and that clinical implant experience is robust. At CDS, there is no formal selection process that would limit the number of third- and fourth-year students who are offered the opportunity to perform dental implant treatment on patients. The director of implant dentistry assigns implant patients by drawing from the entire population of junior and senior students, using only reasonable academic constraints. Those assigned students then conduct all the treatment planning and treatment under close supervision by the instructors; the cases range from simple to complex. In contrast, in the program described by Maalhash-Fard and Nimmo,⁶ the implant education opportunity was offered to only a group of ten senior students out of a class of seventy-two. Zimmermann and Hendricson also described a formal selection process for their implant program, in which nine students

out of a class size of 100 were selected to participate in implant training during their senior year.⁸

The survey of our senior dental students found that, out of the sixty-one respondents, thirty-five had experienced the process of treatment planning implants on clinical patients. The survey also found that, out of sixty-one respondents, thirty had experienced the prosthodontic treatment involved in implants. Both of these numbers reflect more student involvement than the programs mentioned in the other studies.^{6,8} However, out of sixty-one respondents in our study, only seven senior dental students had intimate experience with surgically placing dental implants, possibly reflecting a larger hurdle to overcome in dental implant clinical education. This survey was conducted during December of the students' senior year, so their responses would probably have reflected a higher participation rate if the survey had been conducted at the end of the academic year. It must be noted that 74 percent of the senior class responded to the survey regarding their experience with dental implants and their didactic and laboratory preparation for that experience. This response rate is not as high as those student surveys reported in Jahangiri and Choi,⁹ Kido et al.,¹⁰ and Yuan et al.¹¹

Some consideration of student opinions of implant programs has been built into those implant programs developed and reported upon over the past fifteen years.⁹ By surveying recent graduates, Huebner⁴ and Maalhash-Fard and Nimmo⁶ both found that the quality and extent of dental implant education before graduation have an effect on the involvement of students in implant treatment for their patients after graduation.

Appropriate didactic and hands-on training prior to actual patient experience in dental school has been shown to be necessary 1) for students to be comfortable with incorporating implant treatment into their future practices, 2) for students to envision implant treatment as technically achievable, and 3) for students who would consider theoretically replacing their own first molar with an implant instead of with a bridge.¹⁰ Similarly, appropriate pre-patient care education and preparedness from pre-patient care laboratory exercises have been shown to engender a feeling by dental students of adequate preparation for rendering implant treatment for patients.¹¹ Jahangiri and Choi found that 69.4 percent of their responding dental students perceived the adequacy of their implant curriculum as satisfactory or fair.⁹ Yuan et al. reported that 58.4 percent of their respondents, reporting from "about one-third" of each class, felt

that “pre-patient care laboratory exercises (PCLEs)” had adequately prepared them for treating patients.¹¹ This compares to those CDS students who reported satisfaction with their preclinical curriculum at a rate of 80 percent to 99 percent, depending on which aspect of the curriculum was asked about. With the vast majority of responding students indicating that their pre-patient care education had prepared them for treating patients, by that measure, CDS education has been successful in delivering effective education and training to the dental students prior to their patient implant experience. Limitations to this part of the report, and the possible conclusions, include sample size and time constraints.

Conclusion

With the evolution of implant dentistry education in dental schools, treatment planning, surgical placement, and restoration of dental implants are now being taught, both didactically and clinically, at the predoctoral level. CDS predoctoral dental students receive an education in dental implants that compares favorably with other dental schools, involving perhaps a larger variety of patients, given the fact that no residencies are available at CDS. CDS patient outcomes reflect a highly successful rate, implying that quality of care standards are being maintained.

A majority of responding senior CDS students reported that their preclinical education in the treatment planning and prosthetic disciplines prepared them for their clinical experiences. Out of a senior class of eighty students, over a third reported significant involvement with implant treatment planning and prosthodontic treatment. However, very few senior students reported significant involvement with the surgical placement of dental implants. Therefore, although great strides have been made in educating

CDS predoctoral students in dental implants, there are still opportunities for improvement. We plan to survey the students again in five years in order to gain further, more reflective insight into their perceptions regarding their implant experiences in dental school.

REFERENCES

1. Bell FA 3rd, Jones AA, Stewart KL. A clinical implant program in the predoctoral curriculum. *J Dent Educ* 1991;55(2):169-71.
2. Petropoulos VC, Arbree NS, Tarnow D, Rethman M, Malmquist J, Valachovic R, et al. Teaching implant dentistry in the predoctoral curriculum: a report from the ADEA implant workshop's survey of deans. *J Dent Educ* 2006;70(5):580-8.
3. Wilcox CW, Sheets JL, Nilsson DE. Predoctoral implant education: the Creighton experience at 20 years. *J Prosthodont* 2010;19(2):144-9.
4. Huebner G. Evaluation of a predoctoral implant curriculum: does such a program influence graduates' practice patterns? *Int J Oral Maxillofac Implants* 2002;17:543-9.
5. American Association of Dental Schools. Curriculum guidelines for predoctoral implant dentistry. *J Dent Educ* 1991;55(11):751-3.
6. Maalhagh-Fard A, Nimmo A. Eleven-year report on a predoctoral implant dentistry program. *J Prosthodont* 2008;17(1):64-8.
7. Levin L, Laviv A, Schwartz-Arad D. Long-term success of implants replacing a single molar. *J Periodontol* 2006;77:1528-32.
8. Zimmermann R, Hendricson W. Introduction of an implant surgical selective into a predoctoral dental curriculum. *J Dent Educ* 2011;75(9):1256-62.
9. Jahangiri L, Choi M. A model for an integrated predoctoral implant curriculum: implementation and outcomes. *J Dent Educ* 2008;72(11):1304-17.
10. Kido H, Yamamoto K, Kakura K, Morinaga K, Matsuura T, Matsunaga T, et al. Students' opinion of a predoctoral implant program. *J Dent Educ* 2009;73(11):1279-85.
11. Yuan JCC, Kaste L, Lee D, Harlow R, Knoernschild K, Campbell S, et al. Dental student perceptions of predoctoral implant education and plans for providing implant treatment. *J Dent Educ* 2011;75(6):750-60.

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