

ADVANCED EDUCATION ORTHODONTICS PROGRAM

CURRICULA PRE- AND POST-COVID-19

A THESIS IN
Oral and Craniofacial Sciences

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Of Missouri-Kansas City in partial fulfillment of
the requirements for the degree

MASTER OF SCIENCE

by
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University of Missouri-Kansas City, 2021

ABSTRACT

A survey was conducted to investigate faculty numbers across advanced education orthodontic programs and its association with curriculum, didactic learning, utilization of distance education, and impact of the COVID-19 interruption. An 18-item survey, approved by the UMKC IRB, was developed and sent to 65 program directors of United States advanced education orthodontic programs. The survey was divided into the following four domains: program description, curriculum organization, faculty numbers, and distance education. No significant relationships were found regarding faculty numbers and curriculum structure. No significant relationships were found concerning distance education or the COVID-19 interruption. Interesting findings included structured didactic teaching levels being higher than that proposed by the World Federation of Orthodontists. A trend seen in this research consistent with previous literature was a decrease in curriculum time allocated to research, while a deviation from the trend was an increase in full/half-time faculty members. In summary, with the recent adoption of accreditation changes by the Commission on Dental Accreditation regarding increasing faculty number requirements, another study

could assess this impact and continue to discover the role the current faculty play in how curriculums are evolving.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Dentistry have examined a thesis titled “Advanced Education Orthodontics Program Curricula Pre- and Post-COVID-19,” presented by Patrick Grady, candidate for the Master of Science degree in Oral and Craniofacial Sciences, and hereby certify that in their opinion it is worthy of acceptance.

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CHAPTER 1

INTRODUCTION

History of Orthodontics and Dentofacial Orthopedics as a Discipline

Orthodontics as a specialty can be defined as one which includes “the diagnosis, prevention, interception, and correction of malocclusion, as well as neuromuscular and skeletal abnormalities of the developing or mature orofacial structures” (CODA 2017). Although the subject of orthodontics as an academic field has existed since the 1700s, it was not broadly recognized as a fundamental subdivision of dentistry until the time of Edward Angle in the late 1800s. Initially, Angle was unsuccessful at convincing dental schools across the United States to form orthodontic departments. He then decided to found his own school in 1900, the Angle School of Orthodontia, which operated until 1911 (Will 2015). His curriculum provided a diverse background of subjects ranging from biomedical sciences to arts. Following his lead, several other proprietary schools began emerging, purporting to be teaching orthodontics; however, many believed they lacked the proper background knowledge and training required, and solely focused on the mechanical exercises. The question of what should be taught, where it should occur, what duration was necessary, and other parameters overseeing this process would become topics of much debate raging throughout most of the 20th century.

History of Advanced Education Programs/Residencies

Following Angle’s School of Orthodontia, the country was in much disagreement on what should comprise an orthodontic education. Although orthodontics had already crept its way into the predoctoral dentistry curriculum, many academics thought that the orthodontic

curriculum was still insufficient. In 1924, Martin Dewey, an attendee of the Angle School of Orthodontia and later a public speaker and pioneer of the orthodontic curriculum at the Kansas City Dental School, suggested a one-year internship following dental school for new graduates. Regarding experienced general dentists interested in treating orthodontic cases, he proposed an intensified course of eight to ten weeks (Spencer 1957). There was soon a large driving force to restructure the predoctoral orthodontic curriculum. Other specialties such as oral surgery and prosthodontics were at the time already recognized and given substantial allocation of classroom time and training. Many orthodontists felt that orthodontics should be similarly allocated in the dental school curriculum. It became increasingly clear that a structured, standardized training system for orthodontics would be necessary. The first degree-granting orthodontic program came onto the scene in 1923 at the University of Michigan, with several other schools following suit shortly after. Even during this time, however, it was recognized that dental schools were not adequately equipped for advanced orthodontic programs due to financial pressures of recruiting excellent faculty (Pollock 1946). This fact would continue to remain an issue.

Recommendations on Advanced Orthodontics Curriculum Structure and Faculty

The Commission on Dental Accreditation (CODA), the body overseeing accreditation and governance over advanced education specialty orthodontic programs in the United States, has yet to mandate orthodontic program specifics in many areas. Currently, CODA requires a minimum of total hours (3700) and time duration (minimum of two years) in an orthodontic residency program; however, there is no subdivision of how these hours must be spent. When discussed in the literature, papers break down an orthodontic resident's time

into clinical patient management, research, structured didactic learning, and teaching. In a 2006 meeting by the World Federation of Orthodontists, a task force composed of orthodontic academics across the world, set out to establish several guidelines relating to advanced education training in orthodontics. Regarding faculty numbers, they recommended a clinical staff-resident ratio to be 1:4-6 during supervision of patient treatment. In regard to weekly time allocations, they recommended 24 hours weekly of patient management, eight hours of taught courses, 10-12 hours of research and administration (defined as treatment planning, preparation of tutorials, assignments, and case presentations), two hours of case presentations, and one hour for current literature review; a total of 45-47 hours a week (Athanasίου 2009).

Another study sent out a survey to United States chair/program directors of orthodontic residencies asking factors that encompass an “excellent” orthodontic residency program. They found the mean of the reported ideal number of full-time faculty to be four with a range from one to six. The mean total full-time equivalent, or total hours worked by all faculty at a program annually divided by 2080, was six. The mean number of annual hours spent by residents was: 220 lecture hours, 1300 clinical hours, and 220 treatment planning seminar hours (Allareddy et al. 2019). Once again, these education hours and faculty numbers are all ideal amounts recommended by program directors, not actual data on existing programs. Because faculty numbers affect several factors relating to the resident’s educational experience, there have been multiple studies evaluating potential faculty shortage issues and the problems this creates.

Potential Faculty Shortage Issues

Issues relating to faculty shortage in advanced orthodontic programs has been a historical issue. In a survey sent out in 2003, 35% of programs reported having at least one unfilled faculty position. This study also looked at factors driving orthodontists to choose private practice instead of academic career paths. Major factors cited were income disparities from academics to private practice of \$136,000 yearly compared to \$285,000; additional work time difference of 50 hours weekly compared to 44, and an ever-increasing debt of recent graduates (Lindauer et al. 2003).

During the years of 1984, 1989, 1995, and 1999, surveys were sent out to many advanced orthodontic programs to create fluid tracking of several different factors including: program organization, graduate students, faculty, staff, facilities, infection control, clinical details, treatment techniques, research, and curriculum. Significant findings over the span of the 15 years were a decrease in full-time / half-time faculty numbers, decrease in faculty academic experience, and a decrease in orthodontic resident publications (Keim and Sinclair 2002). This study aimed to determine an association between diminishing faculty number to both a decrease in resident research as well as an increase in clinic time; both associations were found. However, since this set of surveys, there has been a paucity of research regarding more current faculty trends and how this is affecting the overall curriculum of the orthodontic resident.

Curriculum Overview from Residents' Perspective

Most publications regarding advanced orthodontic programs have focused on faculty and program director/chair perspectives. However, there have been surveys sent to residents to gather information regarding demographics, criteria for program selection, and overall

satisfaction with their chosen program. Interestingly, in a survey in 2005 of 329 residents, 98.4% responded being either very satisfied or satisfied with their orthodontic educational experience (Bruner et al. 2005). Data was not gathered as to their satisfaction with the clinical versus the didactic curriculum and other specifics with no questions regarding perceived program shortcomings. A survey of Canadian orthodontic residents in 2009 found similar overall program satisfaction levels, but this study elaborated on certain findings. They found all respondents reporting sufficient clinical time; however, they did find that 32% of residents reported a lack of time for formal educational activities. The author attributed the inadequate formal education activities as possibly being related to an increased reliance on part-time instructors and a decreased number of full-time instructors (Noble et al. 2009a).

CODA Hearing to Change Accreditation Standards

Recently, it appears that the orthodontic community has become more interested in current accreditation standards for orthodontic programs. At the CODA Advanced Education Programs' Winter 2019 meeting, the commission proposed multiple changes to the Advanced Orthodontics accreditation standards. One of the changes reads "The program must ensure a minimum of one (1) full-time equivalent (FTE) faculty to four (4) students/residents for the entire program, including clinical, didactic, administration, and research components." Another change clarifies that sufficient coverage of clinic mandates at least one faculty to eight residents (CODA 2019). On February 12, 2021, the Commission adopted the Accreditation Standards for Advanced Dental Education Programs in Orthodontics and Dentofacial Orthopedics, with implementation July 1, 2022. This makes a current review of faculty numbers even more pertinent.

Distance Education in General

With the advent of technological advances, several opportunities have developed for challenging the status quo of the classical educational experience. Rather than requiring a face-to-face interaction between instructor and pupil, technology has allowed for distance learning opportunities. Distance learning has been defined as “structured learning in which the student and instructor are separated by place, and sometimes by time” (Gunawardena 2004). Distance learning has come to be combined with on-site learning to form what many refer to as blended learning. Distance learning shows the promises of convenient, effective, and collaborative learning while having reported disadvantages such as higher multimedia costs, need for continuous technological support, and user feelings of isolation. Several studies have been conducted to evaluate the effectiveness of blended learning. One meta-analysis of 56 articles looking at its usage in health professions education found that blended learning was as or more effective than a traditional curriculum for knowledge gain (Liu et al. 2016). These findings have been corroborated by other meta-analyses (Cook et al. 2008).

By 2002, 56 out of the 255 American dental hygiene programs were already implementing distance education in their curriculums. Of these programs, 81% reported either being satisfied or very satisfied with their utilization of this learning method (Grimes 2002). When looking at medical student education, one meta-analysis showed that out of 16 articles when evaluating post-test scores, pre- and post-test score gains, and retention test scores, 7 showed no significant difference between traditional learning and distance education, while the other 9 showed a significant improvement in these categories for the distance education group (Pei and Wu 2019). When utilizing distance education with family medicine residents, one study showed that not only was there a significantly higher

knowledge gain when compared to the control group over the span of their integrative medicine curriculum, but the educational methods were viewed very favorably (Lebensohn et al. 2017). Overall, as distance education is gaining wide distribution across various health professions, it has consistently been assessed as either comparable, or superior to traditional learning methods.

Orthodontics Distance Education

The ability to teach remotely has been explored both broadly in education as well as in the orthodontic realm. Robert Scholz, a long-time clinician, faculty, and member of the AAO Council on Orthodontic education, was one of the first people to challenge the norm of orthodontic educational techniques when he wrote an editorial in 2002. In order to address faculty shortages, he proposed interactive seminars over the internet to include more residents and to share niche knowledge from an expert in one department across multiple programs. He wisely stated: “Why should orthodontics’ greatest expert in a particular area share his or her knowledge with just the 8 members of the third-year class when the same seminar can be simultaneously delivered to many more?” (Scholz 2002). This idea was taken and tested as a feasibility study by the University of North Carolina Department of Orthodontics in combination with Ohio State Division of Orthodontics. They recorded and posted 24 lectures that were made available to all United States advanced education orthodontic programs. Over half of the programs, 33, fully participated. Residents in participating programs were given the opportunity to read articles in advance of the seminar pertaining to the lecture topics, listen and or watch the lecture, and then participate in a post-seminar discussion. The study found that in the categories: effectiveness, enjoyability, ability

to learn, and future use, that all categories averaged a mean of 4.0 or higher with some considerably more positive (on a scale of one to seven with seven being agree and one being disagree). This study showed that for residents who reported thoroughly reading the assigned articles prior to watching, they demonstrated significantly higher ratings in all four of these categories (Klein et al. 2012b).

One other feasibility study working with three separate orthodontic programs compared live learning, recorded lectures, and live web seminars to evaluate differences in test scores and student approval based on the instrument of delivery. Both interactive learning techniques showed similar knowledge improvement to live teaching; however, the live webinar was much preferred to the recorded lectures (Bednar et al. 2007).

A separate study focused on advantages and disadvantages of distance education. Common responses for advantages of distance education were learning from prominent leaders in a specific field, varying points of view, enjoyability, and residents reporting being more engaged. Disadvantages were reported as technological difficulties, inability to ask questions during lecture, and feeling impersonal (Miller et al. 2007). Even with all these promising results on blended education, no follow up was ever undertaken to see if these techniques are being implemented in programs or to track their success.

Problem-Based Learning

Another model of education is problem-based learning. This can be defined as “active learning stimulated by, and focused round a clinical, community or scientific problem” (Jones 2006). Problem-based learning begins by focusing on a problem rather than first understanding foundational principles and subsequently moving toward the question. This learning method is currently being implemented across the United States in advanced

education orthodontic programs with cases presented by students and faculty, problem lists created, objectives stated, and treatment plans created. Then, basic tenets and foundational knowledge are discussed as residents learn information they can hopefully apply in future situations. It has been suggested that due to a lack of full-time faculty members, structured didactic teaching has decreased (Noble et al. 2009b). No studies have evaluated if the faculty shortage has also caused a shift towards problem-based learning methods. However, this would be a valuable metric to assess among programs and to evaluate its effects on resident education.

Effects of COVID-19 on Orthodontic Advanced Education

The world entered unprecedented times as the COVID-19 pandemic spread across the globe. As conditions worsened, the American Dental Association, American Association of Orthodontists, and state and local legislatures all came out with guidelines on how to address both education and patient care. Advanced education orthodontic programs eliminated face-to-face interactions across the country outside of very limited emergency care situations. This quickly generated questions as to how to continue educating residents during this time. Many programs switched to almost exclusively teaching and communicating via online methods. Currently there is no published data as to how programs have responded; however, this research hopes to evaluate perspective and programmatic changes regarding curriculum, distance education, and utilization of resources pre/post COVID-19.

Problem Statement

Due to the lack of information regarding advanced education orthodontic program curricula, a project addressing these questions should be conducted. This evaluation is even more pertinent now because of the proposed and accepted changes to accreditation standards

for advanced orthodontic programs set forth by the Commission on Dental Accreditation. Some of these standards address the issue of faculty shortage. Developing a better understanding of current curriculum specifics across programs and how this correlates to the faculty support required to sustain these, could aid in both understanding the effects of an understaffed program as well as in creating required minimum faculty levels by the commission. Additionally, with advancements in technology, it seems that a viable solution would be to incorporate distance education into the curriculum. To date, no studies have evaluated the current usage of distance education and the effect on the curriculum structure. Additionally, no studies have evaluated the impact of COVID-19 on advanced education curriculums.

Hypotheses

1. Structured didactic teaching will be lower than the proposed optimal amount of 220 hours per academic year.
2. As full-time faculty equivalents increase, programs will have less percentage of time allocated for case-based/problem-based learning and more percentage time allocated for didactic teaching.
3. As the percentage of available structured didactic teaching time in a residency lowers, there may be greater usage of distance education.
4. Perceived or actual barriers to distance education may be associated with low implementation of distance education.
5. After COVID-19, there will be greater interest in accessing a curated repository of online lectures than before COVID-19.

CHAPTER 2

METHODS

Survey Development and Description

In order to investigate faculty numbers across advanced education orthodontic programs and its association with curriculum, didactic learning, utilization of distance education, and impact of the COVID-19 interruption, a cross-sectional survey was administered to United States accredited advanced education orthodontic programs.

The 18-question electronic survey focused on four domains: (1) program description, and (2) curriculum organization, and (3) faculty numbers, and (4) distance education. The first domain solicited information regarding the program length and number of residents that comprise each class. These numbers allowed for faculty-to-resident ratio comparisons.

The second domain inquired about orthodontic program curriculums. The survey questions specifically targeted resident time allocated to the five following areas: clinical patient management, didactic learning, problem-based learning, research, and resident teaching. These five categories have been defined previously in literature (Athanasίου 2009) and are similar to CODA accreditation categorical groupings.

The third domain solicited information on faculty numbers within the orthodontic program department, as well as non-departmental contributors. These numbers were broken down into the days per week contribution of each member. These questions sought to understand how a program's number of faculty members affect both curriculum and distance education usage and interest.

The fourth domain contained questions about the program's usage of distance education regarding its ability to aid in faculty shortage, current levels of integration,

modalities employed, and perceived advantages/disadvantages of its usage. This section also investigated how interest in a shared lecture repository may have changed after the COVID-19 interruption as well as how programs have adapted during and after the interruption.

Before the survey questions were developed, similar studies were evaluated and certain questions were incorporated to enable comparisons with the previous studies, as well as to gather novel information. Before sending the survey, a focus group was assembled to evaluate the survey for both clarity and content. This group consisted of two UMKC orthodontic residents, the UMKC orthodontic clinic director, and a program director of an advanced education orthodontic program. This group was sent a copy of the survey with a feedback form to complete (Appendix 1). Pertinent changes were made based on their remarks, as well as those from the Oral and Craniofacial Sciences thesis committee.

After survey finalization, the survey was created within REDCap for administration and distribution (Harris et al. 2009). This REDCap survey was hosted at the Center for Health Insights of the University of Missouri-Kansas City. REDCap allows for data collection and secure information storage. A copy of the survey as designed on REDCap, can be found in Appendix 2.

Distribution of Surveys and Data Collection

Sixty-five United States accredited orthodontic advanced education programs were identified by the American Association of Orthodontists (AAO). Orthodontic programs located in Canada and Puerto Rico were excluded. Advanced Orthodontic program director email addresses were found on the AAO orthodontic program list website and were corroborated by the individual program website and the institutional faculty directory list

(AAO 2020). Programs were contacted when emails were omitted, or discrepancies were present. The goal was to invite all U.S accredited orthodontic residency programs.

The following methods were used to maximize responses from advanced orthodontic program directors:

1. A formal email (Appendix 3) from the student investigator was sent to the designated United States advanced orthodontic program directors. This email contained an invitation to the REDCap survey. Completion of the survey indicated informed consent. No compensation was given to participants. Program directors were asked to complete the survey or forward the survey to the faculty or staff member within the program most qualified to complete the survey, within 14 days from receiving it.
2. Follow-up contact was made to encourage survey completion. Follow-up emails were sent 7 and 14 days after the formal email containing the survey invitation to remind directors to complete the survey (Appendix 4).

The Institutional Review Board (IRB) at UMKC reviewed and approved the protocol and associated documents as exempt (IRB #2025236 KC). The IRB approval form is included in Appendix 5.

Study Design and Sample Size

The sample size was the number of United States accredited orthodontic residency programs that responded to the survey. The independent variables assessed in the survey were the percent of structured didactic learning, number of full-time equivalent faculty, perceived/actual barriers to distance education, and the COVID-19 interruption. The dependent variables analyzed are percent of problem-based learning, percent of structured

didactic learning, implementation of distance education, and interest to participate in a curated lecture repository as seen in table 1.

TABLE 1
EXPERIMENTAL DESIGN

Independent Variables	Dependent Variables
Percent of structured didactic learning time (Q3B)	Ideal of 220 hours (Athanasidou et al. 2009)
Number of full-time equivalent faculty (Q4-6)	a. Percent time allocated to problem-based learning (Q3C) b. Percent time allocated to structured didactic learning (Q3B)
Percent of structured didactic learning time (Q3B)	Implementation of distance education (Q10)
Perceived/actual barriers to distance education (Q12)	Implementation of distance education (Q10)
COVID-19	Interest to participate in curated online lecture repository (Q14-15)

Sample size (n) = Replies out of 65 programs

() Parentheses indicate which survey question addresses variable

Data Analysis

Statistical analyses were performed with a statistical data analysis program¹.

Descriptive statistics (means, standard deviations, counts, and percentages) were calculated for all variables from the survey data.

¹ IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp. Armonk, NY, 10504)

CHAPTER 3

RESULTS

The survey was distributed to 65 program directors of advanced education orthodontic programs, of which 14 directors initiated the survey, and 9 completed the survey. The number of directors who completed the survey was 14% of the total targeted sample.

Program Characteristics

The average resident class size of the responding programs was 6 with the range being 1-18 and 86% of programs having 3-8 residents per class. The average program time length was 32 months with the range being 24-36 months and 79% of programs being 30 months or more.

Curriculum

The percentage of time spent in each of the five areas of teaching and training categories in an advanced education orthodontic curriculum can be seen in table 2. The percentage of weekly curriculum time spent was the highest for clinical patient management and treatment planning (58%) and the lowest for resident teaching (4%). Clinical patient management and research also had the widest range across programs.

TABLE 2
 ADVANCED EDUCATION ORTHODONTIC PROGRAM
 CURRICULUM SUMMARIES (N=11)

	Mean (Std. Deviation)	Minimum, Maximum
Percentage of weekly time spent in:		
Clinical patient management and treatment planning	58 (10)	45, 73
Structured didactic learning	17 (6)	10, 30
Research	12 (8)	3, 30
Problem based learning/ case presentations	10 (5)	3, 16
Resident Teaching	4 (2)	1, 5

Faculty Numbers

The number of faculty members at the programs surveyed can be seen in table 3. On average, the number of full-time faculty was 5 with all programs having between 2-6 and one program having 10. On average the number of part-time faculty was 9. There was a wide range in this category with two of the programs having 0 and the largest having 25. On average the minimum resident to faculty ratio in clinic was 5 while the range was 2-9. When asked their opinion on the lowest acceptable overall resident to faculty ratio they reported on average 7, with a range of 3-12.

TABLE 3

ADVANCED EDUCATION ORTHODONTIC PROGRAM
FACULTY NUMBERS (N=9)

	Mean (Std. Deviation)	Minimum, Maximum
Total full-time faculty (4-5 days per week)	5 (2)	2, 10
Total half-time time faculty (2-3 days per week)	3 (4)	0, 12
Total part –time /volunteer faculty (1 day per week)	9 (8)	0, 25
Minimum resident to faculty ratio in clinic	5 (2)	2, 9

Distance Education

Pre-COVID-19 Interruption

Before the COVID-19 interruption, only three of the nine advanced education orthodontic programs responding utilized distance education. Of these three programs, there was a wide disparity in the number of hours annually distance education was implemented. The responses were 10, 96, and 450 hours. Types of modalities used were video lectures, webinars, and online tutorials. None of the schools reported being able to interact with the speaker during the lecture.

All respondents reported on advantages and disadvantages related to using distance education which can be seen in table 4 below.

TABLE 4

ADVANTAGES AND DISADVANTAGES OF DISTANCE EDUCATION REPORTED
BY ADVANCED EDUCATION ORTHODONTIC PROGRAM DIRECTORS (N=9)

	Number of program directors	Percentage of Respondents (%)
Advantages		
Efficiency	7	78
Flexible viewing times	6	67
Interaction with experts in field	5	56
Cost	5	56
Different points of view	3	33
None	0	0
Disadvantages		
Not personal enough/enough interaction	7	78
Technology issues	5	56
Difficulty clarifying/asking questions	5	56
Different points of view	1	11
Costs	1	11
None	0	0

Efficiency was the most frequently reported advantage of distance education, followed by flexible viewing times. The most common disadvantage reported was that distance education did not provide enough interaction/not personal. Cost was more commonly reported as an advantage of distance education than a disadvantage. No one selected the option “none” for either disadvantages or disadvantages, and every respondent reported at least one advantage or disadvantage.

Program directors were also asked questions regarding the role distance education plays in orthodontic education. The results of these questions can be seen in table 5. When

asked prior to the COVID-19 interruption to what extent distance education could help solve faculty shortage issues, the majority selected neither agree nor disagree, and more agreed than disagreed. Regarding consideration in participating in a curated online repository, before the COVID-19 interruption, 4 directors responded yes, 3 no, and 2 “I don’t know.”

TABLE 5

OPINIONS OF PROGRAM DIRECTORS REGARDING DISTANCE EDUCATION IN
ADVANCED EDUCATION ORTHODONTIC PROGRAMS (N=9)

	Number of program directors	Percentage of Respondents (%)
To what extent do you agree that distance education could help address faculty shortage issues?		
Strongly agree	1	11
Agree	2	22
Neither agree nor disagree	5	56
Disagree	1	11
Strongly disagree	0	0
PRIOR to the COVID-19 interruption, would you have considered participating in a curated online lecture repository shared with different orthodontic residency programs?		
Yes	4	44
No	3	33
I don’t know	2	22
After the COVID-19 interruption, would you now consider participating in a curated online lecture repository shared with different orthodontic residency programs?		
Yes	5	56
No	0	0
I don’t know	4	44

Post-COVID-19 Interruption

Participants were asked to comment on various questions regarding the COVID-19 interruption. Table 4 above shows that after the interruption, there was more of a positive response with participating in a shared online lecture repository.

When asked a series of open-ended response questions, eight of the nine respondents reported beneficial improvements during this time such as increased use of teledentistry, more team cooperation within department, extra time for resident research, and expanded didactic curriculum with more guest speakers. When asked how professional organizations could have helped programs, participants responded that they were satisfied with the increased online lecture availability by the AAO and COVID-19 infection control policies offered by the AAO. In regard to how programs will look different long term due to the COVID-19 interruption, participants responded that they expect more telemedicine/virtual appointments/remote monitoring, increased use of distance learning, possible loss of faculty, switch to entirely online courses, and sharing of online content with others.

CHAPTER 4

DISCUSSION

This study evaluated advanced orthodontic program curricula pre/post COVID-19 and measured both program faculty numbers and usage of distance education. Prior to this study, many curriculum specifics such as resident time allocation had never been assessed. Faculty numbers had not been evaluated in 20 years (Keim and Sinclair 2002) . After two pilot studies in the early 2000s, distance education appeared to be a promising new learning alternative within orthodontic programs; however, no follow-up studies have evaluated its usage or acceptability (Bednar et al. 2007) (Klein et al. 2012a) . Additionally, no studies were found regarding the effects of COVID-19 on advanced education orthodontic programs.

This study hypothesized that structured didactic teaching would be lower than the proposed ideal annual amount of 220 hours put forth by the World Federation of Orthodontists in 2006 (Athanasίου et al. 2009). However, the mean percentage across programs surveyed was 17% which translates to 309 annual hours. While the average time allocated to structured didactic teaching was higher than hypothesized, three programs reported only 10% of time allocated toward structured didactic teaching (184 annual hours), falling below the ideal threshold.

Additional hypotheses that this study attempted to determine dealt with associations between curriculum, faculty numbers, and distance education. Due to the small number of responding program directors (N=9/65, 14%), these associations could not be evaluated. Potential explanations for the small sample size might include timing of the survey, the COVID-19 interruption, and privacy concerns. Regarding timing and COVID-19 interruption, the survey was sent two months after programs started in the fall in hopes that

respondents would be available to complete a short survey; however, the COVID-19 interruption may have contributed to the difficulty in receiving responses. The interruption brought about several changes that programs were forced to make, and this turmoil may have led to non-response. Two follow-up reminder emails were sent to try and bolster responses; however, this did little to increase responses, which may be related to overall survey fatigue. With respect to privacy concerns, many programs may not have felt comfortable in sharing curriculum and faculty information due to concerns related to CODA requirements. CODA has recently proposed raising faculty level requirements, and this may have made programs wary to respond.

Regarding program characteristics, the findings of this study fall in line with previous projections. Previous literature had reported average class size of 5 and average program length increasing over the years with the average in 1994 being 29 months (Rudolph and Sinclair 1997). This study stayed consistent with a mean class size of 6 and mean length of 32 months.

When comparing the survey results of this study with the recommendations of the World Federation of Orthodontists meeting in 2006, several similarities exist (Athanasίου 2009). Clinic time was recommended to be 52% of the curriculum and this study found the average curriculum time for clinic was 58%. Pre-doctoral dental school education generally seems to be lacking clinical orthodontic exposure, so it seems consistent that this would be by far the largest category. In a survey of dental student seniors conducted in 2015 by the American Dental Education Association, 93% stated that their clinical exposure to restoration of single/multiple teeth was sufficient, but only 68% felt that their orthodontics courses were appropriate (Licari and Evans 2017) Structured didactic learning was found to be 17%, which

is the same as recommended. Research time, however, was recommended to be 24% by the federation, while this study found an average of 12%. This is consistent with a previous study which linked a trend in reduced research time and increase in clinic time (Burk and Orellana 2013). This has been attributed to largely three factors in the literature: high level of resident interest and importance placed on their clinical education, reduced full-time faculty levels, and the department's need to generate revenue (Keim and Sinclair 2002; Burk and Orellana 2013). This study did not find a link between faculty levels and amount of time devoted to research; however, the other two suggestions are possible explanations. Problem based learning was also much higher from the survey results (10%) as opposed to the 4% recommended. Overall, values fell well within the recommended limits.

Advanced education orthodontic faculty numbers had been thoroughly tracked from 1983-1999. Over this period, full-time and half-time faculty levels were decreasing while part-time instructors had been on the rise. This study demonstrated a deviation from these trends with a greatly increased full and half-time faculty levels as compared to the last recording in 1999, up from 3 to 5 and from 1 to 3 respectively. Part-timers on the other hand decreased from 12 in 1999 to 9 in this study (Keim and Sinclair 2002) . This may be one of the reasons why structured didactic levels stayed high.

Distance education had previously been suggested as a method to addressing decreasing faculty numbers in orthodontic programs. However, with the COVID-19 interruption, many programs who had previously never used distance education were forced to utilize it. There were several positive responses while using distance education. Many programs also reported that they will likely shift long term to including more virtual appointments as well as switching educational content delivery away from traditional face-

to-face learning and incorporate more distance education. Although there was not much support for the idea from responders that distance education could help solve faculty shortage issues, there was increased desire to participate in a shared curated lecture repository. This is something likely worth pursuing because it has the potential to greatly benefit both the orthodontic community as a whole and future educational efforts.

Implications

This study indicates that advanced education orthodontic program curricula may be structured similarly to that previously proposed as ideal. CODA recently proposed and adopted the new accreditation standard mandating one (1) full-time equivalent (FTE) faculty to four (4) students/residents for the entire program, and at least one faculty to eight residents for clinical coverage; both of which, appear to be met by the sample surveyed (CODA 2017). Programs both responded favorably to using distance education as well as indicated that they are utilizing it more frequently. This could likely encourage professional orthodontic organizations to focus more time and effort into improving its use and distribution of information through this medium. By increasing the use of distance education, this could also increase inter-program collaboration and networking.

Study Limitations

This study had a small sample size which led to difficulties in running comparative analyses. The results are limited by the low response rate of program directors. This study also may have had a respondent/non-respondent bias. Programs that viewed themselves as underperforming may not have completed the survey due to privacy concerns. Survey fatigue, especially with a COVID-related topic during the time of the interruption, likely played a large

role in low response. Overall, the results this study found may not be generalizable or representative of all advanced education orthodontic programs.

Future Investigations

Replicating this study with a larger sample size would be useful. Future studies could conduct this survey at an AAO meeting with easier access to program directors. Additionally, follow up studies could be performed on how programs have evolved post COVID-19.

Distance education is likely to have a greater role as time passes, and a study determining the most efficient, cost effective methods could prove to be extremely beneficial for orthodontic education. Since CODA recently decided to adopt accreditation changes regarding increasing faculty number requirements, another study could assess this impact and continue to discover the role the current faculty play in how curriculums are evolving.

CHAPTER 5

CONCLUSIONS

1. Structured didactic teaching was found to be higher than the proposed optimal amount of 220 hours per academic year among the sample surveyed.
2. No significant relationship was found between the number of full-time faculty equivalents and either case-based/problem-based learning or percentage of time allocated for didactic teaching.
3. No significant relationship was found between the percentage of available structured didactic teaching time and usage of distance education.
4. No significant relationship was found between perceived or actual barriers to distance education and implementation of distance education.
5. No significant relationship was found between the COVID-19 interruption and interest in accessing a curated repository of online lectures.

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APPENDIX A
Survey Feedback Form

Dr. XXX,

I would very much appreciate your effort in taking time to **evaluate the attached survey for clarity and content.**

This survey is part of the OCS thesis project I am conducting which investigates current trends for faculty, curriculum, and distance education in advanced education orthodontic programs. It is intended to be sent to all United States advanced education orthodontic programs. The final survey will be distributed electronically on REDCap.

You need not complete the survey, but instead examine each question critically, and leave comments where you feel necessary. Your comments will greatly help me to improve the survey prior to its final distribution.

Thank you for your assistance and feedback. I greatly appreciate your time and willingness to help with my project.

Respectfully,
Patrick Grady, DDS
UMKC School of Dentistry
Resident, Dept. of Orthodontics & Dentofacial Orthopedics
MS Candidate, Dept. of Oral and Craniofacial Sciences

Evaluation of Survey

1. Are there any questions within the survey that are unclear or that you feel could be worded differently? If so, please explain.
2. Are there any grammatical or formatting errors that you found within the survey? If so, please explain.
3. Are there any questions that you felt could be omitted, or any questions that you feel would be useful to add to the survey? If so, please explain.
4. Please provide any other suggestions you have to improve the survey:

APPENDIX B

Survey to Advanced Education Orthodontic Programs

Trends for Faculty, Curriculum, and Distance Education In Advanced Education Orthodontic Programs

Section 1: Program Description

1. How many incoming residents does your program accept each year?

2. What is the time length of your program (in months, as approved by CODA) from start to completion?

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Section 2: Curriculum Organization

Please answer all questions in regards to your program PRIOR to the COVID-19 interruption.

In the five items below, please give a percentage of the ACTUAL weekly time your residents spend on the following activities. This should be an average across years. Total should sum to 100%.

- 3a. Clinical patient management/treatment/treatment planning

(%)

- 3b. Structured didactic learning (organized discipline specific classes):

(%)

- 3c. Problem-based learning /case presentations

(%)

- 3d. Research

(%)

- 3e. Resident Teaching

(%)

Your percentages above adds to

(%)

Section 3: Faculty Numbers

Please answer all questions in regards to your program PRIOR to the COVID-19 interruption.

For questions 4 through 7, please give the number of departmental faculty currently in your advanced education orthodontic program:

4. Total full-time faculty (4-5 days per week):

5. Total half-time/part-time faculty (2-3 days per week):

6. Total part-time/volunteer faculty (≤ 1 day per week):

7. Average current faculty to resident ratio for clinic coverage:

8. What do you consider the lowest acceptable faculty to resident ratio for clinic coverage? (1: ??)

9. Approximately how many courses across the entire orthodontics curriculum are directed by non-departmental faculty?

Section 4: Distance Education

10. PRIOR to the COVID-19 interruption, did you incorporate distance education (e.g. video lectures, webinars, online modules, online tutorials) into your curriculum?

Yes No

- 10a. You selected "Yes" to using distance education. How many hours per academic year do you estimate that you use distance education techniques in your curriculum?

- 10b. You selected "Yes" to using distance education. What types of distance education does your program include in the curriculum? Check all that apply.

Video lectures Webinars Online modules Online tutorials Additional options not listed above

- 10c. You selected "Yes" to using video lectures, can the residents interact with the speaker/presenter in any of the lectures?

Yes No

- 10d. You selected "Additional options not listed above". Please state your method of distance education.

11. What do you consider as advantages for incorporating distance education (e.g. video lectures, webinars, online modules, online tutorials) into your curriculum? Check all that apply.

Efficiency
 Cost
 Different points of view
 Interaction with experts in the field of interest
 Flexible viewing times
 Other(s)
 None

- 11a. You selected "Other" for advantages of distance education. Please state the advantages.

12. What do consider as disadvantages for incorporating distance education into your curriculum? Check all that apply.

Technology issues
 Not personal enough/ enough interaction
 Different points of view
 Difficulty in clarification or asking questions
 Costs
 Other(s)
 None

- 12b. You selected "Other" for disadvantages to distance education. Please state the disadvantages.

13. To what extent do you agree that distance education could help address faculty shortage issues?

- Strongly agree Agree Neither agree nor disagree Disagree Strongly disagree

14. PRIOR to the COVID-19 interruption, would you have considered participating in a curated online lecture repository shared with different orthodontic residency programs?

- Yes No I don't know

Please answer the following questions in regards to your program SINCE the COVID-19 interruption.

15. DURING the COVID-19 interruption, what was the most beneficial thing that occurred in your orthodontic program curriculum?

16. DURING the COVID-19 interruption, how could professional organizations (AAO, Angle Society, regional society, etc.) have ideally helped your program curriculum?

17. AFTER the COVID-19 interruption, would you now consider participating in a curated online lecture repository shared with different orthodontic residency programs?

- Yes No I don't know

18. AFTER the COVID-19 interruption, how will your program curriculum look different LONG-TERM?

APPENDIX C

Email to Program Directors
REDCap Initial Email to Program Directors

Subject Line:

Reply by [9/28/20]. A survey regarding current trends pre/post COVID-19 for faculty, curriculum, and distance education in advanced education orthodontic programs

Dear Program Director:

Hello, my name is Patrick Grady. I am a graduate student in the MS program of Oral and Craniofacial Sciences at UMKC School of Dentistry. I am conducting a research study focusing on current trends pre/post COVID-19 for faculty, curriculum, and distance education in advanced education orthodontic programs. I would appreciate if you could complete the following brief survey. The information will be used to elicit potential associations between the variables above.

This survey will take approximately 10 to 15 minutes to complete.

Please complete this survey by 9/28/20 by clicking the link below.

[survey-link]

If you feel that another person in your program is better suited to complete this survey, please forward the survey URL below to that person.

[survey-url]

Your participation is entirely voluntary and kept confidential; you may skip any questions that you don't want to answer or choose to stop participating at any time.

Any personally identifiable information collected during the survey will be kept strictly confidential and will be stored by REDCap. You will not be identified in any reports about this research.

If you have any questions concerning the survey, you may contact me at gradyp@umkc.edu.

If you have questions or concerns about your rights as a research participant, you can call the UMKC Research Compliance at 816-235-5927.

Thank you for your assistance in my project. I truly appreciate your time and effort.

Sincerely,

Patrick Grady

APPENDIX D
Email Follow-up

Subject Line:

Reply by 9/21/20. A survey regarding current trends pre/post COVID-19 for faculty, curriculum, and distance education in advanced education orthodontic programs

Dear Program Director:

My name is Patrick Grady, a graduate student in the MS program in Oral and Craniofacial Sciences at UMKC School of Dentistry. You should have already received an email from me requesting your help with my thesis project, which is focused on current trends pre/post COVID-19 for faculty, curriculum, and distance education in advanced education orthodontic programs.

This survey will take approximately 10-15 minutes to complete.

If you have not completed the online survey, please do so by 9/21/20 [survey-link]

If you feel that another person in your program is better suited to complete this survey, please forward the survey link below to that person.
[Insert Link]

Thank you in advance for your time and assistance with my project.

Sincerely,

Patrick Grady

APPENDIX E

IRB Approval



July 02, 2020

Principal Investigator: Mary P Walker
Department: Dean, School of Dentistry

Your IRB Application to project entitled "ADVANCED EDUCATION ORTHODONTICS PROGRAM CURRICULA PRE- AND POST-COVID-19 – OCS MS Grady " was reviewed and determined to qualify for IRB exemption according to the terms and conditions described below:

IRB Project Number	2025236
IRB Review Number	267313
Initial Application Approval Date	July 02, 2020
IRB Expiration Date	N/A Revised Common Rule
Level of Review	Exempt
Project Status	Active - Exempt
Risk Level	Minimal Risk
HIPAA Category	No HIPAA

Approved Documents

grady_research_proposal_to_committee_thesis_v1.docx
grady_email_to_program_directors_v3_final.docx
grady_follow-up_email_v2_final.docx
grady_ocs_redcap_survey.pdf

The principal investigator (PI) is responsible for all aspects and conduct of this study. The PI must comply with the following conditions of the determination:

1. No subjects may be involved in any study procedure prior to the determination date.
2. Changes that may affect the exempt determination must be submitted for confirmation prior to implementation utilizing the Exempt Amendment Form.
3. The Annual Exempt Form must be submitted 30 days prior to the determination anniversary date to keep the study active or to close it.
4. Maintain all research records for a period of seven years from the project completion date.

If you are offering subject payments and would like more information about research participant payments, please click here to view the UM system Policy on Research Subject Payments: https://www.umsystem.edu/oei/shareservices/apss/nonpo_vouchers/research_subject_payments

If you have any questions, please contact the IRB at 816-235-5927 or umkcirb@umkc.edu.

Thank you,
UMKC Institutional Review Board

VITA

Name: Patrick Grady

Date and Place of Birth: November 27th, 1992; Lexington, KY

Education:

5/2011	Diploma	Clarksville High School Clarksville, TN
5/2015	BS/Chemistry	Austin Peay State University Clarksville, TN
5/2019	D.D.S.	UT Health San Antonio School of Dentistry San Antonio, TX

Residency:

2019-Present	Orthodontics & Dentofacial Orthopedics	University of Missouri-Kansas City School of Dentistry Kansas City, MO
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Professional Organizations

2015-Present American Dental Association
2019-Present American Association of Orthodontists