

# Evaluation of a Predoctoral Implant Curriculum: Does Such a Program Influence Graduates' Practice Patterns?

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**Purpose:** Didactic predoctoral dental implant education is part of the curriculum in most US dental schools. However, fewer than half offer laboratory instruction, and only a few allow dental students to place and restore dental implants. The additional time necessary for laboratory and clinical experience encroaches on an already crowded curriculum. Is the additional time necessary in the curriculum for laboratory and clinical experience by dental students reflected by the practice patterns of graduates who have completed such a program over the past 10 years? **Materials and Methods:** A survey was designed to determine the implant practice patterns of graduates of the Creighton School of Dentistry, Omaha, Nebraska, for the 10-year period 1988 to 1997. These graduates had all participated in a formal undergraduate didactic and laboratory curriculum in implant dentistry. Approximately half also had the opportunity to place and/or restore dental implants while students. The survey was also sent to graduates (also 1988 to 1997) from a midwestern dental school without a formal laboratory or clinical component (used as a control group). The data were analyzed statistically. **Results:** In comparison to the control group (56% versus 23%), more than twice as many Creighton graduates restore dental implants as a part of their general practice, surgically place more dental implants, refer more implant patients to surgical specialists, and seek more continuing education hours related to implant dentistry. These conclusions were all supported by statistical analysis of the data. **Discussion:** Student clinical experience with implant dentistry appears to significantly increase the incorporation of implant dentistry into future dental practices. Even if clinical experience was not an option, a school curriculum which included both didactic and laboratory participation still significantly increased the number of graduates who included implant dentistry in their practices. **Conclusion:** The inclusion of laboratory and clinical experience in implant dentistry in the CUSD undergraduate curriculum resulted in significantly greater participation in implant dentistry at the general practice level. (INT J ORAL MAXILLOFAC IMPLANTS 2002;17:543-549)

**Key words:** dental education, dental implants, population surveys, questionnaires

Several surveys have been conducted in recent years to determine the extent to which dental schools incorporate implant dentistry in their predoctoral curricula.<sup>1-5</sup> In the most recent survey, it was reported that 89% of US dental schools include

implant dentistry in their predoctoral curricula.<sup>6</sup> Three dental schools allowed students to surgically place implants, 36% allowed students to restore implants, and 42% offered laboratory instruction in implant dentistry.<sup>1</sup>

Creighton University School of Dentistry (CUSD) in Omaha, Nebraska, has had a predoctoral implant program in place since 1987.<sup>6,7</sup> Interested students may perform surgical placement and fabrication of implant prostheses if patients are available. Students are also eligible to follow implant patients in the regular recall system. Since the recall pool comprises various types of patients, not every student may see an implant recall patient among their particular patient pool.

After the implant program had been in place for 10 years, a survey was developed to determine the degree to which implant dentistry is incorporated

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**Table 1** Predoctoral Program Descriptions

Year	CUSD			MWDS		
	Didactic hours	Laboratory hours	Clinical experience offered?	Didactic hours	Laboratory hours	Clinical experience offered?
1988	16	4	Yes	17	0	No
1989	19	4	Yes	17	0	No
1990	22	4	Yes	17	0	No
1991	22	4	Yes	17	0	No
1992	22	4	Yes	17	0	No
1993	30	4	Yes	17	0	No
1994	30	4	Yes	17	0	No
1995	30	4	Yes	17	0	No
1996	30	4	Yes	17	0	No
1997	30	4	Yes	17	4*	No

\*Implant manufacturer presented company's half day course to senior students involving preparations on plastic mandibles and transfer impressions.

into CUSD graduates' practices. To determine if the predoctoral implant program influenced practice patterns of CUSD graduates, survey results were compared to those of graduates for the same time period from another midwestern dental school (MWDS). MWDS is a state-supported school, with 41% of the respondents practicing in the state where the school is located. CUSD is a private school, with graduates entering practice in many different states. Both schools have similar class sizes. A didactic program has been provided in the time period covered by the survey at the MWDS, but no clinical or laboratory experience has been available for their students. A brief comparison of the respective predoctoral programs is presented in Table 1.

## MATERIALS AND METHODS

The population studied was composed of 595 dentists who had graduated in the 10-year period from 1988 to 1997. Two hundred seventy-nine were MWDS graduates, and 316 were graduates of CUSD. A survey packet, which included a questionnaire and a stamped, self-addressed return envelope, was sent to these graduates. Respondents were asked to return the survey within 30 days. An additional 60 days were allowed prior to tabulation of the results. Altogether, 1,206 surveys were mailed. Other than knowing the school from which the respondents graduated, the survey was anonymous to facilitate candid responses. No follow-up letters or calls were attempted. To maintain confidentiality of the surveys, no attempt was made to determine how characteristics of respondents and non-respondents differed. The effect on response bias by this decision is not known.

The questionnaire was divided into 4 sections. The first section detailed demographic information about the practitioner, including age (25 to 34, 35 to 44, or 45 to 54 years old, or over age 54), gender, year of graduation, practice location, and practice type (solo, group, employee, military, student).

The second section of the questionnaire contained questions regarding predoctoral participation in formal predoctoral (non-elective) implant didactic courses, predoctoral implant and prosthetic laboratories, and formal postgraduate training. The survey instrument did not ask whether the postgraduate training was in general practice residency (GPR), advanced education in general dentistry (AEGD), or one of the dental specialties recognized by the American Dental Association (ADA). It was important not to include those with postgraduate training in the survey results, because this would not have been a true reflection of their dental school education. Inquiry was also made as to the number of hours of continuing education specific to implant dentistry acquired since graduation. Any active participation in implant surgical placement, prosthetic restoration, or recall of implant patients while a dental student was also noted. The following statement was included to define the meaning of "actively participate":

For purposes of the next set of questions, to "actively participate" means to have been actively involved in patient care, and not simply functioning as an observer (eg, surgical = prepared implant sites, placed implants, placed healing abutments; prosthetics = placed prosthetic abutments, prepared transfer impressions, placed prostheses).

The third section of the survey dealt with current practice; specifically, the respondent was asked whether surgical placement and/or restoration of dental implants was incorporated into their practice. If the response was affirmative, the respondent completed questions regarding the number of patients in whom implants were placed and/or restored annually and the type of implants placed and/or restored. Questions were also asked regarding referral patterns for implant placement by graduates who restore implants.

The final section gathered comments regarding the respondent's particular implant experience while in dental school or comments regarding predoctoral implant education in general. These comments were shared with the appropriate educators at the MWDS and CUSD and are not included as part of the survey.

All returned surveys were assigned a control number and entered into a Filmmaker Pro database (Filemaker, Santa Clara, CA). After data were entered, the author reviewed entries from 25 randomly selected surveys, and the accuracy rate of data entry was found to be 100%.

### Survey Data Analysis

Data were analyzed by both descriptive and analytic statistics. Frequency, percentage, and modes were used for description of demographic, education, and outcomes data. The chi-squared test was applied (utilizing the Yates correction for continuity in calculations) to most of the data analysis, since nearly all survey responses were either a Yes or No, thus representing mutually exclusive categories. A  $P$  value  $< .05$  was considered statistically significant. The statistical software utilized was SigmaStat 1.0 (SPSS Science/Jandel Scientific, Chicago, IL).

## RESULTS

There were 4 nondeliverable MWDS surveys, and 279 surveys were returned completed (49.6%). There were 8 undeliverable CUSD surveys, and 316 surveys were returned completed (49.1%). MWDS respondents comprised 66% (185/279) of the 25- to 34-year-old age group, 31% (87/279) of the 35-44 age group, and 3% (7/279) of the 45-54 age group. CUSD respondents comprised 63% (199/316) of the 25-34 age group, 34% (108/316) of the 35-44 age group, and 3% (9/316) of the 45-54 age group. This would be anticipated since all graduates had completed dental school within the past 10 years. Thirty-two percent (89/279) of the MWDS and 10% (33/316) of the CUSD graduates were women.

Nearly 36% of the MWDS entered postgraduate training following dental school, compared to 32% of CUSD students. The statistical information utilized in this article is based upon the responses of 180 MWDS and 215 CUSD graduates who did not receive formal postgraduate training.

Geographic distribution of the respondents who comprise the graduates included in this survey is shown in Figs 1a and 1b.

### Implant Restoration

More than twice as many (56% versus 23%) CUSD graduates restore implants as part of their practices, compared to colleagues from the comparable MWDS (Table 2). This percentage is based upon those graduates who have not participated in any formal advanced education programs (AEGD, GPR, or ADA-recognized specialty).

Participation in the surgical placement and restoration of implants is elective at CUSD.<sup>6</sup> Even when students were exposed only to didactic and laboratory implant curriculum and have no clinical experience, approximately half (46%) included implant dentistry as part of their practice (Table 3). If no exposure to a clinical or laboratory curriculum occurred, as at MWDS, 23% of graduates included implant dentistry as part of their practice.

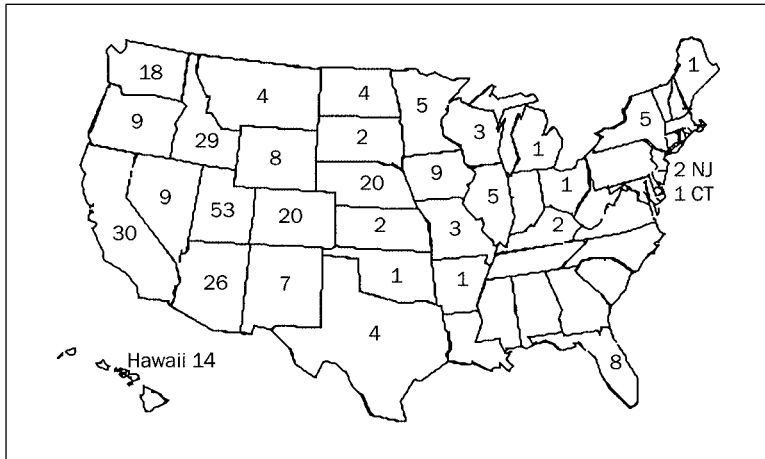
The percentage of graduates restoring implants is consistently higher for the past 10 years, during which the implant curriculum and laboratories have been in place at CUSD (Fig 2). Both schools are near 30% for the 1997 graduates, but this may be explained by the fact that these students' practices were in the first 4 to 6 months of development when the survey was undertaken.

### Implant Surgical Placement

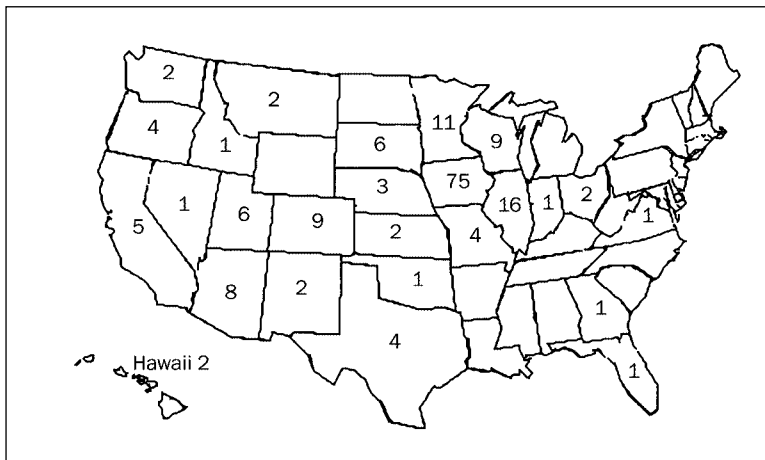
The percentage of CUSD graduates who participated in the predoctoral implant educational program and currently surgically place implants in their general dental practices is 14% (Table 2). This number represents only those graduates who have not had the benefit of formal advanced education (AEGD, GPR, or ADA-recognized specialty). Of the 30 CUSD graduates who had no formal advanced education and are surgically placing dental implants, 70% had surgically placed dental implants while students at CUSD.

### Referrals

The survey documented that CUSD graduates refer a statistically significantly greater number of patients to specialists for implant placement than do the MWDS graduates ( $P < .05$ ). When referring implant patients, CUSD graduates send them to



**Fig 1a** Geographic distribution of CUSD graduates responding to survey.



**Fig 1b** Geographic distribution of MWDS graduates responding to survey.

**Table 2 Implant Practice Patterns of Graduates from Both Schools Surveyed**

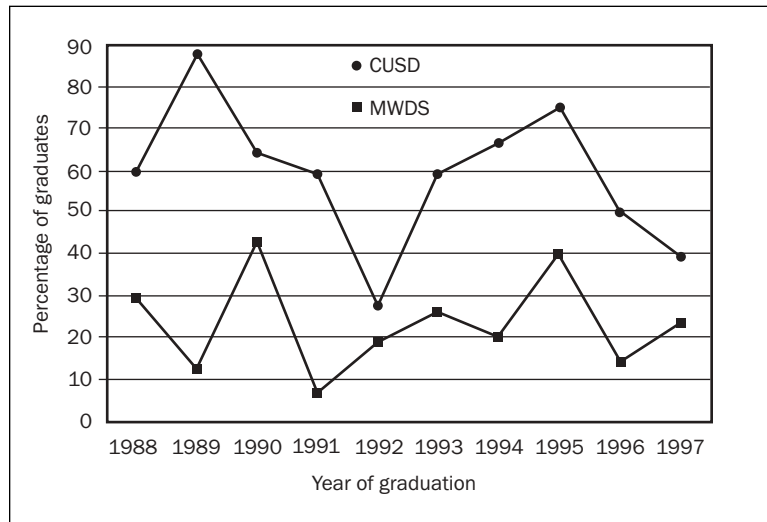
Outcome data	CUSD graduates	MWDS graduates	P value
Currently placing implants	30/215 14%	3/180 3%	.0002*
Currently restoring implants	120/215 55.8%	42/180 23.3%	.0001*
Continuing education hours (restoring implants)	21.5	11.5	.0080*
Refer to periodontist	59/215 15.5%	41/180 6.9%	.005*
Refer to oral and maxillofacial surgeon	145/215 54.2%	120/180 67.4%	.3487
No. of patients referred/y	954/126 7.6 each	543/112 4.8 each	.0127*

\*Statistically significant  $P < .05$ .

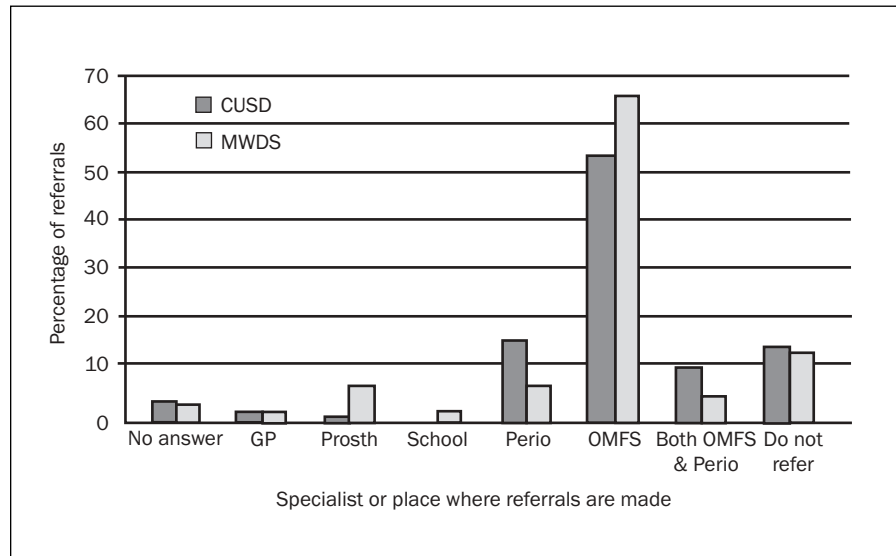
**Table 3 Does Adding a Clinical Component to Predoctoral Implant Programs Influence Practice Patterns?**

Outcome data	CUSD grad with no clinical experience	MWDS grad with no clinical experience
Restoring implants	49/106 46%	42/180 23%
Not restoring implants	57/106 54%	138/180 77%

**Fig 2** Percentages of CUSD and MWDS graduates restoring implants by year of graduation.



**Fig 3** Referral patterns of CUSD and MWDS graduates. GP = general practitioner; Prosth = prosthodontist; Perio = periodontist; OMFS = oral and maxillofacial surgeon.



oral and maxillofacial surgeons and periodontists in a ratio of 3.5 to 1 (Fig 3). The comparable MWDS graduates referred implant patients to oral and maxillofacial surgeons and periodontists in a 10:1 ratio.

### Continuing Education

CUSD graduates who currently restore dental implants as a part of their practice participate to a significantly greater degree in continuing education related to implant dentistry than do the MWDS graduates who restore implants ( $P < .05$ ). Those graduates from both schools who do not restore implants as a part of their practices participate to a lesser degree in continuing education related to implant dentistry.

## DISCUSSION

Kluck-Nygren<sup>8</sup> reported in 1992 that in the previous year, 65.1% of the members of the Academy of General Dentistry performed implant prosthodontics and 9.8% performed dental implant surgery. The results of the current survey indicate that 55% of CUSD graduates provide implant prosthodontic services and 14% perform dental implant surgery, while 23% of the MWDS graduates perform implant prosthodontics and 3% perform dental implant surgery. Since the survey covered only the past 10 years, the age group involved in the survey is probably younger than the average member of the Academy of General Dentistry. Nevertheless,

the 65% as determined by Kluck-Nygren<sup>8</sup> who provide implant placement were considerably greater than the numbers generated by this survey.

Stillman and Douglass<sup>9</sup> designed a survey to determine how many dental implants are being placed, who is placing those implants, and placement information by geographic area. They determined that 9% of general-practice dentists have surgically placed 1 or more implants at some time in their career. They also found that with respect to the age of the dentist, 11.9% of dentists over age 40 years surgically place implants, while only 3.7% of dentists under age 40 surgically place dental implants. The 30 CUSD graduates identified by this survey who surgically place dental implants had an average age of 32.7 years. This 14% (30 respondents) is much higher than the 3.7% under age 40 identified by Stillman and Douglass.

The comfort level of CUSD graduates in performing surgical procedures could be a result of the unusual extent of their surgical training as dental students. Wilcox and associates<sup>6</sup> explained that predoctoral surgical education was emphasized at CUSD because of the lack of advanced educational programs. Upon graduation, the average CUSD dental student has removed 5 impacted teeth, surgically removed 11 erupted teeth, utilized intravenous sedation on 8 patients, and performed 3 segments of alveolectomy on 33 different surgical patients whom they have treated in the oral surgery clinic under the supervision of an oral and maxillofacial surgeon.<sup>10</sup> Some additional surgical experience is also gained through the departments of Periodontics and Endodontics. All of these surgical procedures generally require reflection of mucoperiosteal flaps, and CUSD graduates become relatively adept at this procedure.

Kehoe<sup>11</sup> reported that the percentage of general practitioners who provide restorative treatment following implant placement by another doctor has more than doubled over the past decade, reaching 69% in 1997. This number is considerably higher than was determined by this survey instrument.

The differences between the 3 groups—those with didactic, laboratory, and clinical experience; those with didactic and laboratory experience; and those with didactic experience only—were all statistically significant ( $P = .001$  and  $P = .018$ ). Student clinical experience with implant dentistry appears to significantly increase the incorporation of implant dentistry into future dental practices. However, if clinical experience is not an option and only didactic and laboratory participation is available, the number of graduates who include implant dentistry in their

future practices is still significantly increased over those who received no formal laboratory training.

Over the years, private-practice surgeons have often expressed to the author their concern that the depth of undergraduate surgical training received by CUSD graduates is excessive and diminishes referrals of surgical procedures to specialists. It is believed that participation in, rather than observation of surgical procedures while a dental student may actually produce “better” referrers. The results of this survey appear to validate this conclusion. CUSD graduates refer an average of 7.6 patients each year to specialists, while graduates of the comparable school refer 4.8 patients per year to specialists (Table 2). CUSD graduates refer 3 times as many of their surgical implant cases to oral and maxillofacial surgeons as they do to periodontists, while the control group refers to oral and maxillofacial surgeons at a tenfold level over periodontists. No explanation is offered for this from an educational standpoint. Possibly this is the result of marketing efforts by the respective surgical professional organizations in the various states.

CUSD graduates who currently restore dental implants as a part of their practices participate to a significantly greater degree in continuing education related to implant dentistry than do the comparable school graduates who restore dental implants ( $P < .01$ ). Those graduates from both schools who do not restore implants as a part of their practices participate to a lesser degree in continuing education related to implant dentistry than do their colleagues who incorporate implant dentistry into their practices. Dentists restoring implants who have had a formal undergraduate curriculum component in implant dentistry seek more continuing education on the subject than their colleagues from the control school who are restoring dental implants as part of their practices and did not receive predoctoral education on the subject.

## CONCLUSIONS

In a survey of dentists who graduated in the past 10 years from 2 Midwestern dental schools where the variable studied was the presence or absence of a formal undergraduate implant curriculum, the following were observed. CUSD graduates practicing general dentistry without the benefit of formal advanced education when compared to their colleagues from a similar midwestern institution:

1. Restore dental implants as a part of their practices in about twice as many of their practices
2. Place dental implants as a part of their practice in 14% of their offices, compared to 3% from a comparable institution
3. Refer more patients to surgical specialists and
4. Seek more continuing education hours related to implant dentistry

The 10-year curriculum has been successful in the preparation of CUSD graduates for a general dental practice that includes the placement and/or restoration of dental implants. Other schools may wish to incorporate similar programs that not only include didactic and laboratory components, but actual student participation in the placement and restoration of dental implants, as well as the recall of implant patients.

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