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Authors

Vakili, Ava
Chaffee, Benjamin W
Oberoi, Snehlata

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Impact of COVID-19 pandemic on orthodontics in predoctoral and postdoctoral programs in the United States

Ava Vakili,^a Benjamin W. Chaffee,^b and Snehlata Oberoi^a
San Francisco, Calif

Introduction: The study aimed to characterize the impact of the coronavirus disease 2019 (COVID-19) pandemic on predoctoral and postdoctoral orthodontic education. **Methods:** Electronic surveys were distributed via e-mail to predoctoral orthodontic directors at accredited dental schools (n = 66), postgraduate orthodontic program directors at orthodontic programs (n = 73), and craniofacial orthodontic fellowship directors (n = 5) in the United States and Canada. **Results:** The predoctoral orthodontic survey received a response rate of 38%, of the which 62% indicated significant curriculum modifications. However, orthodontic curriculum hours were largely unchanged because of the COVID-19 pandemic. Of the responding predoctoral orthodontic programs with graduate orthodontic programs in which dental students can gain clinical experience (n = 14), all but 2 reported not allowing or limiting observation or assisting opportunities. The postdoctoral orthodontic survey received a response rate of 39% and was affected by clinic modifications, including financial limitations, severe acute respiratory syndrome coronavirus 2 testing, decreased clinical hours, among other modifications. **Conclusions:** COVID-19 pandemic has had a measurable impact on orthodontic clinical education for the predoctoral and postdoctoral orthodontic programs evaluated. Overall, less patient care was delivered, potentially resulting in delayed treatment for patients and fewer training opportunities for learners, particularly for predoctoral dental students, whose clinical observation and assisting hours were limited. (Am J Orthod Dentofacial Orthop 2021; ■:e1-e11)

Globally and locally, the coronavirus disease 2019 (COVID-19) pandemic has changed how education systems function, impacting teaching and learning on a large scale.¹ The World Health Organization officially declared COVID-19 a global pandemic on March 11, 2020, and the pandemic has since changed the trajectory of world economies, educational systems, and government leadership.² As of June 27, 2020, more than 180.8 million cases of COVID-19 had been reported globally, with 3.9 million deaths.³ With stay-at-home

orders, social distancing, and online learning for many students, the educational system was put on pause and/or substantially reconfigured as part of mitigation effects to reduce severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) spread.¹

Given that SARS-CoV-2 has been detected in the saliva of infected patients and can be easily spread through respiratory droplets commonly generated in dental procedures, the COVID-19 pandemic has had a direct effect on dental practice and dental education.⁴ On March 16, 2020, the American Dental Association called for dentists to limit care provision to emergency procedures only.⁵ The Occupational Safety and Health Administration classified dentists as very high risk for infection because of aerosol-producing procedures.⁶ The COVID-19 pandemic has disrupted the way dental educational institutions treat patients and train students. The present study explores the impact of the COVID-19 pandemic on one component of dental education—predoctoral and postdoctoral training in orthodontics. With the practice of orthodontics deeply grounded in

^aDepartment of Orofacial Sciences, University of California San Francisco School of Dentistry, San Francisco, Calif.

^bDivision of Oral Epidemiology and Dental Public Health, University of California San Francisco School of Dentistry, San Francisco, Calif.

All authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and none were reported.

Address correspondence to: Snehlata Oberoi, Department of Orofacial Sciences, University of California San Francisco School of Dentistry, 707 Parnassus Ave D3000, San Francisco, CA 94143; e-mail, sneha.oberoi@ucsf.edu.

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an understanding of underlying principles gained through didactic and experiential learning, successful orthodontic training may be particularly vulnerable to pandemic-related disruptions to training opportunities.

MATERIAL AND METHODS

Web-based cross-sectional surveys were distributed via e-mail from September to October 2020 to predoctoral orthodontic directors (or equivalent position), postgraduate orthodontic program directors, and craniofacial orthodontic fellowship program directors in the United States and Canada. The primary e-mail was sent out in September 2020 with a reminder e-mail follow-up sent 3 weeks later. A second reminder was sent mid-October before closing the survey on October 31, 2020. Postdoctoral surveys (residency programs and fellowships) were near-identical to each other, differing only in the names of the respective programs in questions stems, but differed substantially from the predoctoral surveys given the different training objectives and activities of predoctoral and postdoctoral programs. Survey administration was via Qualtrics XM Survey Software Platform (Qualtrics, Provo UT).

This study received Institutional Review Board approval by the Committee on Human Research at the University of California, San Francisco (Institutional Review Board no. 20-31860). Potential respondents received a detailed e-mail message that included a description of the survey, the research purpose, anonymity of the research, the voluntary nature of the research, and the survey deadline. Participants followed the embedded survey link to a statement that continuing the survey indicated electronic consent. No compensation was provided for survey completion.

Study investigators compiled contact information for predoctoral orthodontic directors' in the United States, including Puerto Rico. Predoctoral orthodontic directors for the 2020-2021 academic year at accredited dental schools were considered. Only schools that had at least one graduated class were contacted ($n = 66$). Name, e-mail, and other contact information were primarily found on dental school websites and orthodontic department pages. If the e-mail of the program director was not found on the school's Web site, a phone call was made to the orthodontic department to record the accurate e-mail of the respective individual. In the case in which a school does not have a predoctoral orthodontic director, the program director in postgraduate orthodontics was contacted. In the case in which a school had neither a predoctoral orthodontic director nor a postgraduate orthodontic director, the dean of academic

affairs was invited to complete the survey. In total, 25 responses were provided (response percentage: 25 out of 66; 38%), and 21 fully completed responses were included in the analysis. No responses were received from programs in Puerto Rico.

Study investigators compiled a list of all postgraduate ($n = 73$) and craniofacial fellowship ($n = 5$) orthodontic directors' e-mails and contact information in the United States and Canada. Postgraduate and craniofacial fellowship orthodontic directors for the 2020-2021 academic year at all accredited orthodontic postgraduate programs were considered. Contact information was primarily collected from the American Association of Orthodontists Web site. Names and e-mails of program directors were checked against the program's Web site for accuracy. In total, 30 surveys were initiated (response percentage: 30 out of 78; 39%), and 24 fully completed responses were included in the analysis. No responses were received from programs in Canada.

A literature search was conducted for existing studies and survey instruments on the state of orthodontic education in the United States; relevant items were adapted to the present study. To our knowledge, no published survey research has examined the impact of COVID-19 on predoctoral and postdoctoral orthodontic programs. Novel questions were created to characterize the impact of COVID-19 on orthodontic education. The main outcomes of interest were the impact of COVID-19 on predoctoral and postdoctoral orthodontic programs. Predoctoral orthodontics survey contained 35 questions (32 closed-ended and 3 open-ended questions). Postdoctoral orthodontics surveys contained 39 questions (36 closed-ended and 3 open-ended questions). Questions about general characteristics of programs were asked, including class size and the number of orthodontic faculty.⁷ Respondents took on average 6.6 minutes to complete the predoctoral survey, 9.1 minutes to complete the postdoctoral survey. [Supplementary Tables I-III](#) provide a complete list of measurement items.

Statistical analysis

The analysis was descriptive: counts and percentages were calculated for each endorsed response option across relevant survey items, separately for predoctoral and postdoctoral programs. Given the relatively small number of responses and the descriptive and exploratory nature of this study, statistical hypothesis testing was not performed.

RESULTS

From the completed responses ($n = 21$), the majority of responding program directors (62%) of predoctoral

programs reported annual Doctor of Dental Surgery or Doctor of Medicine in Dentistry cohorts of greater than 90 students (Table I). All completed responses were from the continental United States; no response was received from invited predoctoral programs in Puerto Rico. Seventy-six percent of responding program directors indicated 0–4 full-time faculty members, and 57% of reporting programs indicating ≥ 5 part-time faculty members. Seventy-one percent of the responding programs indicated having a graduate-level orthodontic program at their institution, and 67% indicated that the curriculum time offered at their institution is adequate.

Sixty-two percent of predoctoral orthodontic directors agreed there had been significant curriculum modifications because of the COVID-19 pandemic. However, survey results showed orthodontic curriculum hours per year were largely unchanged because of the COVID-19 pandemic. The results indicate a modest change for the second-year (Class of 2023) and third-year (Class of 2022) Doctor of Dental Surgery/Doctor of Medicine in Dentistry cohorts (Table II). Of the responding programs with graduate orthodontic programs in which dental students can observe, assist, and gain clinical experience ($n = 14$), 86% reported not allowing or limiting observation and assisting hours for dental students during the COVID-19 pandemic. Of these programs, 64% indicated requiring 0–10 hours of clinical observation and assisting hours pre COVID-19 pandemic. Compared with during the COVID-19 pandemic, 86% of programs with postgraduate orthodontic programs required 0–10 hours of clinical observation and assisting hours.

Before the COVID-19 pandemic, 76% of all responding programs allowed dental students to treat orthodontic patients in their capacity with the help and supervision of orthodontists and trained faculty. However, because of implemented COVID-19 restrictions and curriculum modifications, 52% of responding programs reported limiting dental students' treatment in orthodontic patients (Table I). Of the responding predoctoral programs currently allowing dental students to treat orthodontic patients ($n = 10$), 90% reported students treated/cotreated 1–2 patients during their clinical years.

All completed responses were from the continental United States; no response was received from invited postdoctoral programs in Canada. From the completed responses ($n = 24$), the majority of responding program directors (58%) reported the mean cohort size for incoming postdoctoral orthodontic students as ≥ 7 students (Table III). Seventy-five percent of responding programs indicated 1–4 full-time faculty members, and 50% of responding programs indicated having ≥ 7 part-time faculty at their institution (Table III).

Survey results point toward major changes in patient volume treated by orthodontic residents because of the COVID-19 pandemic. Most notably, all postgraduate orthodontic programs reported temporarily closing their clinics by the end of March 2020, with most (64%) reporting closing by March 16. From received responses, 46% of orthodontic residents and craniofacial fellows treated 20–30 patients on average per week before the COVID-19 pandemic (Table IV). At the time of the survey, during the COVID-19 pandemic, 54% of received responses indicated orthodontic residents and craniofacial fellows treated on average 4–15 patients per week. Sixty-seven percent of the responding programs state that their residents and fellows have experienced a 1–2 hour reduction a week in clinical hours.

Because of the COVID-19 pandemic, modifications to clinic procedures and operations were reported. Fifty-four percent of responding programs did not SARS-CoV-2 test orthodontic patients for any procedures or appointments. In addition, 38% of responding programs performed SARS-CoV-2 testing for aerosol-generating procedures. However, when asked if dental professions are a part of the screening, prevention, and diagnosis of SARS-CoV-2, 63% indicated yes. Fifty-five percent of responding programs surveyed placed patients undergoing aerosol-producing procedures in separate confined spaces (ie, negative pressure room) and used medical-grade air purifiers in their clinics.

In addition, many programs (70%) instilled a mouth rinse protocol (ie hydrogen peroxide) universally for all patients. More than half of responding programs (65%) indicated donning N95 (or respirator with similar characteristics) 5 or more times. In addition, tele-orthodontics was utilized among 46% of the orthodontic programs surveyed; 96% of responding programs that use tele-orthodontics used this technology for 0%–10% of their appointments. When asked if there is a need for training in the delivery of teleorthodontics, 63% indicated a need for staff training. Twenty-two percent of responding programs SARS-CoV-2 tested orthodontic residents, and 18% of responding programs SARS-CoV-2 tested orthodontic faculty members. Zero of the respondents indicated layoffs in the orthodontic department at their programs. However, 91% of respondents indicated an increased cost of delivery of care in the orthodontic practice because of the COVID-19 pandemic.

DISCUSSION

The results for predoctoral and postdoctoral orthodontic programs point to clinical changes for students, residents, and craniofacial fellows and financial implications for the orthodontic clinics and decreased care

Table I. Predoctoral orthodontic institution characteristics in the United States

Program characteristics [†]	n	%
Geographic location of predoctoral program		
East Coast	5	23.8
Midwest	6	28.6
South	8	38.0
West Coast	2	9.5
Puerto Rico*	0	0
Average cohort size of DDS/DMD at an institution		
0-50 students	4	19.1
51-70 students	1	4.8
71-90 students	3	14.3
91-110 students	8	38.1
Greater than 110	5	23.8
Graduate-level orthodontics program at an institution		
Yes	15	71.4
No	6	28.6
Full-time orthodontic faculty		
0 full-time faculty	1	4.8
1-2 full-time faculty	7	33.3
3-4 full-time faculty	8	38.1
5-6 full-time faculty	3	14.3
>6 full-time faculty	2	9.5
Part-time orthodontic faculty		
0 part-time faculty	2	9.5
1-2 part-time faculty	7	36.3
3-4 part-time faculty	0	0
5-6 part-time faculty	3	14.3
>6 part-time faculty	9	42.9
Predoctoral students allowed to treat orthodontic patients		
Yes	10	47.6
Yes, however now because of COVID-19 restrictions, this is no longer allowed	6	28.6
No	5	23.8
Allotted curriculum time as adequate		
Yes	14	66.7
No	7	33.3

DDS, Doctor of Dental Surgery; DMD, Doctor of Medicine in Dentistry.

*No predoctoral programs from Puerto Rico responded; [†]Excludes predoctoral programs yet to graduate a cohort of students at the time of the study.

delivery for patients. For predoctoral students, clinical observation hours were reduced because of COVID-19 pandemic shutdowns and new physical and social distancing protocols. Although changes in clinical observation hour requirements were modified, orthodontic curriculum hours were modified only slightly, suggesting a greater reliance on didactic teaching. For postdoctoral residents and fellows, clinical hours were reduced, and many new protocols were put in place to reduce the spread of SARS-CoV-2.

In postdoctoral orthodontics, 90% of responding programs indicated an increased cost of delivery of care in the orthodontic practice because of the COVID-19 pandemic. It warrants monitoring in future studies

Table II. COVID-19 pandemic-related changes in predoctoral orthodontic education

Program characteristics	n	% Pre-COVID-19 pandemic	n	% During COVID-19 pandemic
First-year of DDS/DMD curriculum hours				
0-5.0 h	16	76.2	16	76.2
5.1-10.0 h	2	9.5	2	9.5
10.1-15.0 h	2	9.5	2	9.5
>15.0 h	1	4.8	1	4.8
Second-year of DDS/DMD curriculum hours				
0-5.0 h	6	28.5	6	28.6
5.1-10.0 h	0	0	4	19.1
10.1-15.0 h	5	23.8	6	28.6
>15.0 h	10	47.6	5	23.8
Third-year of DDS/DMD curriculum hours				
0-5.0 h	5	23.8	7	33.3
5.1-10.0 h	7	33.3	6	28.6
10.1-15.0 h	2	9.5	3	14.3
>15.0 h	7	33.3	5	23.8
Fourth-year of DDS/DMD curriculum hours				
0-5.0 h	13	61.9	13	61.9
5.1-10.0 h	2	9.5	3	14.3
10.1-15.0 h	5	23.8	4	19.1
>15.0 h	1	4.8	1	4.8
Total clinical observation and assisting hours for programs with graduate orthodontic clinics				
0-5.0 h	4	28.7	7	50.0
5.1-10.0 h	5	35.7	5	35.7
10.1-15.0 h	3	21.4	1	7.2
>15.0 h	2	14.3	1	7.2

DDS, Doctor of Dental Surgery; DMD, Doctor of Medicine in Dentistry.

whether increased costs to programs will result in increased treatment costs for patients. Any increase in treatment fees at university-based clinics could result in reduced patients service utilization.⁸ If patients are required to pay more for treatment, they may elect not to receive care, which can greatly impact residents' and fellows' ability to start and finish orthodontic patients and, more importantly, limit access to orthodontic care.⁹

Telemedicine allows opportunities to provide supportive care to patients and triage more urgent issues to face-to-face clinic visits.¹⁰ A silver lining that came about with the current pandemic is many state boards and legislative bodies have voted favorably toward tele-dentistry, allowing health care workers to stay connected to patients and get reimbursed for doing so.¹¹ During the COVID-19 pandemic and national public health emergency, the federal government has waived penalties

Table III. Postdoctoral orthodontic program characteristics in the United States, Canada, and Puerto Rico

Program characteristics [†]	n	% (n = 24)
Geographic location of postgraduate program		
East Coast	8	33.3
Midwest	5	20.8
South	7	29.2
West Coast	4	16.7
Canada*	0	0
Puerto Rico [‡]	0	0
Average cohort size of the orthodontic program		
0-2 students	2	8.3
3-4 students	3	12.5
5-6 students	5	20.8
7-9 students	7	29.2
≥10 students	7	29.2
Full-time orthodontic faculty		
0 full-time faculty	0	0
1-2 full-time faculty	9	37.5
3-4 full-time faculty	9	37.5
5-6 full-time faculty	3	12.5
≥7 full-time faculty	3	12.5
Part-time orthodontic faculty		
0 part-time faculty	0	0
1-2 part-time faculty	5	20.8
3-4 part-time faculty	3	12.5
5-6 part-time faculty	3	12.5
≥7 part-time faculty	12	50.0

*No postdoctoral programs from Canada responded; [†]No postdoctoral programs from Puerto Rico responded; [‡]Excludes a 1-year clinical fellowship in craniofacial orthodontics.

for Health Insurance Portability and Accountability Act violations against providers that provide care using telehealth in good faith.¹² With approximately half of the programs surveyed using teleorthodontics during shutdown and reopening, the pandemic likely accelerated uptake of this technology; however, there is much further room to implement telemedicine and teleorthodontics to the fullest advantage.

Total predoctoral curriculum hours were not reported to change under the pandemic, perhaps reflecting longer administrative processes required to change curricular hours formally. However, at many schools, learning modalities changed substantially, with more reliance on remote online learning and fewer opportunities for clinical experiences. Of dentists in the United States, 79% practice general dentistry, and of those general dentists, 19% provide comprehensive orthodontic treatment.¹³ Thus, clinical and didactic time dedicated to orthodontics during predoctoral training is an important training opportunity that the COVID-19 pandemic may have interrupted.

Several study limitations must be considered. Generalizability is limited because of the number of responses received. Future qualitative research should examine the underlying challenges, motivators, and decision-making

Table IV. COVID-19 pandemic-related changes in postdoctoral orthodontic education

Program characteristics	n	%
No. of patients residents saw pre-COVID-19/wk		
10-20 patients	5	20.8
20-30 patients	11	45.8
≥30 patients	8	33.3
No. of patients residents see during COVID-19/wk		
4-6 patients	6	25.0
7-10 patients	2	8.3
11-15 patients	5	20.8
≥15 patients	9	37.5
Clinical hours reduction/wk		
1-2 h reduction a wk	16	66.7
3-5 h reduction a wk	2	8.3
6-8 h reduction a wk	1	4.2
9-11 h reduction a wk	1	4.2
≥12 h reduction a wk	4	16.7
Transition to partially open/closed		
Wk of March 9	1	4.2
Wk of March 16	16	66.7
Wk of March 23	5	20.8
Wk of March 30	2	8.3
Did not close	0	0
Patients SARS-CoV-2 tested before ortho appointment		
Yes, for all appointments	2	8.3
Yes, however, only for aerosol-generating procedures	9	37.5
No	13	54.2
No. of donnings before disposal of N95		
After each patient	2	10
After 1 donning	1	5
After 2 donnings	1	5
After 3 donnings	1	5
After 4 donnings	2	10
After 5 donnings	6	20
After 6 donnings	3	15
After ≥7 donnings	6	30

to capture a complete picture of how program directors, faculty, and learners adapted to the changing conditions under the pandemic. Self-report may not reflect actual practice. However, this investigation serves as an initial indication of how the COVID-19 pandemic has affected orthodontic education in North America and may inform further research. Our research represents a limited snapshot of how COVID-19 has affected orthodontic education in the fall of 2020; however, as the COVID-19 pandemic changes and evolves, we anticipate the effects on orthodontic education may change. Further research is needed to establish how the COVID-19 pandemic impacted student, resident, and fellow competency levels in orthodontics.

CONCLUSIONS

The COVID-19 pandemic has had a range of impacts on orthodontic didactic and clinical education in the United States. In many programs, the impact in

predoctoral orthodontic curriculum resulted in decreased clinical observation hour requirements and opportunities, although predoctoral orthodontic didactic curriculum hours were largely unchanged. Postdoctoral programs were affected by various clinic modifications, including SARS-CoV-2 testing for patients, personal protective equipment changes, decreased clinical hours, and other program-specific issues. The implications of the COVID-19 pandemic on predoctoral and postdoctoral orthodontic education have been significant and are likely just part of many ways the pandemic has affected dental academia.

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Supplementary Table I. Predoctoral orthodontic survey

Questions	Responses
Geographically where is your orthodontic program located?	West Coast; East Coast; Midwest; South; Puerto Rico
What is the average cohort size of your DDS/DMD program at your institution?	0-50; 51-70; 71-90; 91-110; > 110
Does your institution have a graduate-level orthodontics program dental students shadow and gain experience from?	Yes; No
How many full-time orthodontic faculty teaching positions does your institution currently have?	0; 1-2; 3-4; 5-6; >6
How many part-time faculty teaching positions does your institution currently have?	0; 1-2; 3-4; 5-6; > 6
How many curriculum/didactic hours were spent per semester devoted to orthodontics pre-COVID-19 in the first year of dental school curriculum?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; >15.0 h
How many curriculum/didactic hours were spent per semester devoted to orthodontics pre-COVID-19 in the second year of dental school curriculum?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; >15.0 h
How many curriculum/didactic hours were spent per semester devoted to orthodontics pre-COVID-19 in the third year of dental school curriculum?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; >15.0 h
How many curriculum/didactic hours were spent per semester devoted to orthodontics pre-COVID-19 in the fourth year of dental school curriculum?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; >15.0 h
Were curriculum hours in orthodontics modified because of COVID-19?	Yes; No
How many curriculum hours are spent per semester devoted to orthodontics during the COVID-19 pandemic in the first year of the dental school curriculum?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; >15.0 h
How many curriculum hours are spent per semester devoted to orthodontics during the COVID-19 pandemic in the second year of the dental school curriculum?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; >15.0 h
How many curriculum hours are spent per semester devoted to orthodontics during the COVID-19 pandemic in the third year of the dental school curriculum?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; >15.0 h
How many curriculum hours are spent per semester devoted to orthodontics during the COVID-19 pandemic in the fourth year of the dental school curriculum?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; >15.0 h
Are dental students allowed to treat orthodontic patients?	Yes; Yes, however, now, because of COVID-19 restrictions, this is no longer allowed; No
On average, how many patients do students treat/co-treat in their clinical years?	0 patients; 1-2 patients; 3-4 patients; 5 or more patients
What type of patients are students treatment planning and performing?	Limited orthodontic treatment; clear aligner treatment; other, (please specify):
On average what percent of your graduating class specializes in orthodontics?	<1%; 4-10 Johns Hopkins; 11%-20%; >20%
In general, do you consider the allotted curriculum time in orthodontics at your institution to be adequate?	Yes; No
What types of assessments are used to test competency in orthodontics pre-COVID-19? (select all that apply)	Written examination; laboratory; clinical; OSCE (Objective Structured Clinical Examination); other methods (please specify):
Were any of these assessments modified or changed because of the current COVID-19 pandemic?	Yes; No
What assessments were modified or changed? (select all that apply)	Written examination; Laboratory; Clinical; OSCE (Objective Structured Clinical Examination); Other methods (please specify):
Does your program have any orthodontic electives?	Yes; No
What types of electives are offered? (select all that apply)	Shadowing elective; clear aligner elective; other (please specify):
At your institution, are dental students involved in research?	Yes; No
What type of research?	Clinical science research; basic science research; public health research; other (please specify):
Does your school have a graduate orthodontic program in which students gain clinical experience?	Yes; No

Supplementary Table I. Continued

<i>Questions</i>	<i>Responses</i>
Are dental students allowed to shadow during clinical hours?	Yes; Yes, however, a limited number of students because of the new COVID-19 protocol; No, because of physical distancing and COVID-19 protocol, predoctoral students are not allowed to shadow
Are dental students required to observe and assist residents in the graduate orthodontic clinic as part of their predoctoral program?	Yes; No
How many total clinical observation and assisting hours did the program require pre-COVID-19 for dental students?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; >15.0 h
Were clinical observation and assisting hours limited because of COVID-19?	Yes; No
How many total clinical hours does the program require now during the COVID-19 pandemic for dental students?	0-5.0 h; 5.1-10.0 h; 10.1 to 15.0 h; > 15.0 h
How was your program affected by COVID-19 and the closure?	Neither you nor your school will be identified with the comment
Do you consider the allotted curriculum time and clinical experience given the impact COVID-19 has had, as adequate?	Neither you nor your school will be identified with the comment
Do you have any comments or suggestions about how to improve the predoctoral orthodontic curriculum during this COVID-19 time?	Neither you nor your school will be identified with the comment

DDS, Doctor of Dental Surgery; *DMD*, Doctor of Medicine in Dentistry.

Supplementary Table II. Postgraduate orthodontic survey

<i>Questions</i>	<i>Responses</i>
Geographically where is your orthodontic program located?	West Coast; East Coast; Midwest; South; Puerto Rico, Canada
What is the average cohort size of your orthodontic program at your institution?	0-2 Students; 3-4 students; 5-6 students; 7-9 students; ≥ 10 students
How many full-time orthodontic teaching positions does your institution currently have?	0; 1-2; 3-4; 5-6; ≥ 7
How many part-time orthodontic teaching positions does your institution currently have?	0; 1-2; 3-4; 5-6; ≥ 7
With the financial implications of COVID-19, were there any layoffs in the orthodontic department at your institution?	Yes; No
Which team members were let go because of COVID-19 financial implications?	Orthodontic assistants and staff; part-time faculty; full-time faculty
Because of the limitations of COVID-19, are the graduate orthodontic cohort size staying the same for 2020-2021 and future years?	Yes; No
By what percent is your cohort size decreasing?	Approximately 25% reduction; Approximately 50% reduction; Approximately 75% reduction; $\geq 75\%$ reduction
Are all didactic courses in your orthodontic training program taught via distance learning?	Yes; No; Not sure
Do you believe that online platforms for teaching (such as Zoom) are conducive and can replace in-person learning?	Yes; No; Not sure
On average, how many patients did a resident typically see pre-COVID-19 in a week?	10-20 patients, 21-30 patients, ≥ 30 patients
On average, how many patients does a resident typically see now during the COVID-19 pandemic in a week?	4-6 patients; 7-10 patients; 11-15 patients; ≥ 15 patients
How many hours a week have clinical hours been reduced for residents in your program because of the impact of COVID-19?	1-2 h reduction a wk; 3-5 h reduction a wk; 6-8 h reduction a wk; 9-11 h reduction a wk; 12 or more h reduction a wk
When did your practice make the transition to partially open/closed?	Wk of March 9; wk of March 16; wk of March 23; wk of March 30; we did not close

Supplementary Table II. Continued

<i>Questions</i>	<i>Responses</i>
Who in your program saw emergency patients during the beginning of the shutdown for COVID-19?	Full-time faculty; residents; both
What strategies have you used to communicate with your patients during the COVID-19 pandemic? (select all that apply)	Teleorthodontics through virtual platforms; phone calls to patients; e-mails to patients; texts to patients
For which group of patient types are you using tele-orthodontics in your practice? (select all that apply)	Patients new to the practice; Patients in active fixed treatment; patients in active clear aligner treatment; patients with emergencies; patients being monitored for future treatment; patients in retention; other (please specify)
What percentage of appointments are being done via tele-orthodontics?	0%-10%; 11%-20%, 21%-40%, 41%-60%, 61%-80%, 81%-100%
Is there a significant need for staff training to deliver teleorthodontic services?	Yes; No
What platform are you using for teleorthodontics?	Zoom; Webex; other, please specify
Do you see the dental professional as a part of the screening, prevention, diagnosis, and management of the novel coronavirus (COVID-19)?	Yes; No
Are patients being COVID-19 tested before entering the orthodontic clinic?	Yes, for all appointments; Yes, however, only for aerosol-generating procedures; No
Are orthodontic residents being tested for COVID-19?	Yes; No
Are orthodontic residents being repeatedly tested for COVID-19?	Yes; No
How frequently are orthodontic residents being tested for COVID-19?	Daily; weekly; biweekly; monthly; unsure
Are orthodontic faculty and staff members being tested for COVID-19?	Yes; No
Are orthodontic faculty members being repeatedly tested for COVID-19?	Yes; No
How frequently are orthodontic faculty members being tested for COVID-19?	Daily; weekly; biweekly; monthly; unsure
What is the standard for personal protective equipment (PPE) in the orthodontic clinic at your institution? (select all that apply)	N95 respirator (or respirator with similar characteristics); surgical mask; disposable clinic gown; face shield; gloves
Is your institution placing patients undergoing aerosol-producing procedures in separately confined operatories (ie negative pressure room)?	Yes; No
Is your institution purifying the air using special medical-grade air purifiers (ie, HEPA air purifiers)?	Yes; No
Does your institution have a mouth rinse protocol before dental procedures (ie, hydrogen peroxide rinse)?	Yes; No
When using an N95 respirator (or respirator with similar characteristics), how often are you disposing of your respirator?	After each patient; After 1 donnings; After 2 donnings; After 3 donnings; After 4 donnings; After 5 donnings; After 6 donnings; After ≥ 7 donnings; not using an N95 respirator (or respirator with similar characteristics)
Does the orthodontic clinic at your institution experience a fear of decreased personal protective equipment (PPE) supply levels?	Yes; No
Do you find that it is difficult to acquire personal protective equipment (PPE) during the COVID-19 pandemic?	Yes; No
Has there been an increased cost of care in your orthodontic practice because of the financial implications of COVID-19?	Yes; No
How was your program affected by COVID-19 and the closure?	Neither you nor your school will be identified in the comment
Do you consider the allotted curriculum time and clinical experience given the impact COVID-19 has had, as adequate?	Neither you nor your school will be identified in the comment
Do you have any comments or suggestions about how to improve the graduate orthodontic curriculum during this COVID-19 time?	Neither you nor your school will be identified in the comment

Supplementary Table III. Craniofacial fellowship orthodontic survey

Questions	Responses
Geographically where is your orthodontic program located?	West Coast; East Coast; Midwest; South; Puerto Rico, Canada
What is the average cohort size of your craniofacial fellowship program at your institution?	1-3 1 fellow, 2 fellows, ≥ 3 fellows
How many full-time orthodontic teaching positions does your craniofacial fellowship program currently have?	0; 1-2; 3-4; 5-6; ≥ 7
How many part-time orthodontic teaching positions does your craniofacial fellowship program currently have?	0; 1-2; 3-4; 5-6; ≥ 7
With the financial implications of COVID-19, were there any layoffs in the orthodontic craniofacial fellowship program?	Yes; No
Which team members were let go because of COVID-19 financial implications?	Orthodontic assistants and staff; Part-time faculty; Full-time faculty
Because of the limitations of COVID-19, is your graduate orthodontic craniofacial fellowship program cohort size staying the same for 2020-2021?	Yes; No
By what percent is your cohort size decreasing?	Approximately 25% reduction; Approximately 50% reduction; Approximately 75% reduction; $\geq 75\%$ reduction
Are all didactic courses in your craniofacial fellowship program taught via distance learning?	Yes; No; Not sure
Do you believe that online platforms for teaching (such as Zoom) are conducive and can replace in-person learning?	Yes; No; Not sure
On average, how many patients did a craniofacial fellow typically see pre-COVID-19 in a week?	10-20 patients, 21-30 patients, ≥ 30 patients
On average, how many patients does a resident typically see now during the COVID-19 pandemic in a week?	4-6 patients; 7-10 patients; 11-15 patients; ≥ 15 patients
On average, how many patients does a craniofacial fellow typically see now during the COVID-19 pandemic in a week?	1-2 h reduction a wk; 3-5 h reduction a wk; 6-8 h reduction a wk; 9-11 h reduction a wk; ≥ 12 h reduction a wk
When did your practice make the transition to partially open/closed?	Wk of March 9; wk of March 16; wk of March 23; wk of March 30; we did not close
Who in your program saw emergency patients during the beginning of the shutdown for COVID-19?	Full-time faculty; residents; both
What strategies have you used to communicate with your patients during the COVID-19 pandemic? (select all that apply)	Teleorthodontics through virtual platforms; phone calls to patients; e-mails to patients; texts to patients
For which group of patient types are you using teleorthodontics in your practice? (select all that apply)	Patients new to the practice; patients in active fixed treatment; patients in active clear aligner treatment; patients with emergencies; patients being monitored for future treatment; Patients in retention; other (please specify)
What percentage of appointments are being done via tele-orthodontics?	0%-10%; 11%-20%, 21%-40%, 41%-60%, 61%-80%, 81%-100%
Is there a significant need for staff training to deliver teleorthodontic services?	Yes; No
What platform are you using for tele-orthodontics?	Zoom; Webex; Other, please specify
Do you see the dental professional as a part of the screening, prevention, diagnosis, and management of the novel coronavirus (COVID-19)?	Yes; No
Are patients being COVID-19 tested before entering the orthodontic clinic?	Yes, for all appointments; Yes, however, only for aerosol-generating procedures; No
Are craniofacial fellows being tested for COVID-19?	Yes; No
Are craniofacial fellows being repeatedly tested for COVID-19?	Yes; No
How frequently are craniofacial fellows being tested for COVID-19?	Daily; weekly; biweekly; monthly; unsure
Are orthodontic faculty and staff members being tested for COVID-19?	Yes; No
Are orthodontic faculty members being repeatedly tested for COVID-19?	Yes; No
How frequently are orthodontic faculty members being tested for COVID-19?	Daily; weekly; biweekly; monthly; unsure
What is the standard for personal protective equipment (PPE) in the orthodontic clinic at your institution? (select all that apply)	N95 respirator (or respirator with similar characteristics); surgical mask; disposable clinic gown; face shield; gloves

Supplementary Table III. Continued

<i>Questions</i>	<i>Responses</i>
Is your institution placing patients undergoing aerosol-producing procedures in separately confined operatories (ie negative pressure room)?	Yes; No
Is your institution purifying the air using special medical-grade air purifiers (ie, HEPA air purifiers)?	Yes; No
Does your institution have a mouth rinse protocol before dental procedures (ie, hydrogen peroxide rinse)?	Yes; No
When using an N95 respirator (or respirator with similar characteristics), how often are you disposing of your respirator?	After each patient; after 1 donning; after 2 donnings; after 3 donnings; after 4 donnings; after 5 donnings; after 6 donnings; after ≥ 7 donnings; not using an N95 respirator (or respirator with similar characteristics)
Does the orthodontic clinic at your institution experience a fear of decreased personal protective equipment (PPE) supply levels?	Yes; No
Do you find that it is difficult to acquire personal protective equipment (PPE) during the COVID-19 pandemic?	Yes; No
Has there been an increased cost of care in your orthodontic practice because of the financial implications of COVID-19?	Yes; No
How was your program affected by COVID-19 and the closure?	Neither you nor your school will be identified in the comment
Do you consider the allotted curriculum time and clinical experience given the impact COVID-19 has had, as adequate?	Neither you nor your school will be identified in the comment
Do you have any comments or suggestions about how to improve the graduate orthodontic curriculum during this COVID-19 time?	Neither you nor your school will be identified in the comment