The Current State of Predoctoral Orthodontic Education in the United States

Florence Kwo, B.A.; Maria Orellana, D.D.S., M.Sc., Ph.D.

Abstract: The objective of this study was to assess the current state of predoctoral orthodontic education in the United States. We hypothesized that there are significant differences in the teaching methods, course content, and assessment methods in current predoctoral orthodontic curricula in U.S. dental schools. To test this hypothesis, predoctoral orthodontic directors at fifty-five dental schools were invited to complete an anonymous online survey during the months of June and July 2010. Twenty-nine program directors (53 percent) completed the survey. Our data showed that the mean number of full-time and part-time equivalent faculty members teaching predoctoral orthodontics is 2.12 and 2.5, respectively. Students are presented with orthodontic material as early as the first year in some dental schools; however, the majority of schools present the most orthodontic material in the third year. The number of curriculum hours devoted to teaching orthodontics during the predoctoral years varies greatly between schools, and many programs teach students a variety of orthodontic techniques. Less than half (48.15 percent) of the responding programs require students to treat orthodontic patients. The majority of the responding programs require students to observe residents (65.38 percent), while those requiring students to assist in graduate orthodontics clinic are in the minority (34.62 percent). Two-thirds of the responding programs consider the current time allotted for predoctoral orthodontic clinical education at their institutions to be adequate. Our results suggest that there are, indeed, large variations in teaching methods, curriculum content, and methods of assessment in predoctoral orthodontic programs.

Ms. Kwo is a D.M.D. Candidate, Harvard School of Dental Medicine; and Dr. Orellana is Assistant Professor, Department of Orofacial Sciences, Division of Orthodontics, School of Dentistry, University of California, San Francisco. Direct correspondence and requests for reprints to Dr. Maria Orellana, School of Dentistry, University of California, San Francisco, 707 Parnassus Avenue, D-1011 Box 0438, San Francisco, CA 94143-0438; 415-476-4730; maria.orellana@ucsf.edu.

Keywords: predoctoral orthodontics, dental education

Submitted for publication 9/7/10; accepted 11/9/10

General dentists serve as key players in the proper treatment of malocclusion, since they not only refer patients to further specialized care, but also provide interceptive and other orthodontic services. In fact, 19.3 percent of general dentists provide comprehensive orthodontic treatment to their patients. In order to ensure optimum patient care, clinical training and a basic understanding of orthodontic treatment practices are important components of the predoctoral dental education.

The lack of uniformity among the predoctoral orthodontic curricula of dental schools in the United States may be due to the fact that predoctoral orthodontic education guidelines have evolved to become more open to interpretation during the past few decades. Currently, the American Dental Association’s Commission on Dental Accreditation (CODA) standards for malocclusion and space management state:

Graduates must possess the basic knowledge, skills, and values to practice dentistry, independently, at the time of graduation. The school identifies the competencies that will be included in the curriculum based on the school’s goals, resources, accepted general practitioner responsibilities, and other influencing factors. The comprehensive care experiences provided for patients by students should be adequate to ensure competence in all components of general dentistry practice.

The general nature of these standards has led to differences in the focus, assessment, and timing of orthodontic education among dental schools. A survey of predoctoral orthodontic education in the United States in the 1980s illustrated a wide range in the number of hours devoted to orthodontics and the timing of didactic and clinical instruction. The same survey recommended specific minimum hours of instruction be required for the topics described in the CODA guidelines. To address this issue, some schools have piloted courses that use specific evaluation criteria that are objectively assessed to develop a more uniform curriculum. Other schools have used the case-based method to help students develop clinical reasoning skills and improve students’ confidence in orthodontic management.

These variations in the curricula invariably result in variations in students’ skill level and knowledge base at graduation, potentially impacting...
patient care by increasing the possibility that signs of malocclusion may be overlooked or misdiagnosed by the general dentist. For instance, one study found that although didactic knowledge increased over the four years of dental education, fourth-year students did not show significant improvements in orthodontic diagnostic skills.6

Information regarding the current state of the undergraduate orthodontic curricula in the United States is scarce. Most of the available data is based on studies from the 1980s or focuses on other countries.3 This study will help address this gap in our knowledge and provide an updated report on predoctoral orthodontic education in the United States. The results of this study may be used as a basis for assisting dental schools in evaluating their curricula to better prepare graduates in the management of orthodontic issues.

Materials and Methods

This study received approval from the University of California, San Francisco (UCSF) and Harvard School of Dental Medicine Research Ethics Boards. The survey (Appendix), developed by the authors, was not formally assessed for validity and reliability; it was tested by faculty members at UCSF to determine completion time and identify components that needed revision or clarification.

An e-mail was sent to the director of each predoctoral orthodontic program (for the 2009–10 academic year) as listed on the websites of the fifty-eight dental schools in the United States. Only those schools that had been established for at least four years were surveyed: thus, fifty-five dental schools qualified. After obtaining confirmation that each person contacted was either the program director or the faculty member with the best knowledge of the predoctoral orthodontic curriculum, the survey link was e-mailed to each along with an explanation of the research and disclosures regarding the study. A survey response from the program director/primary contact was taken as informed consent.

To ensure an adequate response rate, the initial e-mails were followed up by a second round of e-mails and phone calls. Follow-up e-mails were sent eighteen days after the first survey e-mail. Since the survey was anonymous, all of the directors also received a follow-up phone call twenty-two days after the first e-mail was sent. The collected data from the online survey were compiled electronically on the survey website. Twenty-nine schools responded to the survey, which was 55 percent of those contacted.

Results

For the responding schools, the average size of the incoming first-year dental class was eighty-six students. The percentage of responding schools with a graduate orthodontic program was 92.59 percent. The mean number of full-time equivalent and part-time equivalent faculty teaching predoctoral orthodontics was 2.12 and 2.5, respectively.

Dental instruction relating to orthodontics was presented as early as the first year of study in responding schools. During the first year, 77.78 percent of responding schools reported devoting from 0 to 5.0 curriculum hours per semester to orthodontic instruction, while 7.41 percent provided 5.1 to 10.0 hours and 14.81 percent greater than 15.0 hours. In the second year, 33.33 percent of responding schools provided 0 to 5.0 curriculum hours of orthodontic instruction per semester, 18.52 percent provided 5.1 to 10.0 hours, 3.70 percent provided 10.1 to 15.0 hours, and 44.44 percent provided greater than 15.0 hours. The majority of schools offered most of their orthodontic material in the third year (Figure 1). During the third year, 44.44 percent of responding schools provided greater than 15.0 hours of orthodontic instruction per semester, 14.81 percent provided 10.1 to 15.0 hours, 25.93 percent provided 5.1 to 10.0 hours, and 14.81 percent provided 0 to 5.0 hours. In the fourth year, 53.85 percent of responding schools provided 0 to 5.0 hours of orthodontic instruction per semester, 11.54 percent provided 5.1 to 10.0 hours, another 11.54 percent provided 10.1 to 15.0 hours, and 23.06 percent provided greater than 15.0 hours. Of the time responding institutions devoted to orthodontic instruction during the fourth year of their predoctoral programs, 61.54 percent provided didactic instruction for greater than 50 percent of scheduled time, 26.92 percent divided scheduled time evenly between didactic and laboratory instruction, and 11.54 percent devoted less than 50 percent of scheduled time to didactic instruction.

It is important to note that many schools do not require students to provide orthodontic treatment for patients. In fact, less than half (48.15 percent) of responding schools in our study provide dental students with the opportunity to treat orthodontic cases. For the purpose of this study, “orthodontic treatment” integrated different modalities of trea-
ment; for example, treatment with clear aligners as well as minimal treatment, such as two by fours or one arch full fixed appliances. Students at all responding schools that permit predoctoral students to treat orthodontic patients work with no more than five patients per semester. Most of these schools (69.23 percent) permit students to treat patients with both mixed and permanent dentition, but 23.08 percent restrict treatment to permanent dentition cases while 7.69 percent restrict treatment to mixed dentition cases. Among those schools that permit treatment of orthodontic patients in their undergraduate programs, 46.15 percent utilize full fixed appliances.

Well over half (65.38 percent) of the responding schools require students to observe residents in the graduate orthodontic clinic. Nearly half (43.75 percent) of those schools reported their students shadow residents fewer than 5.0 hours per semester, but 25.00 percent of those schools require 5.1 to 10.0 hours and 31.25 percent require greater than 10.0 hours of observation (Figure 2). Compared to the observation requirements, a smaller percentage of schools require students to assist residents in the graduate orthodontics clinic (34.62 percent). Most of these schools (62.50 percent) require students to assist residents for 5.1 to 10.0 hours.

Two-thirds (66.67 percent) of the responding schools consider the curriculum time allotted for predoctoral orthodontic clinical education at their institutions to be adequate. The percentages of schools providing instruction in a variety of orthodontic techniques are listed in Table 1. Assessment methods employed in testing orthodontic competence are listed in Table 2. Comments and suggestions from predoctoral orthodontic directors relating to means of improving orthodontic education are listed in Figure 3.

**Discussion**

The results of this survey show large disparities in the methods of teaching, curriculum content, and methods of assessment in predoctoral orthodontic programs in U.S. dental schools. The number of curriculum hours devoted to orthodontic instruction during each of the four predoctoral years varied greatly. For example, 77.76 percent of responding schools provide 0 to 5.0 hours of orthodontic instruction per semester in the first year, but 14.81 percent of schools provide greater than 15.0 hours. In the second year, the difference between schools is even greater, as 33.33 percent of responding schools provide 0 to
5.0 hours of orthodontic instruction per semester and 44.44 percent provide greater than 15.0 hours. A varied dental program can influence the proficiency of students in the practice of orthodontics during their dental school years and beyond since more hours of instruction often translate to a greater understanding and comfort level with the practice.6

The differences are prominent in many other aspects, including the method of teaching orthodontics. Only 48.15 percent of responding dental schools offer students the opportunity to treat orthodontic patients. This is striking because it is estimated that almost 20 percent of general dentists in the United States provide comprehensive orthodontic treatment for their patients, but more than half of the graduating dental students have not actually treated patients.1 Dental schools in the United States also have widely varying requirements for observing and assisting graduate orthodontic residents.

This study revealed differences among pre-doctoral program directors themselves regarding the treatment of orthodontic patients by students. One director responded with this comment: “Without a clinical component where students treat patients, the orthodontic experience has little value”; but an-
Orthodontics should be a bigger part of the national boards and be a part of NERB/WREB examinations so that students will focus more.

The diversity among institutions is so great that they range from very good to poor. Without a clinical component where students treat patients, the orthodontic experience has little value. The orthodontic educators do not value predoctoral orthodontic education; it is also not highly valued by the administrative structure of the dental school. The orthodontic experience must have a longitudinal experience with the patients versus a rotation.

Unfortunately, predoctoral students, because of their clinical orientation in other dental school disciplines, tend to give poor evaluations of orthodontics because of their assessment that it is only teaching diagnosis and referral. Since orthodontic treatment takes at least 2-3 years, it is unrealistic to include full-banded orthodontics in the dental curriculum as currently structured in the US. It is true that there are a few schools in Canada that do teach full-banded orthodontics on the predoctoral level. To my knowledge, however, any evaluation of this clinical experience has never shown that graduates do more orthodontic treatment upon leaving dental school. It did show that they tended to recognize and refer orthodontic cases to even a greater degree. My take on this finding is that we should teach more case diagnosis rather than actual hands-on full-banded treatment.

We teach students space maintenance and growth & development. For those wishing to do orthodontic treatment, we recommend specialty training.

...we have three didactic course in which full banding and functional are discussed; however, they only will do limited treatment cases 3-9 months with direct supervision. They are required to observe/assist in the graduate clinic for 16 hours of clinic time during one quarter.

Have other disciplines value and identify orthodontic treatment as a part of a patient’s dental and/or facial rehabilitation.

Currently the predoctoral clinic is elective. It should be incorporated as part of the regular curriculum hours.

More adequate curriculum time allotted/required of our students.

Giving the students an opportunity to work in the postgraduate clinic on simple cases.

More scheduling flexibility to allow further interaction of ortho residents as TAs for the dental students.

I would start the basic orthodontic courses in second year instead of third year.

I would like the dental students to have more experience with Invisalign so they could see the pros and cons of the appliance and be able to determine which patients would actually benefit from Invisalign versus those cases that are too complex.

We have gone to a program in which we teach 7 orthodontic topics in 7 small group modules with each one hour and each covered by a web-based lecture. The students also rotate for one week through the clinic. All the material is designed to introduce orthodontic concepts without details that require proficiency. Invisalign is mentioned and introduced but with concepts of pro and cons of using it. Dental students can also attend a quarter in the clinic to observe, as well as a quarter orthodontic journal club.

Figure 3. Comments and suggestions from predoctoral orthodontics directors

other stated, “we should teach more case diagnosis rather than actual hands-on full-banded treatment” (Figure 3).

Many programs provide instruction to students on a variety of orthodontic techniques (Table 2). The lack of a consistent curriculum across dental schools might explain, in part, the varying levels of proficiency demonstrated by general dentists across the United States as well as their orthodontic treatment preferences and referral decisions.

The assessment methods used to test dental students for competence in orthodontics also vary greatly across schools. All schools assess students through written examinations and most use laboratory methods for assessment as well; however, only a quarter of responding schools incorporate the objective structured clinical examination (OSCE) method. Approximately half of the responding schools incorporate clinical examinations. This variation in examination methods is a contributing factor for the varying levels of competence amongst dental graduates in the United States.

When comparing our results with those of Nieberg and Sinclair,4 we observe the mean number of full-time equivalent faculty teaching predoctoral orthodontics seems to have decreased from 3.4 to
2.12 since their survey was reported in 1988. In their study, a greater percentage of schools (66.66 percent) required students to perform an orthodontic clinical procedure or procedures, compared to 48.15 percent in our study. Two-thirds (66.66 percent) of predoctoral orthodontic directors responding to our survey believe the curriculum hours scheduled for orthodontic clinical education to be adequate, an increase from 57 percent in 1988. This finding may lend support to the suggestion that there has been progress in curriculum development since that time, but course directors still voiced concerns with current programs. For example, one director responding to our survey recommended that “orthodontics should be a bigger part of the national boards and be a part of NERB/WREB examinations so that students will focus more”—a statement that underscores the need to provide a standard assessment method.

It may be argued that current CODA curriculum guidelines for malocclusion and space management contribute to the differences among predoctoral orthodontic curricula. This set of guidelines has allowed dental schools significant latitude in choosing the orthodontic techniques to be incorporated into their curricula and, as such, it may represent one of the factors that have led to the existence of inconsistent competency standards for graduating dental students. While every dental school prides itself in creating a unique program, drawbacks exist in this method, as schools may equivocate in terms of selecting which techniques to highlight and also equivocate in selecting the most appropriate means of assessing students.

**Conclusion**

To improve the quality of predoctoral orthodontic education on a broad level, it is our suggestion that U.S. dental schools establish standards in terms of the number of curriculum hours assigned each year to orthodontic education and the specific orthodontic skill set to be attained by the time of graduation. Apart from clarifying the skills in which students should display competence, guidelines should also specify the most appropriate methods for assessing students in the competencies. Standardizing assessment methods between dental schools will enhance preparation for national exams and also increase the likelihood that dental students will graduate with similar competence, with the ultimate goal of improved patient care.

**REFERENCES**

## APPENDIX

**Survey of U.S. Predoctoral Orthodontic Programs**

### General Questions
1. What is the size of your incoming 1\textsuperscript{st} year dental class this year?
   - a. 0-40
   - b. 41-60
   - c. 61-80
   - d. 81-100
   - e. Greater than 100
2. Is there a graduate orthodontics program in your school?
   - a. Yes
   - b. No
3. How many full-time equivalent faculty teaching predoctoral orthodontics does your institution currently have (include yourself)?
   - a. 0
   - b. 1-2
   - c. 3-4
   - d. 5-6
   - e. Greater than 6
4. How many part-time equivalent faculty teaching predoctoral orthodontics does your institution currently have (include yourself)?
   - a. 0
   - b. 1-2
   - c. 3-4
   - d. 5-6
   - e. Greater than 6

### Structure and Method of Teaching
5. In general at the dental school, how many curriculum hours per semester are devoted to teaching orthodontics (please average the time spent in your class and others)?
   - a. 1\textsuperscript{st} year of dental school curriculum
     - i. 0-5.0 hours
     - ii. 5.1-10.0 hours
     - iii. 10.1-15.0 hours
     - iv. Greater than 15.0 hours
   - b. 2\textsuperscript{nd} year of dental school curriculum
     - i. 0-5.0 hours
     - ii. 5.1-10.0 hours
     - iii. 10.1-15.0 hours
     - iv. Greater than 15.0 hours
   - c. 3\textsuperscript{rd} year of dental school curriculum
     - i. 0-5.0 hours
     - ii. 5.1-10.0 hours
     - iii. 10.1-15.0 hours
     - iv. Greater than 15.0 hours
   - d. 4\textsuperscript{th} year of dental school curriculum
     - i. 0-5.0 hours
     - ii. 5.1-10.0 hours
     - iii. 10.1-15.0 hours
     - iv. Greater than 15.0 hours
6. From those curriculum hours, in general, what is the distribution between didactic and laboratory (such as making retainers) training?
   - a. More than 50% time didactic
   - b. 50% time didactic and 50% time laboratory
   - c. Less than 50% time didactic
7. Do dental students at your school treat orthodontic patients?
   a. Yes
   b. No
7a. (Only displayed if survey recipient answered “Yes” to Question 7)
    How many patients do students treat on average once orthodontic-specific education begins (per semester)?
    a. 1-5 patients
    b. 6-10 patients
    c. 11-15 patients
    d. More than 15 patients
7b. (Only displayed if survey recipient answered “Yes” to Question 7)
    Which type of cases do they treat?
    a. Mixed dentition cases only
    b. Permanent dentition cases only
    c. Both mixed dentition and permanent dentition cases
7c. (Only displayed if survey recipient answered “Yes” to Question 7)
    Do dental students treat patients with full fixed appliances (braces)?
    a. Yes
    b. No
8. Are dental students required to observe residents in the graduate orthodontics clinic?
   a. Yes
   b. No
8a. (Only displayed if survey recipient answered “Yes” to Question 8)
    How many hours per semester do dental students observe residents?
    a. 0-5.0 hours
    b. 5.1-10.0 hours
    c. 10.1-15.0 hours
    d. Greater than 15.0 hours
9. Are dental students required to assist residents in the graduate orthodontics clinic?
   a. Yes
   b. No
9a. How many hours per semester do dental students assist residents?
    a. 0-5.0 hours
    b. 5.1-10.0 hours
    c. 10.1-15.0 hours
    d. Greater than 15.0 hours
10. In general, do you consider the allotted curriculum time for predoctoral orthodontic clinical education at your institution adequate?
    a. Yes
    b. No

**Course Content**

11. Are dental students at your institution taught the usage of full fixed appliances?
    a. Yes
    b. No
12. Are dental students at your institution taught the usage of passive appliances (i.e., space maintainers and retainers)?
    a. Yes
    b. No
13. Are dental students at your institution taught the usage of functional appliances?
    a. Yes
    b. No
### APPENDIX (continued)

14. Are dental students at your institution taught Invisalign techniques?
   a. Yes
   b. No

14a. (Only displayed if survey recipient answered “Yes” to Question 14)
   Are the students required to be Invisalign-certified before graduating from dental school?
   a. Yes
   b. No

#### Assessment
15. Which type(s) of assessments are used to test competence in the orthodontics courses?
   a. Written examination
      i. Yes
      ii. No
   b. OSCE (objective structured clinical examination)
      i. Yes
      ii. No
   c. Clinical
      i. Yes
      ii. No
   d. Laboratory
      i. Yes
      ii. No
   e. Other methods (please write in space below)

#### Optional
16. Do you have any comments or suggestions about how to improve the predoctoral orthodontic curriculum at your school that you would like to share? (Neither you nor your school will be identified with the comment.)