RECORDED INTERACTIVE SEMINARS
IN ORTHODONTIC DISTANCE EDUCATION

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ABSTRACT

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Recorded Interactive Seminars in Orthodontic Distance Education
(Under the direction of Dr. William R. Proffit, Dr. Wallace M. Hannum, and Dr. David J. Hall)

Increasing internet speeds at a time of orthodontic faculty shortages has made distance learning a viable supplement to orthodontic education. Previous investigation with orthodontic residents has shown viewing a recording of a small group seminar and having short follow-up discussion is almost as effective and acceptable as participating live and interactive from a distance, requiring less equipment, reducing necessary Internet speeds, and adding flexibility for residents and faculty. Internet based libraries of recordings may also offer private practitioners an alternative to traditional continuing education.

We investigated the effectiveness and acceptability of using interactive seminar recordings and follow-up discussion in orthodontic education with both residents and private practitioners. In a series of three papers, we conclude that this type of learning experience is well accepted by both residents and private practitioners. Also, recordings and follow-up discussion appears as effective as being live and interactive, both locally and from a distance.
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INTRODUCTION

In specialty education for dental and medical residents in the health sciences and post-graduate education in general, interactive small group seminars are considered the gold standard. Participants not only sharpen problem-solving skills through interaction with an instructor but also learn valuable collaborative skills through interaction with their peers. Recorded lectures on a web site already are being widely used to supplement instruction available locally. Would it be possible to reproduce the dynamics of interactive seminar instruction while taking advantage of Internet-based distance education, and if so, could this be done in a cost-effective way?

In 2007, with current orthodontic faculty shortages in mind, Bednar et al investigated whether conducting small group seminars from a distance would be an acceptable and effective method of learning for orthodontic residents. Residents at three university orthodontic programs participated in concept seminars in three ways: by 1) live interaction with a distant seminar leader, 2) observing the live seminar in real-time from a distance with no ability to interact with the seminar leader, and 3) later viewing of a recording of the seminar, followed by a short follow-up discussion. Residents also participated in clinical seminars and conferences with both local and distant instructors. High-speed Internet2 connections (which theoretically are 400 times faster than typical University connections) were used to allow the virtually instantaneous transfer of data (Powerpoint slides) plus video and audio in both directions. Although ‘last mile’ limitations between dental school and main
campus servers prevented true Internet2 speeds from being reached, the multi-channel transfer of information was successful.

Residents in this study preferred being live and interactive, with almost no difference between having a local or distant instructor. The test score improvement for residents who only viewed interactive seminar recordings, however, was comparable to that with live interaction, and the residents’ rating of the acceptability of this type of instruction was quite favorable. This positive evaluation led Bednar et al to conclude that “further development of recorded seminars with live follow-up discussion has the potential to supplement instruction in graduate orthodontic programs...”.

The advantage of recorded seminars would be that standard broadband Internet connections would be adequate both for viewing a distant seminar and for a later live discussion by a distant seminar leader. Neither the expensive equipment for multi-channel Internet2 connection nor access to Internet2 would be needed, even if live discussion with a distant instructor followed up a recorded seminar. It could be even more cost-effective to have local post-seminar discussions. Residents could still benefit from access to distant experts while gaining the flexibility to view the recordings at their convenience. Programs could benefit from faculty time freed by distant teaching, because no seminar preparation would be needed even if local follow-up discussions supplemented the recording. Looking to the future, virtual libraries of recorded seminars could offer a wealth of information with just the few clicks of a mouse. Once in place, these libraries could also be used to help private practitioners stay in touch with research and clinical innovations.

With these possible advantages in mind, I looked to further explore the effectiveness and acceptability of recorded interactive seminars and follow-up discussion in a series of
three studies. In the first of the attached papers that make up this thesis, the acceptability of three methods of follow-up discussion with a distant seminar leader was assessed; videoconference, teleconference and Internet chat. As a group, residents preferred videoconference discussions, found teleconference almost as acceptable, and did not rate Internet chat highly for this purpose.

The second paper, based on a much larger group of national and international residents, presents data for both the effectiveness and acceptability of live seminars (with a local or distant seminar leader) versus viewing interactive seminar recordings with no follow-up discussion, local follow-up, distant teleconference and distant videoconference discussion. The data showed that residents taught at a distance showed equal or greater improvement in test scores than those taught locally, and follow-up discussion of any type was rated higher than no follow-up.

The third paper reports an initial evaluation of the use of recorded seminars for in-office continuing education of current practitioners. The participants found that bringing this technology to a their office or home was less technologically demanding than they expected, and reported that for the most part they enjoyed the experience and found it quite acceptable. It appears that recorded seminars followed up via videoconference discussion can be an effective and cost-efficient alternative to the time commitment and travel associated with traditional continuing education.

I would like to thank my thesis committee. Dr. William Proffit’s vision for orthodontic education made these projects possible, and I am forever indebted to him for giving an aspiring orthodontist a chance to be part of this research. Dr. Wallace Hannum from the School of Education provided invaluable insight based on his long experience with
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and evaluations made these projects possible.
Paper #1: USE OF RECORDED INTERACTIVE SEMINARS IN ORTHODONTIC DISTANCE EDUCATION

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**INTRODUCTION**

Small group seminars and clinical discussions between residents and faculty are important part of post-professional specialty training programs such as orthodontic residencies, as they are for higher-level education generally.\(^1\)\(^-\)\(^4\) High-speed Internet connections now make it feasible to involve distant faculty in seminars and clinical conferences. This allows experienced faculty to contribute to residency programs at other schools as well as their own, and perhaps also to provide individualized continuing education.

A recent study of orthodontic distant education showed that although orthodontic residents preferred live interaction to observation of an interactive seminar, they appeared to learn almost as much from observation, especially if they could interact afterward.\(^5\) The purpose of this project was to follow up and further evaluate the potential for using prerecorded seminars and follow-up discussion in distant learning in both orthodontic training programs and continuing education.
METHOD

First year residents at 3 schools, the University of Sydney (Australia), the University of Manitoba (Canada) and Manchester University (England), were invited to prepare for and then watch 3 previously recorded seminars on basic topics and participate in live discussion with the seminar leader immediately afterward. Seminar preparation included readings and 1 assignment to view a special experimental program that included complex graphics on a commercial web site. Three types of communication in the post-seminar discussion were evaluated, with a different type of interaction after each seminar: audio interaction via telephone; chat room interaction via Net Meeting software (Microsoft, Bellevue, Wash); and live video interaction with high speed Internet connections. In addition, a recorded seminar with live video interaction afterward was presented and evaluated at the 2006 Iranian Orthodontic Congress.

The seminars had been recorded in an earlier experiment, by using dual-streaming video conferencing equipment and Internet2 connections. The recording showed various views of the seminar leaders, their data and slides (Powerpoint), and residents in the two groups who were being taught simultaneously. The recordings also captured interactions among the instructor and the residents at remote locations. To make the recordings available to distant schools, they were digitized with RealVideo and uploaded to a website at the University of North Carolina that was accessible by user name and password. The seminar subjects were eruption problems and their management, the development of modern fixed appliances, and new information about the biology of orthodontic tooth movement. For the
Iranian orthodontists, a recorded seminar on changes in treatment of Class III malocclusion was used.

After each session, the residents were asked to evaluate the seminar on its perceived effectiveness (how good was the learning experience?) and acceptability (how well did you like it?). A 7-point Likert scale was used to rate specific aspects of each seminar and the interaction that accompanied it. Differences in ratings of the interaction methods were evaluated statistically using repeated measures t-tests. After the 3 seminars and at the Iranian meeting, participants were asked to evaluate the entire experience using a combination of closed and open-ended questions, and descriptive statistics were compiled.
RESULTS

3.1. Technical aspects

Although UNC and the distant schools had Internet2 availability, the connection speed for the post-seminar video conference was within the range of regular high-speed Internet because of “last mile” limitations. Nevertheless, all 3 schools and the Iranian orthodontists could access the videos on the web site and watch them with few complications. The video from the UNC web site was seen at the distant locations with no delay except for Australia, where a barely perceptible delay (perhaps half a second) was noted. The more complex program from the commercial web site was seen without problems at all 3 schools, but bandwidth limitations limited access to this site from Iran.

The residents rated the video quality of the recorded program quite positively (Figure 1), despite minimal postproduction editing of the original programs. The quality of the recordings was hampered by relatively crude camera selection and a recorder with less than optimal quality. Nevertheless, the residents thought the videos were adequate for teaching purposes, with the content explained clearly and at a suitable pace. This is consistent with previous studies showing that videos need not be technologically advanced to be a success from an education standpoint.7

For the live discussion immediately after each recorded seminar, it proved more difficult to establish chat room interaction than it did with audio or video conferencing, because of problems with university wireless networks and firewalls. Despite a successful
test, chat room interaction after the seminar proved impossible in Sydney, and video conferencing was substituted. The other interactions occurred as scheduled.

3.2. Overall seminar experience

In evaluating the overall experience with recorded seminars and follow-up real-time interaction, the residents were positive (Figure 2). They agreed that the overall experience was an effective and efficient way to learn, better than they expected, and that on average the technology was not a major distraction. On average, residents reported themselves more attentive and the experience more enjoyable than a traditional classroom, but they were close to neutral when asked if they could interact better than when in a classroom. This indicated that the residents did not perceive less interaction during the distance learning experience when compared with a classroom experience.

The Iranian orthodontists, who participated through an interpreter in a follow-up videconferencing, disagreed that their experience was as good as a traditional classroom and rated their experience below the residents in nearly every category (Figure 2). Several remarked that they could not get all of their questions answered. Because more than 85 orthodontists participated in this session, the 30 minutes allotted for the videoconference was inadequate, especially because additional time was needed for questions and responses to be translated.

Seminar evaluations by interaction type are shown in Table I. The evaluations were favorable for all the types of interaction, with video conferencing rated highest. However, the differences were not statistically significant. Table II, which lists comments that were made more than once, helps to place the ratings in perspective, particularly with regard to the
impact of the technology. It may not have been a major distraction, but it certainly was noticed as a disadvantage, especially when problems arose.

3.3. Evaluation of interaction type

Although the seminars were rated highly regardless of the type of interaction (see Figure 3), video conferencing received the highest scores, with audio a close second. The average score was actually a little higher in Manchester, and two residents commented they thought it was as good as video conferencing. Despite this, all but one resident chose video conferencing as their favorite approach, including all those in Manchester who had rated audio slightly higher (Figure 4), and five voted it their least favorite method. Internet chat received the lowest average ratings, and ten voted it their least favorite.
DISCUSSION

Technically, it is much less demanding to observe a digital recording from a distant web site and then participate in a post-seminar discussion, than it is to participate in a live distance seminar with dual streaming of data and video. In these experiments, at connection speeds that were well within the capacity of the regular Internet, all 3 schools were able to view the recorded seminars from a distant web site, although Sydney experienced one interruption. A post-seminar video conference discussion also reduces demand on the Internet connection, because there is no need to stream data as well as video. It is clear that orthodontic programs without Internet2 access can participate in and benefit from the approach to distance learning.

The video conference worked very well with Sydney and Winnipeg. It was problematic with Manchester despite a successful previous test, probably because of the amount of Internet traffic at the time of day. This difficulty probably contributed to Manchester’s lower evaluation of the video conference experience.

Audio quality is critically important when audio-only or video is the mode of interaction. Good seminar room microphones and speakers become an important part of the necessary equipment. Residents at one school complained about difficulty in hearing during their audio discussion, which may have affected the ratings given this method.

We did not expect technical problems with chat room interaction, but they prevented its use with Sydney. The other residents remarked that chat was slow and cumbersome, and
only ‘slightly agreed’ that it was easy to have their questions answered. Questions and answers are traded only as fast as they can be typed, and it is difficult to keep questions and answers in sequence. Another comment was that the answers received to their questions during Internet chat were abbreviated compared to those with audio-only or video conference. One resident, however, said he cited Internet chat as his favorite interactive method because it allows those who typically are not outspoken to feel comfortable interjecting questions. For these people, who are reluctant to interact with the instructor for fear of some reaction from others, chat might be a desirable mode of interaction.

An important question becomes whether the post discussion video conference was worth the extra equipment and cost compared with audio-only or chat-room interaction. In this study, the residents overwhelmingly preferred the video conference but did not rate their seminar with it significantly higher than the ones with audio or chat interaction. Additional data are necessary to determine whether their preference for videoconferencing results in greater learning gains.

All of the residents, and the Iranian orthodontists who participated in this study rated the learning experience as effective and enjoyable (see Fig. 2), and all residents stated that they would like to be taught in this manner again. In the post-seminar interaction, residents typically were called on individually if they did not volunteer questions and comments. Many residents said the forced interaction was a plus because it made them pay closer attention to the video and during the follow-up conference.

Some residents, particularly those in Manchester, said they felt intimidated when they were questioned, particularly during a video conference. An instructor there commented that his students were more used to group discussions of posed questions, as opposed to
responding individually. Almost everyone is apprehensive the first time they are on camera, and the effect was magnified if there was no previous experience with interactive discussions. Distance education can easily be adapted to overcome problems of this type. As with other forms of instruction, students need to develop skills as learners in courses taught by video conferencing. Most learners need time to acclimate to the cameras and to seeing and hearing themselves on the monitors. Typically, learners without experience of distance learning that uses 2-way video are reluctant to enter into the discussion initially, but, in time, most “warm up” and ignore the cameras and the microphones. Once this happens, their interactions are more frequent and more natural.
CONCLUSION

Distance education with recorded interactive seminars accompanied by real-time post seminar discussion has two potentially important advantages: it can be quite acceptable to orthodontic residents and practitioners, and it does not require bandwidth beyond what is available with the regular Internet. For that reason, it also could be used in continuing education for orthodontic practitioners, perhaps by making recorded seminars available to be viewed in the orthodontist’s office at his or her convenience, and following this up with an interactive session soon afterward. Chat room interaction would be particularly well suited to this application, and some of the problems with chat room access within the university would not exist.

These data suggest that further experiments with recorded seminars in both orthodontic residency programs and continuing education are warranted. It appears that adding a real-time interactive discussion after viewing the recorded video can strengthen the overall quality of the learning experience while constraining costs.
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Paper #2:  RECORDED INTERACTIVE SEMINARS AND FOLLOW-UP DISCUSSION AS AN EFFECTIVE METHOD FOR DISTANCE LEARNING

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INTRODUCTION

In a series of distant seminar sequences with orthodontic residents, Bednar et al showed that although they preferred live participation from a distance, later observation of a recorded interactive seminar produced similar improvements in pre/post test scores. The use of recorded seminars was also well accepted by distant residents, especially when participating in short follow-up discussion with faculty after viewing. Positive evaluations from the three participating orthodontic programs led to the conclusion that “further development of recorded seminars with live follow-up discussions has the potential to supplement instruction in graduate orthodontic programs.” Recorded interactive seminars can be created by properly equipped schools as they progress through their normal curriculum, and offer flexibility to distant residents and faculty while reducing the cost and complexity of distance education.

In this experiment involving second year residents at the University of North Carolina, The Ohio State University, the Tri-Service Residency at Lackland Air Force Base, West Virginia University, University of Louisville, University of Minnesota, University of Manitoba, the University of Sydney and other residents from Australia/New Zealand programs, we looked to evaluate the effectiveness and acceptability of various forms of post-seminar feedback after distant residents viewed recorded interactive seminars.
METHOD

2.1. Research Design

Between UNC and Ohio State, recordings of 25 seminars organized into 4 sequences were created. Sequences 1 and 3 originated at UNC and covered topics pertaining to Growth and Development and Biomechanics respectively. Sequences 2 and 4 originated at OSU and covered topics pertaining to Advanced Diagnosis and Treatment Planning and Treatment Sequellae respectively. The recordings were digitized, edited and uploaded to a website accessed by user name and password. Prior to live participation or accessing and viewing a recorded seminar, residents were given a seminar outline and preparatory reading list. If not involved in the live seminar, distant residents accessed the seminars, watched them at their convenience, and evaluated four different methods of post-seminar interaction; local follow-up discussion, videoconference, teleconference, and no discussion. Effectiveness was measured by pre/post test data. Acceptance was measured by rating presented statements on a 7-point Likert Scale. Open-ended questions gave participants the ability to share specifics of what they liked or disliked, and an opportunity to suggest improvements.

2.2. Digitized Recordings and Follow-Up Discussion

Although the origin of the seminars rotated between UNC and Ohio State, all recordings were made and processed at UNC. For final assembly, incoming video and audio signals, obtained from cameras and microphones dispersed throughout the room at UNC or from a Polycom videoconferencing system from Ohio State, first passed through separate
interfaces that digitized the signals and placed them into their respective video- and audio-editing software. The digitized video signal was routed and recorded through Wire Cast 3.0, an Apple program that allows recording of multiple feeds, via cameras or data in the form of a Powerpoint file, with the benefit of Live On Tape (LOT) editing, essentially doing preliminary editing ‘on the fly’. The digitized audio signal was routed and recorded through Sound Track Pro. Then processed audio and video files were imported into Final Cut Pro, where they were synchronized, edited further, and combined into a single Quicktime file. The Quicktime file was then converted to a Flash file and uploaded to the project’s web site.

Before accessing a recorded seminar, distant schools completed the same readings as the residents in the recorded seminars. After viewing, residents rotated through the following post-seminar interactions: local follow-up discussion, videoconference or teleconference with the distant faculty who originated the seminar, and no discussion.

2.3. Evaluation

The overall effectiveness of the seminar sequences was determined from pre/post tests taken by the residents. Tests were compiled from questions created by the different seminar instructors. Each seminar topic in Sequence 1 translated to approximately 10 multiple choice questions with a total of 63 questions on the test. Residents in Australia and New Zealand, who only participated in 3 seminars from Sequence 1, completed a test consisting of 32 questions. For Sequences 2, 3 and 4, each seminar topic translated to approximately 8 questions, with 48 questions on each test.

Acceptance of the recorded seminars as well as the methods of interaction was measured using evaluation forms containing 12 short statements descriptive of the experience, which residents rated on a 7-point Likert Scale on which ‘7’ meant ‘strongly
agree’ and ‘1’ meant ‘strongly disagree’. A score of ‘4’ meant they were neutral on the subject. The statements were further separated into the following descriptive categories: 1) resident’s opinion 2) learning experience and 3) descriptions of the discussion with each method of interaction.

2.4. Statistical Analysis

Descriptive statistics were computed for the pre/post test data. A table of means and standard deviations is used to compare sequence test scores for schools which participated local live and interactive and those at a distance who participated through recordings and follow-up discussion.

A one-way analysis of variance was used to test the null hypothesis that there were no differences in acceptability between types of seminar interaction or follow-up discussion using the Tukey-Kramer test for pairwise comparisons.
RESULTS

Not all participating schools took part in all 4 seminar sequences. Follow-up discussion for most distant schools consisted of videoconference, teleconference, and no discussion; deviations from these are specified below. For Sequence 1, pre- and post-tests were completed by residents from Manitoba, Minnesota, Sydney, TORP, UNC, and WVU. All of these schools and Louisville, who evaluated being live and interactive from a distance, also completed evaluations of acceptability. Residents in the other orthodontic programs in Australia and New Zealand besides Sydney, namely Adelaide, Melbourne, Queensland, Western Australia and Otago, participated in three seminars from Sequence 1, completed a pre/post test, and evaluated being local live and interactive, local follow-up discussion, and no discussion. Sequence 2 and 3 tests and evaluations were completed by OSU, TORP, and UNC. UNC evaluated being live and interactive from a distance once in Sequence 2, and OSU in Sequence 3. Sequence 4 tests were completed by UNC, OSU, TORP, and WVU, with evaluations by all of these except WVU.

3.1. Effectiveness (Fig. 1)

Post-test scores improved in each seminar sequence, from an average of 6.7% for Sequence 4 to 17.8% for Sequence 1. For each of the 4 seminar sequences schools local live and interactive with an instructor improved 8.48%, 7.29%, 10.97%, and 8.17%, as opposed to schools viewing recordings who improved an average of 20.13%, 20.94%, 10.97%, and 6.25% in each sequence respectively. Average improvement of for all 4 seminar sequences
was 8.51% (+/- 1.2%) for local live and interactive residents versus 15.30% (+/- 12.2%) for those viewing recordings and having short follow-up discussion.

3.2. Acceptability

3.2.1. Recorded Seminars (Fig 2). Residents agreed (6.1) that the videos helped them understand the material better than the readings alone. They also agreed that use of the videos improved their educational experience (5.6) and provided a better learning experience than it would have been without them (5.6). Residents slightly agreed (5.3) that they learned more by watching the instructor interact with other residents as opposed to a video of just a lecture from the instructor and barely slightly agreed (4.7) that they would have learned more if present in person.

3.2.2. Type of Interaction and Discussion.

i. Resident Opinion: Good or Bad Experience (Fig 3). Residents appeared to have the most positive opinion of local follow-up discussion (5.7), although the difference was small and not statistically significant compared to being live and interactive both locally (5.5) and from a distance (5.3). Residents’ opinion of videoconference discussion (4.9) was significantly different from both local live and interactive (p=.04) and local follow-up discussion (p=.02). Residents were neutral to both teleconference (4.4) and no discussion (4.0), both of which were significantly different from all other methods (p<.0001) but not from each other.

ii. Quality of learning experience (Fig. 4). Residents gave the highest rating to being distant live and interactive (5.7), but the differences between all the other settings that included interaction were small and not statistically significant. No discussion (4.3) was rated below all the other methods, and was statistically different from being live and interactive
(local and distant) and local follow-up discussion (p<.0001), as well as videoconference (5.1) and teleconference (4.9) (p=.0012 and p=.036 respectively).

iii. Effect of type of discussion (Fig. 5). There were no significant differences when live discussion (5.8/5.6) was evaluated relative to local follow-up discussion (5.7) or videoconference (5.3), but there was a significantly lower rating (p=.02) for teleconference (5.2) relative to being local live and interactive.

All responses were also averaged into an overall representative value for each method of interaction and are shown in Fig. 6. From the residents’ perspective, live interaction of any type as well as local follow-up discussion, is preferred to videoconference and teleconference, with no discussion viewed below any type of discussion. Open-ended questions show, however, teleconference had some supporters who felt it was the least intimidating form of discussion. Others felt teleconference was impersonal. Many residents appreciated the exposure to distant experts in the field and being able to watch the recordings at their convenience.
DISCUSSION

When developing problem solving skills, the least efficient discussion is more often than not superior to most lectures. Therefore in programs such as an orthodontic residency, it is generally accepted that interactive small group discussions are the gold standard. Students gain from applying newly obtained information with an authority during learner-instructor interaction and develop important collaborative skills necessary for being part of a profession during learner-learner interactions, both of which are unique to small groups. The data in this study provides insight into three important questions: 1) Is being local live and interactive more effective and acceptable than participating live and interactive from a distance? 2) Is there an advantage to participating live and interactive during seminar versus watching a recorded interactive seminar with short follow-up discussion? 3) When interactive seminar recordings produced by distant faculty are used, is follow-up discussion an important part of the learning experience, and if so, which type?

4.1. Live and Interactive: Local vs. Distant

When participating live and interactive, is there an advantage to being local rather than at a distance? Our findings suggest that there does not appear to be. Schools participating local live and interactive, showed a post-test score improvement average of 8.5% for each seminar sequence. Although the direct effectiveness of being live and interactive from a distance could not be measured, Bednar et al. showed an average post-test score improvement of 27.8% for three distant live and interactive residencies. This does not mean that being at a distance is better, as test scores in Bednar’s study were higher in
general, but it suggests that being at a distance may be at least as effective. In terms of overall resident acceptance, although we had a discrepancy in the number of evaluations of being local (N=60) versus distant (n=17), we found no statistically significant difference between the two methods.

4.2. Live and Interactive vs. Recorded Interactive Seminars

Is there an advantage in being live and interactive versus watching a recording with short follow-up discussion? The data from this study suggest strongly that participation by viewing a recorded seminar is no less effective than being live and interactive and if anything may be better. In each of the four seminar sequences, the most test score improvement was accomplished by residents at a school participating through recordings and a follow-up discussion. Resident acceptance of using recordings was not statistically different from being live and interactive when the follow-up discussion was done locally. Although residents did not prefer videoconference, it was not statistically different from local follow-up discussion in the quality of the learning experience or the discussion itself.

4.3. Type of Follow-up Discussion

When participating by watching recordings, do residents prefer follow-up discussion, and if so what type? Residents were neutral to no discussion which was statistically below all other methods tested. This shows that some form of interaction is important to residents, although no discussion can be used successfully on occasion. Local follow-up discussion was most preferred, and was not statistically different from being live and interactive (local or distant). Although residents would rather participate in videoconference than
teleconference, confirming results from a previous study, no significant difference was found between the two.

4.4. Implication of These Findings

What implications do these findings have? The increasing internet speeds of the last decade are beginning to make distance learning a viable supplement to orthodontic curriculum. The use of interactive seminar recordings and follow-up discussion offers both scheduling flexibility and efficient use of faculty time. Residents appreciate watching recordings at their convenience and faculty benefit from time freed by follow-up discussions shorter than typical seminars. Follow-up discussion and live interaction can be carried out by distant faculty as residents appreciate the exposure to experts in the field. Equipment for distance interaction can range from expensive conferencing hardware necessary for high quality interaction similar to being in a classroom, to a desktop computer, and even a conference telephone while still being well accepted by residents. As visual learners, residents prefer the experience most similar to a traditional classroom, but find it acceptable to learn from audio only interaction. With all of this in mind, interested schools can begin to tailor a technologic education to fit their specific needs.
CONCLUSIONS

1) Being live and interactive from a distance appears to be as effective and acceptable as local live interaction.

2) The use of interactive seminar recordings and follow-up discussion appears to be as effective as participation live and interactive in seminar.

3) After watching an interactive seminar recording, residents prefer local follow-up discussion more so than videoconference, teleconference, and no discussion in that order.
ACKNOWLEDGEMENTS

We would like to thank the AAO for their support of this project. We also thank Tarrl Morley for his help recording and editing the interactive seminars, Ceib Phillips for statistical consultation and all the residents in the United States and abroad who participated and evaluated their experience.
Paper #3:  DISTANCE LEARNING FOR THE PRIVATE PRACTITIONER

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INTRODUCTION

Recent studies have shown that distance learning can be an effective supplement to graduate orthodontic education. Although live interaction in a seminar with a distant leader might be the ideal way to use distance learning, it is expensive and requires extremely high-speed connections (Internet 2) if both data and video transfer are needed.6

Results of previous studies with orthodontic residents indicate that participation in live interactive seminars from a distance not only leads to test score improvement similar to typical classroom instruction, but also that students can learn as much by watching a previously recorded interactive seminar.5 This is especially true when the recorded seminars are supplemented with live follow-up discussion. Between preparatory readings and viewing interactive seminar recordings, students can obtain a great amount of exposure to a topic at any convenient time and at their preferred pace. Faculty, local or distant, can schedule follow-up discussions, which are generally shorter than typical seminars, in order to address questions and comments. Scheduling flexibility combined with lower equipment costs, makes this effective method of distance learning also an inexpensive and efficient supplement to a program’s educational resources.10
Conducted research has created, and continues to create, an online library of cataloged interactive seminar recordings, only used thus far by orthodontic residents. A question remains: Can recorded seminars be used to bring continuing education to practitioners in their offices? Traditional continuing education courses typically offer a lecture with limited discussion with the presenter, along with the possibility of engaging in useful discussion outside the lecture room with colleagues who were in attendance. The time and monetary costs associated with attending, however, tend to limit the number of CE courses that individuals attend. Access to experts and discussion with colleagues are key components of an orthodontic residency; these are two of the possible benefits of using recorded interactive seminars and follow-up discussion for continuing education without having to leave one’s office or home.

The purpose of this study was to test the perceived effectiveness and acceptability to orthodontists of interactive distance learning in their office using three components: preparatory reading, recorded interactive seminars, and live follow-up discussion via video conference.
METHOD

2.1. **Participants.** Twelve orthodontists in private practice who had a typical broadband Internet connection were recruited to participate in a six-week project to test this distance learning model as a means for continuing education. It is generally acknowledged that for post-professional learning, interactive small group seminars are preferred. This leads to better discussion and development of problem-solving skills more so than traditional lectures. For this reason, participants were broken into two groups. Group 1 consisted of 5 male orthodontists in North Carolina and Virginia with an average of 21 years in practice. Group 2 consisted of 2 female and 5 male orthodontists in California and Washington with an average of 15 years in practice.

2.2. **Weekly Preparation.** Each week presented and focused on a new topic in orthodontics. The recorded seminars were chosen from the library of previously recorded interactive seminars created by the University of North Carolina (UNC) and The Ohio State University (OSU). These specific seminars were chosen for this study because the topics were those thought to be the most appealing to private practitioners. These seminar topics are listed in Figure 1. The same readings used by residents to prepare for the recorded seminars were photocopied and mailed to each participant prior to beginning the study. Participants were asked to go through the assigned readings before using a user name and password to access and watch the previously recorded seminars on a web site created for this study.
Each video shows an approximately 60-75 minute small group, interactive seminar in which faculty members and residents share ideas, questions, and opinions about the selected readings and their experiences with that topic. The participants could view the recorded seminars at any time.

2.3. **Follow-Up Discussion.** Each participant was sent a Logitech web camera to connect to their computers for follow-up discussions. Discussions were scheduled to be as convenient as possible for the participants taking into account both their time zone and work schedule. Almost all were set to begin at 6 PM local time, so that the orthodontists could finish their office day and stay at the office for the discussion. Although the original seminars were led by six different UNC or OSU faculty (see Fig. 1), all discussions were led by Dr. William Proffit, except for the temporary anchorage device seminar for Group 2, which was led by Dr. Robert Scholz. Participants were told before the experiment began the discussions would last approximately 30 minutes, but they frequently ran over the allotted time because the group wanted to continue talking about points of interest.

WebEx, which was used for the videoconferencing, allows real-time sharing of desktop information such as word documents and slides. Due to suggestions by Group 1 to include slides during the discussion, they were also used for Group 2. To minimize bandwidth issues, and to maintain communication with a participant who may have computer trouble, WebEx was used solely as a video feed. For audio, participants used their telephones to join a numerically-identified conference call through a standard conference-calling service.

2.4. **Evaluations.** Along with their readings and video camera, each participant was sent a total of 8 evaluation forms. The first was to be completed prior to the installation of the
camera and any videoconferencing, and was designed to assess each participant’s self-perceived computer abilities. The next six evaluations were completed after each of six follow-up discussions. These evaluations focused on the readings, the recorded seminars, and the follow-up discussion. Finally, at the end of the 6 week project, participants completed a summary evaluation in which they reflected on their experience as a whole.

Each evaluation form consisted of statements that participants rated on a Likert Scale of 1-7 depicting their level of agreement with the statement. A statement rated a ‘1’ meant that the participant strongly disagreed with the statement, a rating of ‘4’ meant they were neutral, and a ‘7’ meant they strongly agreed with the statement. Because of our small sample size only descriptive statistics are used. Due to floor and ceiling effects of Likert scale data, responses were grouped into the following categories: statements marked 1 or 2 indicate ‘disagree’; statements marked 3, 4, or 5 indicate participants were ‘neutral’ to the statement; and, finally, statements marked 6 or 7 indicate ‘agreement. With only twelve ratings for each statement, results of both the pre-seminar and summary evaluations are reported by the number of responses. The summary evaluation also contained open-ended questions so that the participants could include their own thoughts about their experience and critiques of what was good or what could be changed. With 72 ratings for each statement, the results of seminar evaluations are reported as percentage of responses.
RESULTS

3.1. Pre-Seminar Evaluation

All 12 participants agreed that they felt comfortable and proficient with their computers. Nine agreed they did not need assistance to accomplish most tasks on their computers and that they use their computers for more than just emailing and Web-browsing. Despite this, 10 responded neutral (i.e., weren’t completely confident) that their skills would be adequate for the experiment, and 7 indicated some concern as to how much time the project would take.

3.2. Evaluations of Individual Seminars (Figures 2,3)

3.2.A. Weekly Preparation. As mentioned, weekly preparation consisted of reading selected articles and text as well. Overall, 51% of combined responses were neutral with regards to whether there was too much reading. Group 1 never agreed that there was too much reading for any single seminar. Group 2 had more diverse responses and 70% agreed there was too much reading for the 3-D seminar. In the open-ended responses, one member of Group 1 noted the reading was “well-selected” and a member of Group 2 said that the readings should be “more focused”.

For the combined groups, 80% of responses agreed that the material in the videos was interesting. The only two videos below 90% agreement were 3-D Imaging and One-couple Mechanics. These differences were group-specific, as Group 1 was in 100% agreement those two videos were interesting. Group 2 agreed 71% and 40% respectively. Seventy percent of responses agreed they were attentive as they watched the recordings, and both groups were in
100% agreement that they were attentive during the Smile Esthetics video. Six participants specifically commented that they liked being able to watch the videos at their convenience. There were also some suggestions for improvement. Because of occasional glitches (freezing video streams and audio problems during recording that could not be fixed by editing without losing information) three open-ended comments noted that the quality of the recorded seminars could be improved. Also, two participants felt the resident interactions in the video did not add much to their experience.

3.2.B. Interactive Follow-Up Discussions. Data for evaluations of the individual seminars are summarized in Figure 2. For the combined responses across the 6 seminars, 89% agreed that the post-seminar discussions were beneficial, and there were no responses in disagreement. There was small variation in this from week to week, which ranged from 78% agreement for the Transplants/Decoronation discussion to 100% agreement for Vertical Growth Modification. There was 72% agreement that they were able to learn the material as well as in a traditional class. It is unclear whether practitioners thought of traditional class as a seminar or a lecture. The only disagreement came from one participant from Group 2 for the One-couple Mechanics seminar. Eighty-seven percent of participants agreed, and none disagreed, that if they had questions these questions were answered during the post-seminar discussion. Overall, 55% of responses disagreed and 37% were neutral that the use of technology was a distraction. Generally speaking, technology was more of a problem for Group 1, where one member agreed technology was a distraction for 4 separate weeks.

3.2.C. Summary Evaluations (Fig 4). Eleven participants agreed this was an enjoyable and effective way to learn, and that they would participate in this type of learning in the future; only one response was neutral to these statements. Five participants disagreed
that the use of technology was a distraction and six participants were neutral. Four out of five participants from Group 1 felt the use of technology was even easier than expected. All the participants agreed that they would recommend this method of learning to others, and four specifically commented that they liked not having to travel to interact with other orthodontists and experts in the field.
DISCUSSION

After completion of an orthodontic residency, practitioners become responsible for further education throughout the remainder of their careers. With families and busy practices, it can be a challenge to stay on top of new knowledge and particularly to critically review information that comes from multiple sources. Distance learning is well suited for making learning logistically easier and helping practitioners put new findings in perspective, but it requires the use of technology and carries with it a psychological issue caused by physical separation from the instructor or seminar moderator that is different for individual participants.\textsuperscript{13} Evidence suggests a key to overcoming this effect of separation is to provide participants with a balance of flexibility and cohesiveness.\textsuperscript{14}

Half the participants in this study specifically commented that they appreciated the flexibility distance learning provides. On the other hand, for flexibility to be successful and to keep the educational scale balanced, the distance learning experience must also provide cohesiveness. Cohesiveness refers to the framework of learning ‘events’ laid out in the course design and how they relate to each other; or providing participants with a logical sequence of events to aid them in integrating the information and putting it in clinical perspective.

The first task asked of practitioners was selected readings. For a busy practitioner, reading multiple articles each week can be cumbersome, especially when he or she feels the need to be familiar enough with key points to contribute to small group discussion. To some
this may have added stress, but others indicated it is what they enjoyed. Several commented on the breadth of information covered during the 6 weeks of the experiment, and the readings were certainly a contributor. One participant said the live discussions made one accountable for the readings as well as the content of the video, and as a result he gained more from the experience. Most of the participants appreciated the fact that the articles were selected as important for that topic, and that the readings were sent directly to their offices. In the future, selected reading can easily be made available on the web site as .pdf files, so that it can be printed in the office or read directly from the screen.

The next event in weekly preparation was watching a recorded interactive seminar; termed ‘interactive’ because they show an educational conversation between a professor and residents. Perhaps because residents in the videos may not be as familiar with the topics as the practitioners, a couple of participants noted the videos seemed a little slow-paced, making it hard to stay engaged with the material. Two commented that observing resident interaction did not add much to the experience, and suggested watching a video of a lecture as opposed to an interactive seminar. Cognitively, a professor talking directly to a camera adopts a different ‘social role’ making him or her more of an authoritative advocate rather than a colleague. Interaction places the educator more ‘eye to eye’ with the students. For orthodontic continuing education, the ideal situation might be to have a recording of practicing orthodontists interacting with an educator. What is clear about the recorded seminars is that the participants really liked the flexibility of watching the recordings at their own convenience as well as being able to stop/start/rewind/fast forward as they pleased, and saw that the method could be refined and improved in the future.
The final event in the framework of this project was the post-seminar discussions. It was interesting to watch how the discussions with each group evolved over the six weeks, as participants began to know each other better and were more comfortable with being televised. Generally, the discussions got longer as the study proceeded. One participant noted that having a personal biography of the group prior to starting might ‘break the ice’ a little sooner. Overall, they liked having others with whom they could talk about clinical practice, liked having an expert commenting on their thoughts about a subject, and liked doing it from their home or office. One participant even noted that being in familiar surroundings made him more at ease with participating in the conversation.

The post-seminar discussions did receive some criticisms that were largely related to technological issues. The first was bandwidth. Previous distance learning experiments in this AAO-supported series have used Internet 2, which is very fast but requires expensive equipment. Slower Internet connections suffer from latency that causes transmitted data to be received in a different order that it was sent, leading to grainy, choppy, or frozen feeds. We attempted to minimize our bandwidth requirement by transmitting audio through the telephone, which improved latency only slightly while introducing connection difficulties. In the future, voice over Internet seems a better choice, especially as VoIP continues to improve.

The second technological issue was a conflict between Logitech’s software for the web cams and WebEx’s control of the video feed. If Logitech’s software was active, WebEx was not able to control the feed and participants could not “send” their video to be seen by others. This was a set-back during our first two live follow-up discussions with Group 1, and
is the likely reason for their neutral responses to technology being a distraction for these discussions. Fortunately, as the study progressed this became a ‘quick fix’.

The participants handled the use of technology and its glitches very well. To some practitioners, the idea of installing software, connecting a web cam, and watching videos through the Internet could seem a daunting task. As technology advances, the ease of use generally progresses as well, and interactive continuing education for private practitioners already seems quite feasible. Currently, there is an AAO sponsored web site in place for orthodontic residents to access and view seminar recordings prior to participating in follow-discussion. Hopefully, a similar site can be created for practitioners in the near future.
CONCLUSIONS

Overall, the private practitioners enjoyed their experience with this in-office (home) version of continuing education and found it an effective way to learn. They overwhelmingly agreed that they would recommend this way of learning to others, and appreciated the interaction with experts, the camaraderie and meeting new people, and the flexibility it provided. As one participant said in regards to the 3-D seminar, “I now have a better understanding of a broad range of 3-D imaging technology and its uses as it pertains to orthodontics and oral surgery, and I didn’t have to pay for an airline ticket or a hotel room.”
ACKNOWLEDGEMENTS

This work was supported in part by a grant from the AAO through the AAO Foundation. We thank both Frank Meiners and Dr. Robert Scholz from Ortho II for their technical and WebEx support, Dr. David Hall for his assistance, Dr. Ceib Phillips for her advice, and all the practicing orthodontists whose participation made this possible.
Table 1. Data from each residency was compiled and averaged to determine effectiveness and acceptability of each individual seminar experience. An overall average is given on the far right and is a good indication of resident’s opinions. For each question, the mean and standard deviation for each group are shown.
<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learn from prominent leaders in the field (15)</td>
<td>Technological difficulties (9)</td>
</tr>
<tr>
<td>Points of view from all around the world (8)</td>
<td>Unable to ask questions during video (6)</td>
</tr>
<tr>
<td>Enjoyable (7)</td>
<td>Impersonal at times (3)</td>
</tr>
<tr>
<td>More engaged during video and interaction (5)</td>
<td>Typing skills needed for Chat Interaction (2)</td>
</tr>
<tr>
<td>Interactive (3)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Comments made more than once by residents who completed the summary evaluation.
Figure 1. Resident ratings of seminar video quality. The first six questions of the individual seminar evaluation pertained to the acceptability of the previously recorded seminars. The data was averaged for each method of interaction.
Figure 2. Data from the summary evaluation completed by each residency and the Iranian Orthodontic Congress (I.O.C.).
Figure 3. Overall acceptability of the teaching experience, by type of interaction with the 3 schools grouped together. Due to firewall issues, Sydney did not participate in Internet Chat.
Figure 4. The number of residents who ranked each type of interaction their favorite and least favorite. No one put video as least favorite or audio as favorite.
Figure 1. Pre and Post test scores of each school and combined. In Sequence 1, all 6 schools participating by watching seminar recordings improved more than the originating school. For sequences 2, 3, and 4 the most improvement was also made by a distant school.

<table>
<thead>
<tr>
<th>Sequence:</th>
<th>School</th>
<th>Pre-Test Average %</th>
<th>Post-Test Average %</th>
<th>Difference</th>
</tr>
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<tbody>
<tr>
<td><strong>Sequence 1: Growth and Development</strong></td>
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<td>51.82</td>
<td>68.70</td>
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<td></td>
<td>TORP</td>
<td>52.62</td>
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<tr>
<td></td>
<td>UNC</td>
<td>48.79</td>
<td>57.27</td>
<td>+8.48</td>
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<td></td>
<td>WVU</td>
<td>40.26</td>
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<td></td>
<td>Manitoba</td>
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<td></td>
<td>Sydney</td>
<td>66.24</td>
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<tr>
<td></td>
<td>Australia</td>
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<td>Combined</td>
<td></td>
<td>49.45</td>
<td>66.88</td>
<td>+17.44</td>
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<tr>
<td>S.D.</td>
<td></td>
<td>18.88</td>
<td>19.90</td>
<td>+10.48</td>
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<tr>
<td><strong>Sequence 2: Advanced Diagnosis and Treatment Planning</strong></td>
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<td>89.24</td>
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<tr>
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<tr>
<td>S.D.</td>
<td></td>
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</tbody>
</table>
Figure 2. Evaluation of Interactive Seminar Recordings. Overall, residents were positive in their opinions of the recordings and their ability to learn from them.
Figure 3. Resident opinion of each method of interaction. Videoconference and Teleconference received their lowest respective ratings in this category. Resident’s neutral opinion of no discussion was statistically different from all methods except teleconference.
Figure 4. Statements of learning experience separated and averaged. No statistical difference was found between methods except no discussion.
Figure 5. Statements describing discussion separated and averaged. The only statistical difference found was between local follow-up discussion and teleconference.
Figure 6. Overall averages of each method of interaction. Local follow-up discussion was as acceptable to residents as being live and interactive. Although its neutral rating is the lowest, no discussion can still be used successfully when necessary.
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Recorded Seminar Location</th>
<th>Recorded Seminar Instructor</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>3-D Imaging</td>
<td>UNC</td>
<td>Cevidanis</td>
</tr>
<tr>
<td>2</td>
<td>One Couple Systems</td>
<td>UNC</td>
<td>Ko</td>
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<tr>
<td>3</td>
<td>Smile Esthetics</td>
<td>OSU</td>
<td>Fields</td>
</tr>
<tr>
<td>4</td>
<td>Vertical Growth Modification</td>
<td>UNC</td>
<td>Proffit</td>
</tr>
<tr>
<td>5</td>
<td>Transplants/Decoronation</td>
<td>OSU</td>
<td>Fields/Rao</td>
</tr>
<tr>
<td>6</td>
<td>Temporary Anchorage Devices</td>
<td>OSU</td>
<td>Huja</td>
</tr>
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Fig 1. Topics chosen from the interactive seminar library and their origin.
Fig 2. Seminar Evaluations. Each statement was rated a combined 72 times during the six seminar weeks.
Fig 3. Responses to Open-Ended Questions.
Fig 4. Combined results of Summary Evaluation.
References


