Predoctoral Implant Education: The Creighton Experience at 20 Years

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Abstract

The landscape of predoctoral implant education has changed dramatically in the short span of two decades. Documented success and increased patient demands have driven heightened expectations upon the educational community. Predoctoral education must play a pivotal role in preparing the profession to meet these new opportunities. The evolution of implant education in the predoctoral sector is examined, and a typical implant program is described.

As evidence for the successful use of dental implants has mounted, the prospect of replacing missing teeth with dental implants has captured the public imagination. As a result, the last two decades have witnessed a rapidly growing demand for implant services. Initially thought to be the exclusive domain of specialty practitioners, implant treatment is now considered a vital part of a general dental practice.

To assume the task of preparing the profession for these challenges, dental educators and commentators have attempted to describe "...the future of implant education."[1-5] Familiar venues for education, such as specialty residencies, corporate courses, postgraduate courses, study clubs, and predoctoral programs, have all been enlisted.[6-8] The purpose of this article was to examine the evolution of implant education at the predoctoral level both in North America and at the Creighton University School of Dentistry (Omaha, NE).

Literature review

1986

In a 1986 review of implant dentistry, the American Dental Association (ADA) Council on Dental Materials stated that dental implants are "not recommended for routine clinical practice."[9] This typifies the general tone of repudiation of dental implants that prevailed at the time.

Two surveys conducted in the early 1990s by Bavitz[10] and Arbree and Chapman[11] confirm that there was emergent implant activity in North American predoctoral programs during that time. They found that 65% of schools (34/52) included implants in their programs; however, most limited the topic to a single quarter of lectures. They found that 18% of responding schools allowed students to perform prosthodontic procedures in the clinic, while only two schools allowed predoctoral students to be involved in implant surgery. Bavitz summarized the general atmosphere by stating that implants were "...taught within the existing specialties at a graduate level, with undergraduate education being limited to didactic familiarity."

At a 1991 meeting of the American Association of Dental Schools, a survey reported that "...91% of deans indicated that implant dentistry should be incorporated in the predoctoral curriculum."[12] Even so, they further stated that implants were to be taught to the "understanding" level, and they gave no indication for offering clinical experience.

1996

In a 1996 statement, the ADA Council on Scientific Affairs expressed a note of cautious acquiescence.[13] In their report they stated that implants "...can be used only for treatment of carefully selected patients where the relative merits of benefit and risk have been fully discussed."

At this time, a study by Weintraub et al revealed that 86% of responding schools had predoctoral implant programs.[14] While these were still predominantly lecture courses, 42% of these schools included preclinical laboratories, and 48% allowed

some clinical involvement. A 1998 workshop cosponsored by the American College of Prosthodontists and The Prosthodontic Forum recommended that didactic instruction be pitched to the level of "understanding" and that restorative skills be developed at the "exposure" level.[15]

2006

The tenor of the ADA's Council on Scientific Affairs' 2004 statement is one of enthusiastic endorsement.[16] In it, they observed ". . .a dramatic movement away from [implant] application as an experimental, even esoteric, treatment modality to one that can be considered a standard of care and be recommended routinely in general practice." The Council went on to endorse the restoration of implant-supported single crowns and the use of two independent implants to stabilize a mandibular complete denture as part of the realm of general practice.

A 2005 survey by Lim et al reveals that at that time, 84% of North American dental schools included implant dentistry as part of their school's requirements.[17] The average number of lecture hours devoted to these programs was 20.4 hours. Seventy-eight percent of programs included laboratory exercises, while 88% allowed predoctoral students to restore implants in the clinic.

A survey of deans conducted at an American Dental Education Association (ADEA) workshop conducted in 2006 concluded that, among North American dental schools, 97% of students received didactic instruction, and 86% of students received clinical experience.[18] In addition, they found that ". . .single tooth implant restorations and implant-retained overdenture prostheses are performed at the predoctoral level in most schools."

Table 1 Educational goals of the implant program

Graduating predoctoral students should
Be knowledgeable in the physical and physiologic mechanisms that impact on implant success
Be knowledgeable in the mechanisms of healing & integration
Be competent to evaluate & maintain implants/prostheses that have already been placed and restored
Identify normal/abnormal peri-implant soft and hard tissue response
Provide maintenance and hygiene services
Identify and correct minor mechanical abnormalities (eg., loose screw, occlusion, etc.)
Be competent to evaluate treatment suitability and advise patients seeking implant placement/restoration
Identify patients for whom implant restoration would be feasible
Identify and weigh risks and benefits of proposed treatment
Design prostheses
Be competent to restore simple implant cases
Construct a mandibular complete denture using 2 implants with ball attachments
Construct a single-tooth, implant-supported crown
Be familiar with advanced fixed/removable concepts
Be competent to manage a patient who will undergo implant placement
Prescribe implant placement
Design and construct surgeon's guides
Provide interoperative provisionalization
Be familiar with the special surgical protocols used when placing an implant

Implant programs

Several predoctoral programs have been described over the past decade.[5,14,17,19–25] As would be expected, these programs resemble each other in many ways. The majority of schools engage all students in group lectures and some level of laboratory exercise. Where programs differ markedly is in the amount of student clinical participation. In some programs, only a select group of students participate in patient treatment[21,22] while in others, all students are encouraged to participate in at least the restorative aspect of treatment.[1,5,19,23] When surgical experience is included, it is generally limited to observation or assisting.

The Creighton program

Weintraub et al reported that prior to 1988 there were only seven schools with predoctoral implant programs in North America.[14] Having started in 1987, the Creighton University School of Dentistry program was among this small pioneering group. The program was described in 1997.[19]

Central principles

Currently, Creighton is one of only two North American university programs that have no residencies that include advanced restorative or surgical training.[25] This arrangement presents distinct opportunities and challenges for the program. Although there are no resources to assume responsibility for advanced cases, predoctoral students have been able to be engaged more fully in both the restorative and surgical aspects of implant treatment.

Like many other programs, the Creighton program is not organized into a separate Department of Implantology. Rather, clinical and teaching resources are drawn from a number of departments within the school, coordinated by a program director. Classes and clinics are taught by a cadre of eight instructors, and patients are treated in the general clinic.

In any system of dispersed responsibilities, it is essential to create a central statement of operating principles. This is a multipage document grounded in scholarly evidence and contains the aims of the program, educational goals (Table 1), patient selection criteria (Table 2), program philosophies, and principles of best practice. The entire document is reviewed three times per year by the implant stakeholders. The implant stakeholders are the clinicians (prosthodontic, surgical, and radiology faculty) directly involved with implant teaching, implant treatment, and clinical oversight. Not only is this an extremely effective way of fostering communication between independent departments, but by reviewing and continually revising the philosophies and best practices, this group serves to ensure that the program is properly attuned to current clinical standards. The group also identifies new opportunities and desirable improvements.

Table 2 Table of prosthodontic complexity

	General	Complex	Advanced
Participation	Treatable by predoctoral student Simple treatment plan Full-time faculty (implant qualified) Prosthodontics clinic only House temperament class I	Treatable by predoctoral student Complex treatment plan protocol Full-time faculty (implant qualified) Prosthodontics clinic only House temperament class II	Not treatable by predoctoral student Does not meet a recognized teaching goal Suitable for treatment by a specialist House temperament class III
Fixed	PDI dentulous class I No change to OVD Single missing tooth	PDI dentulous class II No change in OVD Multiple missing units in a single sextant	PDI dentulous class III & IV Change in OVD Ancillary pros procedures too advanced for predoctoral students.
Removable	PDI edentulous class I & II 2 implants in mandibular anterior restored with independent attachments 1 or 2 implants to support an RPD	PDI edentulous class III Maxillary appliance All bar-retained appliances	PDI class IV Double arch with bars More than 4 implants per arch Limited inter-arch space Hybrid appliance

Didactic program

Table 3 outlines the overall structure of the program. Student involvement begins at the end of the sophomore spring semester as part of the preclinical prosthodontics laboratory course. The selected lectures and laboratory exercises constitute a "just in time" training module. This was developed to provide the students with information necessary to manage implant patients when the students start clinical activity as new juniors.

For the junior year, a 4-hour block of lectures is included in the regular lecture series in periodontics. These lectures reinforce material on the biologic basis of implant success, clinical evaluation, and maintenance. All additional implant education is provided on a one-on-one basis in the clinic.

The seniors begin their year with a surgery simulation laboratory exercise. This is scheduled to coincide with achieving operator status in the Department of Surgery (rather than functioning as assistants/observers). This exercise is the familiar placement of implants into a simulated bone mandible and is required of all students before they are allowed to place implants.

Despite many drawbacks, the group lecture remains a time-tested venue for consistently dispensing foundational information to large groups of people. Moreover, limited classroom time is put to best use in this fashion, for both students and faculty. With this in mind, the senior class is presented with three quarters of lectures and examination preparation exercises. The total available lecture schedule is divided roughly in half, the first half being "Implant Fundamentals," and the second half being postgraduate level lectures on "Advanced Implant Topics" (Table 4). "Implant Fundamentals" is timed to be completed immediately prior to the students challenging National Boards Part II. The lectures presented in "Advanced Implant Topics" vary from year to year, focusing on topics of current interest. Each lecture series is concluded with a written competency examination.

In addition to the live lectures, students have access to study materials through a BlueLine® site established for the program.

Table 3 Program design

	Sophomores (late spring)	Juniors	Seniors
Lecture	Implant history Treatment planning Introduction to clinic	Periodontics lecture block	Implant fundamentals Advanced implant topics
Laboratory	Surgeon's guide fabrication Implant impression making	None	Implant placement (summer clinic)
Clinic	All students – maintain completed cases in periodontal recall program	All students – maintain completed cases in periodontal recall program Interested students (1) Assist senior students in all aspects of treatment planning and patient care (2) Restore uncomplicated cases under individual mentoring	All students – maintain completed cases in periodontal recall program Interested students Practice all aspects of treatment planning and patient treatment (including fixture placement)

Table 4 Senior class lectures

Week	Implant fundamentals	Advanced implant concepts
1	Review of implant history	Implants in growing children
2	Physiologic basis of implants	Treatment of ailing/failing/failed implants
3	Treatment planning	Management of bisphosphonate patients
4	Basic surgical procedures, Part 1	Implant site development – preoperative
5	Basic surgical procedures, Part 2	Implant site development – intraoperative
6	Implant prosthodontics – removable	Evidence-based implant outcomes
7	Implant prosthodontics – fixed	Advanced diagnostic imaging
8	Post-treatment assessment/management	Principles of designing implant systems

The BlueLine® website is accessible to registered students from computers in the library's Learning Resource Center or from the students' off-campus personal computers. This is a restricted access computer website that includes:

1. Selected current journal articles and readings placed in the medical library's e-reserves. This collection supplants the use of a textbook, and permission and copyright requirements are managed by the university library.
2. Online examination preparation exercises that are designed to resemble the current American Board of Dental Examiners (ADEX) computer-administered examination. Photographs are presented, accompanied by an appropriate question. All seniors must participate in the exercises, but the grades are not recorded.
3. A link to previously presented lectures from the course. A recording of each lecture is combined with PowerPoint slides to create a "movie." These can be viewed at the students' convenience.

Clinical program

Clinical participation is open to all students and is voluntary. Patients are not generally assigned based upon the incorporation of implants into their treatment plan. Rather, students are encouraged to develop implant cases from their own patient families and from new patients they may acquire during their clinical year. There are currently no requirements for either implant restoration or placement. Patients with completed implant restorations are randomly assigned to students for periodic examination and maintenance. Currently, approximately two-thirds of the students will manage an implant case during their 2 years of clinical experience. The reasons often given by students for nonparticipation include either a need to focus upon more pressing educational requirements, an inability to develop a viable case for treatment from their available patients, or the student is planning to practice a specialty that does not include implants. On the other hand, other students may participate in multiple cases.

Second semester sophomores are introduced to implant maintenance for those persons in their patient families who have implants. Juniors continue to engage in patient maintenance, adding development of new cases, restoration of implant-supported prostheses and assisting in surgical placement to their clinical repertoire. Implant placement and uncovering are only added to the total clinical experience during the senior year.

The "Tables of Complexity" (an example of which can be found in Table 2) were developed to serve as guidelines for patient inclusion and are part of the Statement of Policies and Practices. With no graduate programs with whom to partner, each patient must be viewed from the perspective that all of their dental needs (including nonimplant-related needs) can be met in the predoctoral clinic.

An informational website was developed as part of the program's informed consent process. It was designed to present unbiased information desired by patients who are making decisions regarding future implant treatment. The website is available through the open Internet (www2.creighton.edu./dental/implants), but students are also expected to view the website with their patient and answer any questions the patient might present. This website has proven to be quite popular and has experienced more than 350 visitors per month since its launch in October 2006. This is especially surprising given that the website has never been announced to the public external to Creighton's program.

Evaluation

Students are evaluated by written examination, evaluation of laboratory projects, and their clinical performance. Several of the written examinations function as competency examinations.

The program itself is routinely evaluated. In addition to the tri-annual stakeholder's evaluation, the program director performs an annual review of 100% of all active implant records. Table 5 presents patient treatment data for the past 20 years. During that time, the program has shown reliable annual growth and has transitioned from predominantly removable prosthodontic treatment to predominantly fixed prosthodontic treatment. The overall fixture survival rate of 92.2% is commensurate with contemporary implant success reports.[18,26–31]

Discussion

At this time, most predoctoral implant programs have adequately adapted to changing requirements and are meeting or exceeding current educational expectations. It appears that the most confounding issue presently confronting program directors is that of competency statements regarding implant restoration. The 2006 statement by the ADA Council on Scientific

Table 5 Decade comparison

	1986–1996		1996–2006	
No. of Appliances	134		329	
No. of Fixtures	397		630	
No. of In service	351		596	
Fixture survival rate 3 year/5 year	91%/88.4%		97%/95.4%	
Appliance type	No. of cases	% of cases	No. of cases	% of cases
Overdenture, implant-supported	35	26.1%	31	9.4%
Overdenture, implant/tissue-supported	18	13.4%	21	6.3%
Removable partial denture	6	4.5%	21	6.3%
Fixed partial denture	56	4.2%	92	27.9%
Single tooth	18	13.4%	163	49.5%

Affairs does not require, but strongly implies, that graduates of predoctoral programs should be "competent" to perform these procedures.[16]

At the 2006 ADEA workshop, the assembled deans noted that at the present time, there is ". . . no predoctoral clinical competency requirement for implant prosthodontics in most schools that responded," and ". . .there is no predoctoral clinical competency requirement for surgical implant placement in all schools that responded."[18] All of the educational goals expressed in Table 1 are fulfilled by graduating Creighton students, with the exception of "competency to restore implants." As desirable as this might be, the Creighton program cannot presently award this competency to graduates, if actual clinical experience is a prerequisite.

Considering the program changes necessary to convert from voluntary clinical participation to required clinical participation (establishing clinical requirements, guaranteeing patient availability, treatment financing, assigning and tracking of patients, clinical testing, etc.), such a mandate would be prohibitively intrusive. Complicating this is the ever-present competition for patients with in-house residency programs.[21] Also, it has been the experience of those schools that allow universal clinical participation that there will be a significant number of predoctoral students who choose not to participate for one reason or another.[5,19,21] Finally, any implant program must assume a proportional place within the overall predoctoral curriculum.[5,15,21] Competition for even a small part of the finite amount of student time is intense.

If, however, competency testing can be couched in laboratory or simulation exercises, then, this goal, while time-consuming, should be more readily achievable. Imaginative simulation exercises, which could also be used as a basis for competency testing, would be a welcome addition to any program.

Summary

The landscape of predoctoral implant education has changed dramatically in the short span of two decades. Documented success and increased patient demands have driven heightened expectations upon the educational community. Predoctoral education will continue to play a pivotal role in preparing the profession to meet these new expectations. The predoctoral mission should stay true to its mandate: to prepare the new general dentist for a practice that includes basic implant skills. In the final analysis, any individual program design must respond to its local educational vision. There are many ways to approach program design, all of which are valid and viable. There will continue to be a need for postdoctoral education of all types into the foreseeable future.

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