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Ten-Year Survey of Program Directors: Trends, Challenges, and Mentoring in Prosthodontics. Part 1

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Abstract

Purpose: This study consisted of two parts. Part 1 was a survey of US program directors, and Part 2 reports on the survey findings distributed to the deans of US dental schools. Both surveys evaluated observations of trends in prosthodontic education. The first survey (2005) of program directors and deans was published in 2007. This second survey was conducted in 2009. The 2009 survey provided 10-year data on trends in prosthodontics as reported by program directors.

Materials and Methods: A national e-mail survey of 46 program directors was used to collect enrollment data for years 1 to 3 of prosthodontics training for US and international dental school graduates, the total number of applicants and applications considered, and the trends over time of applicants to prosthodontics for US dental school graduates and for international graduates. In addition, the program directors were asked to rank 13 key factors that may have contributed to any changes in the prosthodontic applicant pool. Program directors were also asked for information on student financial incentives and whether their programs were state or federally funded, and whether their sponsoring institution was a dental school.

Results: Of the 46 program directors, 40 responded, for an 87% response rate. Respondents reported that 66% of their enrollees were graduates of US dental schools. Between 2000 and 2009 the applicant pool in prosthodontics nearly doubled, with 50% of the program directors reporting an increase in US-trained applicants, 42.5% reporting no change, and only 7.5% reporting a decrease. Using the Spearman correlation for the 10-year survey, there was a positive, statistically significant correlation that society's demand for a higher level of training and credentialing and interest in prosthodontics among dental students contributed to an increase in the number of US dental graduates applying to prosthodontic programs. Only four programs offered no financial packages to offset tuition. The remaining 36 respondents reported some financial package. Among the respondents, there were 23 state-sponsored programs and 6 sponsored by private universities; the remaining 9 were sponsored by hospitals or federal agencies.

Conclusions: A nearly doubled applicant pool and more US-trained applicants to prosthodontics ensure a much more competitive applicant pool for our specialty. In the 2009 survey, program directors reported that factors such as society's demand for a higher level of training and credentialing, interest in prosthodontics among US dental students, advances in implant, esthetic, and reconstructive dentistry, literature pertaining to the need of prosthodontists for the future, marketing of prosthodontics as a career, and the dollar value of prosthodontic training have all had some impact on increasing the mentored applicant pool to prosthodontic training in the United States.

In 2002, the American Dental Association (ADA) reported a 35.9% decrease in the number of applicants to prosthodontics programs and a 21.4% decrease in first-year enrollment between 1991/92 and 2000/01.[1] Although the ADA reported the following year that the number of applications to prosthodontics programs rose from 905 in 2000/01 to 1069 in 2001/02,[2] many authors were concerned about the decrease in enrollment and applications. In 2001, Felton et al[3] reported that from 1991 to 1999 there was a 40.2% decline in applications and a 31.7% decline in enrollment. Only periodontics faced a similar decline. This was in contrast to the other specialties of endodontics, oral and maxillofacial surgery, orthodontics, dentofacial orthopedics, and pediatric dentistry, which had a 12.2% increase in applications and a 3.5% increase in enrollment. From 1994 to 2002, there were more international graduates than US graduates enrolled in prosthodontic programs.[1,4] Prior to 1987, some training programs in prosthodontics were either fixed or removable prosthodontics. This period of decline for prosthodontics began just 5 years after the specialty and the ADA changed the educational standards in prosthodontics to include didactic and clinical training in both fixed and removable prosthodontics. In *Dental Education at the Crossroads: Challenges and Change, Institute of Medicine*, Field[5] projected that the percentage of specialists in dentistry would increase from 15 to 25% in this second decade of the 21st century.

Despite a decade of declining applicants, disappointing enrollment numbers for US graduates, and widespread concern within the specialty, Douglass and Watson[6] predicted a large need for prosthodontic treatment that will exceed the supply and a manpower shortage extending to at least 2020. The US Department of Labor, Bureau of Labor Statistics, recently found higher earnings for prosthodontists than all other specialties of dentistry, with the exception of oral and maxillofacial surgery.[7] Nash and Pfeifer[8] reported that the internal rate of return for the expenses associated with prosthodontic training was a positive finding, indicating that prosthodontic training is a sound investment and that there will be a continuing demand for prosthodontic specialty training. In another report, Nash and Pfeifer disclosed that the average net earnings for a prosthodontist were 35% higher than general practitioners and that the average net earnings are competitive with other specialties.[9] Forbes magazine ranked prosthodontists as the sixth highest income level among professionals, just two places lower than oral and maxillofacial surgery.[10]

Wright et al[11] reported that advanced education programs in prosthodontics have witnessed at least a 23% increase in the applicant pool since 2000, and the enrollment is now comprised of 64% US-trained graduates. Part 1 presented evidence from program directors that factors such as mentoring, society's demand for a higher level of training and credentialing, data depicting current and projected income for prosthodontists, number of prosthodontic faculty at the predoctoral level, the dollar value of prosthodontic training, demand for prosthodontic services, and advances in implant, esthetic, and reconstructive dentistry have had an impact on an increased applicant pool. In Part 2, Wright et al[12] reported that dental school deans observed an increased interest in specialty training in prosthodontics, along with a high exposure to full-time prosthodontists in the clinic; 80% of the deans reported established mentoring programs for students interested in prosthodontics.

Recruitment and mentoring of the best and brightest students have been the focus of many prosthodontics organizations, including the Greater New York Academy of Prosthodontics, which began a program in 2000. The American College of Prosthodontists (ACP) held discussions of mentoring at each of the educators'/mentors' seminars beginning in 1999, and the 2001 seminar was described by Wright in the ACP *Messenger*.[13] Friedman et al[14] described mentoring as a strategy to address recruitment. Mentoring is defined as a voluntary or reciprocal interpersonal relationship in which an individual with acknowledged expertise shares his or her experience. Mentoring relationships are usually long term, and there are benefits not only to the mentee but also personal satisfaction and stimulation for the mentor.

Esthetic dentistry, improvements in materials, implant prosthodontics, and the associated science and technology have all had a positive impact on the specialty of prosthodontics. In addition, this contemporary era of total body fitness and patients' expectations and self-interest are driving higher standards in prosthodontics.[15]

In a report by Haden et al, the shortage of prosthodontic faculty ranked fourth of all specialties of dentistry.[16] Faculty shortages have been scrutinized since 1999 when the American Association of Dental Schools (now the American Dental Education Association) published a report on the findings from the president's task force on the future of dental school faculty showing a high number of vacated positions, 75% of which were in the clinical sciences.[17]

In 2000, the *American Dental Association News* reported that dental school applicants and enrollment was at its highest level since 1978. This trend in enrollment and applications occurred while five new dental schools are being planned in Arizona, Arkansas, Maine, Nevada, and Texas. East Carolina University (Greenville, NC) and Western University (Pomona, CA) recently opened new dental schools.[18]

Materials and methods

In 2009, the 2005 survey was distributed electronically to all US prosthodontics program directors. A current list of program directors was obtained from published ADA records, along with a list from the ACP. An Internet-based survey company (KeySurvey Inc., www.keysurvey.com, Braintree, MA) was employed to conduct the distribution and processing of completed questionnaires, validating and processing follow-up e-mails to nonrespondents, and storage of survey information in an electronic format. A cover letter (RW and DM), which communicated the purpose of the survey and included a statement of confidentiality to safeguard data and identity of respondents, accompanied all electronic mailings. Also included was listing of a contact at the Office for Research Subject Protection at Harvard Medical School to allow the respondent an opportunity to validate the legitimacy of the survey.

The first survey questionnaire was sent to 46 program directors and covered several topics, including:

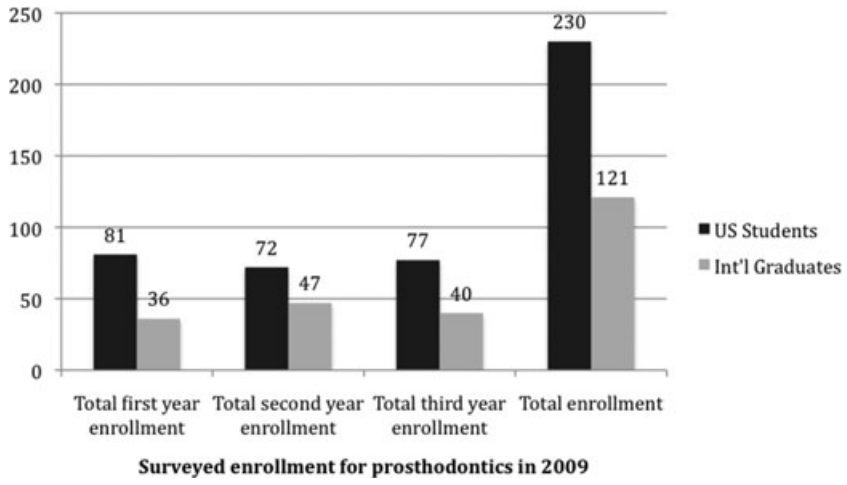

Figure 1 Total surveyed enrollment 2008 to 2009.

(1) Number of current US and international dental school graduates in each year of training;
(2) number of applicants over the past 5 years as well as change in the number of US-trained and international applicants over the past 5 years;
(3) educational, social, economic, or technological factors affecting change in the applicants' demographics in the past 5 years;
(4) financial incentives used to recruit applicants;
(5) type of institution (state funded, private university, hospital, federal).

This survey was designed to represent a partial, introspective view of the current state of prosthodontic education in the United States according to program directors. Program directors were viewed as legitimate indicators of change within predoctoral and postdoctoral prosthodontic education. Statistical analysis was carried out using Statistica Version 9.1 (Statsoft, Tulsa, OK).

The 46 surveys were distributed to the program directors. Faulty e-mail addresses can occur when new faculty members are appointed, e-mail systems are changed, or alternative e-mails are used. The software was configured to allow respondents to change entries after completion of the survey but to allow one response per respondent e-mail address. Each potential survey respondent was given a unique link to the survey software to monitor progress of the questionnaire and to remove completed surveys from the e-mail reminder list.

Results

Respondents to the program directors' survey included 40, for a response rate of 87%. A total of 23 of the respondents were program directors at state-supported schools, 6 were at privately supported schools, and 9 were from hospitals, military, or federal institutions. Two respondents did not respond to this survey question.

The 40 program directors reported that the current enrollment for all 3 years includes an average class size of approximately three per class for years 1 through 3. US-trained students comprised 66% of the enrollment, and internationally trained residents comprised 34% of the current total enrollment (Fig 1). This survey reported an increase of 2% in the number of US-trained students over the 2005 survey. Figure 2 shows a dramatic increase in the applicant pool from 2000 to 2009. The number of applicants in 2009 increased 80% when compared to the 2001 data. In 2009, the average number of applicants per program was 32.

Fifty percent of program directors reported an increase in the number of US-trained applicants to their prosthodontics programs; 42.5% reported no change. A decrease in the US-trained applicant pool was reported by only 7.5% of the program directors. Similarly, 43.6% reported an increase in the internationally trained applicant pool, and 51.3% reported no change. Only 5.1% reported a decrease in the internationally trained applicant pool. Compared with the previous survey, the 2009 survey found four more program directors reporting an increase in US-trained applicants (Table 1).

Program directors were asked to identify factors that have affected the US- and internationally trained applicant pool over

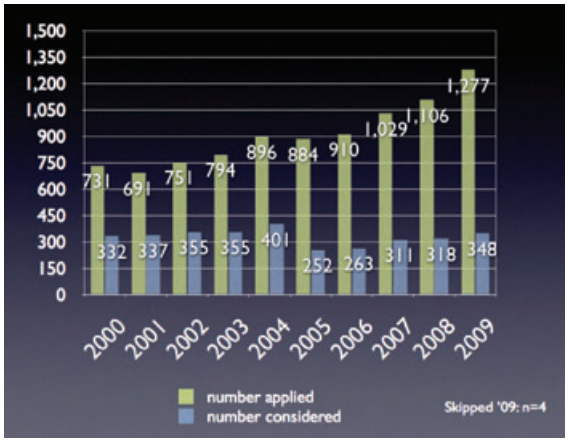

Figure 2 Increase in applications to prosthodontics over 10 years (2000 to 2009).

Table 1 "Have you seen an increase, decrease, or no change in the number of US-trained applicants in the last 5 years?"

	2005 respondents	2009 respondents
Increase	16(41%)	20(50%)
Decrease	5(12.8%)	3(7.5%)
No change	18(46.2%)	17(42.5%)

the last 5 years. They ranked 13 factors on a 5-point scale that included: strong increase, slight increase, no change, slight decrease, and strong decrease. Each of the 13 factors was reported to have increased, decreased, or had no effect on the size of the applicant pool to prosthodontics training programs according to program directors (Tables 2 and 3).

The 13 factors were analyzed to see if there was a correlation between the change in the number of US applicants and the 13 factors. For further analysis of the factors, the responses for "In your opinion, have the following factors led to an increase, decrease, or no change in the number of US-trained applicants to your program?" were collapsed into three categories: increase, no change, decrease. The responses for "have you seen an increase, decrease, or no change in the number of US-trained applicants to your prosthodontics program in the last 5 years?" were increase, no change, and decrease. The Spearman correlation was used to rank order the relationship between these two survey responses. Interest in prosthodontics among US dental students ($\rho = 0.61$, $p < 0.001$), advances in implant, esthetic, and reconstructive dentistry ($\rho = 0.52$, $p = 0.001$), literature concerning the need for prosthodontists in the future ($\rho = 0.51$, $p = 0.001$), marketing prosthodontics as a career ($\rho = 0.43$, $p = 0.008$), dollar value of prosthodontic training ($\rho = 0.43$, $p = 0.008$), and society's demand for higher training and credentialing ($\rho = 0.33$, $p = 0.04$), all had positive significant correlations (Table 4). The same analysis was performed for internationally trained applicants, and no factors had statistically significant correlations.

Program directors also reported what incentives they offered to recruit applicants to their programs. Most common responses were stipend (45%) and offers of hospital or military incentives (32.5%), followed by tuition reduction (17.4%), teaching fellowships (15%), and graduate medical education (GME) funding (12.5%). A review of the data revealed that only 10% (4/40) offer no financial packages or incentives to students in advanced education in prosthodontics programs (Table 5).

Discussion

The size of the applicant pool in prosthodontics increased 75% in the last 10 years. This significant growth in the applicant pool has begun to show signs of real progress in recruiting the best and brightest into prosthodontics after 10 years of consistent decline prior to 2001. In addition, the percent of US dental school graduates enrolled in prosthodontic programs, as reported by the 40 respondents, is now at 66%. This is in sharp contrast to the 1994 to 2002 ADA data, which revealed that the majority of students enrolled in prosthodontic programs were international students. One limitation of our study is that we did not survey program directors regarding enrollment citizenship, so a small percentage of the US dental school graduates could be noncitizen students who might return to their respective countries to practice prosthodontics, or they could be international graduates who remain in this country as prosthodontists. The increasing number of applicants reported by this study is comparable to the data from the ADA, including a recent survey from 2008 that also reveals an increasing applicant pool. The 2008 ADA survey shows a significant increase in the applicant pool of 30% when compared to the 2004 ADA data.[19]

The majority of program directors again reported in 2009 that more US graduates are expressing increased interest in prosthodontic education. The majority of program directors

Table 2 Program directors' response to survey (number of respondents). The question was "In your opinion, have the following factors led to an increase, decrease, or no change in the number of US-trained applicants to your program?" Factors in bold have 10 or more responses in the increase categories and very few responses in the decrease categories

Factors	Strong increase	Slight increase	No change	Slight decrease	Strong decrease
Loss of GME funding for residents enrolled in prosthodontics	0	2	22	7	5
Interest in prosthodontics among US dental students	**5**	**22**	**9**	**1**	**1**
Growth in the United States and global economy	1	6	23	5	1
Predoctoral curriculum time pertaining to prosthodontics	**0**	**20**	**15**	**3**	**0**
Demand for prosthodontic services in the public sector	**6**	**12**	**20**	**0**	**0**
Number of prosthodontic faculty in predoctoral clinic	**0**	**10**	**22**	**4**	**1**
Marketing of prosthodontics as a career	**4**	**17**	**16**	**1**	**0**
Mentoring/dental students by prosthodontic faculty	**5**	**17**	**16**	**0**	**0**
Literature concerning the need for prosthodontists in the future	**1**	**14**	**22**	**0**	**0**
Data depicting current and projected income for specialists	**3**	**14**	**19**	**0**	**0**
The dollar value of prosthodontic training	**3**	**15**	**16**	**1**	**0**
Society's demand for higher level of training and credentialing	**2**	**19**	**17**	**0**	**0**
Advances in implant, esthetic, and reconstructive dentistry	**19**	**12**	**7**	**0**	**0**

GME = graduate medical education.

Table 3 Responses to the survey (number of respondents). The question was, "In your opinion, have the following factors led to an increase, decrease, or no change in the number of foreign-trained applicants to your program?" Factors in bold have at least 10 responses in the increase categories and a very low number of responses in the decrease categories

Factors	Strong increase	Slight increase	No change	Slight decrease	Strong decrease
Loss of GME funding for residents enrolled in prosthodontics	1	1	29	1	1
Interest in prosthodontics among US dental students	2	6	28	0	0
Growth in the United States and global economy	2	7	22	3	1
Predoctoral curriculum time pertaining to prosthodontics	**0**	**12**	**24**	**0**	**0**
Demand for prosthodontic services in the public sector	**5**	**12**	**18**	**0**	**0**
Number of prosthodontic faculty in predoctoral clinic	0	9	23	3	0
Marketing of prosthodontics as a career	**1**	**12**	**21**	**0**	**0**
Mentoring/dental students by prosthodontic faculty	**1**	**9**	**23**	**1**	**0**
Literature concerning the need for prosthodontists in the future	**3**	**7**	**23**	**1**	**0**
Data depicting current and projected income for specialists	**2**	**12**	**20**	**0**	**0**
The dollar value of prosthodontic training	**6**	**9**	**20**	**0**	**0**
Society's demand for higher level of training and credentialing	**7**	**12**	**17**	**0**	**0**
Advances in implant, esthetic, and reconstructive dentistry	**15**	**9**	**11**	**0**	**0**

also reported that there is an increased interest in prosthodontics or no change from 2005 to 2009. A positive, significant correlation between the change in number of US graduates and the following factors affecting the applicant pool was seen for interest in prosthodontics among US dental students: advances in implant, esthetic, and reconstructive dentistry, literature concerning the need for prosthodontists in the future, marketing prosthodontics as a career, dollar value of prosthodontic training, and society's demand for higher training and credentialing. Two factors, society's demand for higher training and credentialing and interest in prosthodontics among US dental students, were found to have a positive significant correlation in both the 2005 and the 2009 surveys. There was no relationship between the change in number of foreign graduates and the factors affecting an increased interest in prosthodontics for the international students in this survey. An analysis was performed on 13 factors, because they were thought to have a positive impact on the future of the specialty.

Table 4 Correlation between the change in the number of US applicants and significant variables fostering an increasing interest in prosthodontics

Factors	Spearman correlation (ρ)	p-value
Interest in prosthodontics among US dental students	0.61	<0.001
Advances in implant, esthetic, and reconstructive dentistry	0.52	0.001
Literature/need for prosthodontics in the future	0.51	0.001
Marketing of prosthodontics as a career choice	0.43	0.008
Dollar value of specialty training in prosthodontics	0.43	0.008
Society's demand for higher training and credentialing	0.33	0.04

For this analysis, responses for "In your opinion, have the following factors led to an increase, decrease, or no change in the number of US-TRAINED applicants to your program?" were collapsed into three categories: Increase, No change, and decrease.

The choice to enter specialty training is a complex one. Nash and Pfeifer reported net earnings as a specialist, potential earnings lost during residency training, and tuition and expenses required for residency as major determinants of choosing advanced dental education.[8] They also reported earnings for private-practicing prosthodontists to be relatively high compared to other dental professionals. Net earnings are often seen as an indicator of health within a profession, but high net earnings do not sufficiently explain the current rise in applications to prosthodontic residencies. An important result of this survey attempts to demonstrate some of the factors other than financial gain that may influence dental students to choose a career in prosthodontics.

An increasing applicant pool is an indicator of the health of a specialty education program; recruitment of the best and brightest into prosthodontics is a priority. A future survey of dental students will report on mentoring programs and a measurement of outcomes.[20]

Table 5 "Which financial packages do you offer to your students?"

Financial packages	2005 Yes	2009 Yes
Teaching fellowships to recruit	8	6
Scholarships	7	3
Tuition reduction	14	7
Production incentives	3	2
Grants	2	0
Stipends	19	18
GME funding	6	5
No packages	5	4
Hospital or military incentives	8	13

Conclusion

The health of a specialty training program can be examined by the sheer number of applicants and the competitiveness of the application process. A significant increase in the size and competitiveness of the applicant pool in the past 10 years suggests that prosthodontic programs have become more attractive to dental students. Our findings suggest that factors such as mentoring, society's demand for a higher level of training and credentialing, interest in prosthodontics among US dental students, advances in implant, esthetic, and reconstructive dentistry, literature concerning the need for prosthodontists in the future, marketing prosthodontics as a career, and the dollar value of prosthodontic training have all had some impact on increasing the applicant pool for prosthodontic training in the United States in the past 10 years.

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