Interactive Distance Learning in Orthodontic Residency Programs: Problems and Potential Solutions


Abstract: Sharing resources through distance education has been proposed as one way to deal with a lack of full-time faculty members and maintain high-quality content in orthodontic residency programs. To keep distance education for orthodontic residents cost-effective while retaining interaction, a blended approach was developed that combines observation of web-based seminars with live post-seminar discussions. To evaluate this approach, a grant from the American Association of Orthodontists (AAO) opened free access during the 2009–10 academic year to twenty-five recorded seminars in four instructional sequences to all sixty-three orthodontic programs in the United States and Canada. The only requirement was to also participate in the evaluation. Just over half (52 percent) of the U.S. programs chose to participate; the primary reason for participating was because faculty members wanted their residents to have exposure to other faculty members and ideas. The non-participating programs cited technical and logistical problems and their own ability to teach these subjects satisfactorily as reasons. Although participating distant faculty members and residents were generally pleased with the experience, problems in both educational and technical aspects were observed. Educationally, the biggest problem was lack of distant resident preparation and expectation of a lecture rather than a seminar. Technically, the logistics of scheduling distant seminars and uneven quality of the audio and video recordings were the major concerns of both residents and faculty members. Proposed solutions to these educational and technical problems are discussed.

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Virtually all university and dental school administrators agree that e-learning will play an important role in the future of education. Evidence from previous studies indicates that distance education is at least as effective, perhaps more effective in some circumstances, than traditional classroom instruction. E-learners often demonstrate increased content retention that results in improved knowledge, skills, and attitudes because they have control over the content. Advancements in e-learning are creating the groundwork for a revolution in graduate medical education by individualizing learning, enhancing learners’ interactions with each other, and transforming the role of teachers from disseminators of information to facilitators of self-motivated learning.

In postdoctoral residency programs, interactive small-group discussions are accepted as the gold standard for teaching because they challenge residents to think critically about concepts presented in assigned readings. In distance education, it is important not to lose this key interactive component. Based on the results of previous evaluations of interactive distant seminars with orthodontic residents, Miller et al. evaluated a “blended” interactive distance learning approach (Figure 1) that combined observation of recorded seminars followed by live follow-up discussion. Using this method with residents at eight other schools, it was shown that distant residents learned at least as much as those physically present for the seminar and that the distant faculty and residents found the learning
experience quite acceptable although they preferred live interaction.

For the 2009–10 academic year, a grant from the American Association of Orthodontists (AAO) opened free access to twenty-five recorded seminars in four instructional sequences to all sixty-seven orthodontic programs in the United States and Canada. The only requirement was to also participate in the evaluation. Drawing on this experience with a broad group of orthodontic residents and faculty members, this article focuses on problems that are likely to be encountered in the use of blended distance learning in postdoctoral health science education.

Acceptability of Interactive Distance Seminars

Orthodontic programs were invited to use the free educational materials via both mail and e-mail, and non-responding departments received follow-up phone calls to increase participation. Just over half (n=33, 52 percent) of the sixty-three U.S. graduate orthodontic programs chose to participate in this project. None of the Canadian programs did. Ten other American programs (16 percent) registered for participation but did not use the teaching materials, and twenty (32 percent) never responded to repeated invitations to participate.

At the participating programs, why did faculty members and residents say they use distance learning? Faculty members at participating programs cited a variety of reasons (Figure 2). Interestingly, although widespread faculty shortages were the main reason this project was conceived, only 23 percent of the respondents said they did not have enough faculty resources to cover basic needs. One faculty member stated, “We have enough faculty, but we can’t expect the group to be experts on all topics”; another said, “Having the ability to access specialized academicians through distance education is certainly a benefit for students”; and a third commented that the learning materials were “a very helpful adjunct to our curriculum” and an “excellent reinforcement of concepts taught in our curriculum.” These responses echo recent findings from the e-learning literature that students and faculty members do not see distance learning as replacing traditional instructor-led training, but as a complement to it. A third participant cited more global reasons for using the learning materials: “As an orthodontic educator for a number of years, I am fully aware of the need for more orthodontic faculty and better quality orthodontic education. I support the concept of distance learning and I believe it should have a significant role in the future of orthodontic education.”

Residents at participating programs had the opportunity to access all of the seminars for viewing, whether or not they were assigned to do so. The seminars most frequently viewed by residents focused on the more academic/didactic topics (Growth and Development, Biomechanics), with less use of seminars in Diagnosis/Treatment Planning and Sequelae of Orthodontic Treatment. This may reflect a lack of faculty members available to teach the more “academic sciences” and a perceived need by some residents to supplement their existing knowledge in those areas.

Why did many programs choose not to participate? Although we were unable to contact all non-participating programs, efforts were made to determine why so many did not participate. Various reasons were cited such as the following: concern that seminars would not engage residents; logistical hurdles such as “our class is only fifty minutes” (recorded seminars with post-seminar discussion were planned to be about sixty minutes long and thirty minutes of post-seminar discussion were expected, but there was considerable variability in seminar length); technological difficulties such as “the university bars us from adding or downloading programs onto our computer”; and the feeling that “we are really busy and just never got around to it.”
One program representative said, “We didn’t do it because we could and did teach the selected subjects perfectly well.”

These real and perceived barriers match previous research findings explaining why distance learning has not been more fully embraced in dental education. Reasons for slow implementation of distance learning in dental schools have included a lack of faculty desire to change their curricula, lack of funding, unwillingness among individuals and institutions to share ideas and teaching materials, fear of losing programmatic control over didactic curriculum, and poorly designed educational materials.\(^1\) Adapting e-learning and its related technology does require an investment in faculty time and resources, even at programs that are only recipients, not contributors.

**Perceptions of Participating Residents and Faculty**

Perceptions of the participants in the project were measured using survey instruments that combined statements to be evaluated on a seven-point Likert scale (7=strongly agree to 1=strongly disagree) and open-ended questions. Of the 256 residents and forty-two faculty members who participated in the seminars, 80 percent of the residents and 83 percent of the faculty members completed surveys providing feedback on their experience.

Faculty and resident perceptions of the blended learning experience are graphically represented in Figure 3 and are presented in detail elsewhere by Klein et al.\(^10\) The majority of responding faculty members (79 percent) and residents (74 percent) thought this form of distance learning was effective as a teaching tool; 76 percent of responding faculty members and 71 percent of responding residents thought the time spent was worthwhile; and 76 percent of responding faculty members and 84 percent of responding residents said they wanted to use distance learning materials again in the future. Both groups were essentially neutral as to whether residents were able to learn from the recorded interactive seminars as well as they do in a traditional classroom. Most faculty respondents (82 percent) agreed that the seminar content was appropriate for residents, and 56 percent of the faculty respondents agreed that distance learning could lessen the teaching burden for faculty members in the future.

Perceptions of the technology as rated by the Likert scales are shown in Figure 4. Most responding residents (72 percent) agreed they were not distracted from learning because of the technology. Both faculty and resident respondents strongly agreed that having the capability to stop, rewind, and skip through sections of the seminar was extremely beneficial to the learning experience. Both groups agreed that the video clarity was acceptable, but the faculty members were less positive about the sound quality. Among
these respondents, most of the residents (82 percent) and two-thirds (68 percent) of the faculty members agreed that more extensive visual aids to supplement the discussion between the seminar leader and the live participants would be beneficial to the learning experience.

Problems and Possible Solutions

The problems with the blended approach used in this study and some possible solutions can be
summarized under two major headings: educational considerations and technical quality.

Educational Considerations

Lack of resident preparation prior to seminar viewing. Most faculty respondents (82 percent) thought the reading assignments were appropriate for the objectives of these seminars and agreed that adequate preparation was essential. Although neither faculty nor residents reported there were too many articles to read prior to viewing the recorded seminars, only 14 percent of the residents said they read all assignments in-depth, and 29 percent reported not reading any of them before watching the recorded seminars. Although the reading assignments had been sent to the school, one resident who did not read them said, “We were not given reading assignments prior to the lecture, which would have made the experience better. Regardless, it was an enjoyable and beneficial lecture.” There were statistically significant differences in residents’ perceptions of the quality of the learning material based on the depth of their preparation (Figure 5). Residents who did not read any of the articles thought that the seminars were less enjoyable ($p=0.004$) and less effective ($p=0.0028$) than residents who thoroughly read at least some articles. Prepared residents reported a greater ability to learn from the seminars ($p=0.0014$) than those who did not read and also said they were more likely to use the seminars again in the future ($p=0.0025$).

Regarding a possible solution to this problem, interactive distance learning is meant to be an active learning process and not simply a passive, “television-watching” experience. Active learning can only be accomplished when the participants are prepared. Although postdoctoral students should be motivated enough to complete reading assignments without being told to by a superior, our findings show that the importance of adequate preparation needs to be further emphasized by local faculty members. When it is, our data indicate the experience will be more enjoyable and beneficial to the residents.

Pace of the recorded seminars. The seminars were recordings of actual Socratic-type seminars and were not scripted or practiced by the residents. As such, the recorded seminars were well-guided discussions, but many distant participants thought the pace was too slow. As one resident stated, “I think the discussion format is the most effective way of learning the material, but at the same time, not the most time-efficient, as there is a lot of dead-time in a discussion, waiting for pauses while people think about what they want to say.” Another distant resident said, “Too much time was spent waiting for the resident to walk over to the computer tablet and then draw. The professor should have the necessary diagrams prepared in order to keep the topic moving.” Despite minor frustration from residents “wanting to know the right answer and [waiting to] listen to people fish for answers,” most faculty members and residents thought it was more interesting and a better

![Figure 5. Relationship between resident preparation and satisfaction with the distance learning seminars](image-url)
learning experience to watch the interaction between the residents and faculty on the recorded seminar than it would be to just see a recorded lecture.

A difference between what some residents and faculty members thought the recordings would be and the reality of the recorded seminars most likely affected their acceptance. One resident “expected a Mosby review type seminar” and was surprised that “[the interactive distance learning experience] was excellent, but it was a lot more work than I thought it would be.” Another resident said, “I need short, concise material to study and not dedicate all that time to a lengthy video. . . . There’s just too much material and not enough time.” The degree of satisfaction with many experiences, of course, relates to how well it matches expectations. It is important for local faculty members to help residents understand what they should expect from the recorded seminars.

One of the virtues of seminar teaching is also a weakness: there is no way to know in advance exactly what is going to happen as the discussion develops, so it cannot be tightly scripted and what is unnecessary discussion for one participant is important for someone else. In a recorded seminar, however, it is important for the seminar leader to “keep it moving.” This can be facilitated by having an outline of the topics to be covered for the onsite residents. This does not cue the answers to questions, but rather indicates the overall and transitional direction of the discussion and should serve as a simple aid to keep live participants from drifting too far from the basic elements of the seminar and its goals. Presenting important information in a concise time period needs to be accomplished in future production.

**Post-seminar discussion.** The blended approach to distance education allows residents to watch the recorded seminars without the pressure of answering a question immediately, but the intent is that they will be challenged to interact with faculty members to discuss concepts further after viewing the recording. One resident stated, “The live discussions following the seminars were very helpful—both to make sure I understood key points and concepts and to keep me motivated to do all of the work for each session.” Almost all responding residents (92 percent) agreed that participating in live discussions with faculty members added to their understanding of the subject. One distant resident who participated in post-seminar discussions with the author of the seminar said, “I really enjoyed this way of learning and especially liked being able to speak with the professors who taught the course on the video conference after the video had finished.”

Interestingly, only 9 percent of the distant residents were given the option to participate in a discussion with the leader of the recorded seminar although this was available if requested. There was a $150 charge for the video conference to do this, and scheduling it could quickly become a problem. In general, the video conference with the original seminar leader was simply judged to be unnecessary. Local faculty members felt confident in their abilities to manage a discussion after viewing the recording.

The general agreement that the post-seminar discussion is valuable is further evidence that it should be taken seriously as part of this educational approach. Ideally, the group of distant residents should watch the recorded seminar together with a faculty member, and then the discussion should be held either immediately afterward or should begin (by pausing the recording) whenever a participant (resident or faculty member) feels there is a point for further discussion. The data show that this method, which we recommended, was used by approximately two-thirds of the participating schools. We suspect but do not know for sure that the residents who participated in this way got more out of the discussion than those who watched a recording on their own and discussed it later.

**Length of the seminars.** The recorded seminars and the post-seminar discussion were planned to take about ninety minutes, and several faculty respondents commented, “Ninety minutes is too long. . . . The material could have been covered more quickly.” Most clinical seminars in postdoctoral dental programs are scheduled for approximately sixty minutes, and some faculty respondents expressed the sentiment that “it was logistically difficult to use these seminars.” Some residents felt “there was too much time lag between the professor and the residents answering questions . . . and sometimes the lecture got off topic. Could these portions of the lecture be removed prior to posting on the web?” One resident recommended “breaking down each seminar into smaller chapters” as a way to maximize learning in the designated time each program has for seminars.

The flow and direction can be controlled on site by an outline. At the originating schools where interactive seminars are used for didactic subjects, one and one-half to two-hour sessions usually are scheduled. Almost everywhere, clinical seminars are scheduled for one hour. The recorded seminars
can and should be either one- or two-hour sessions, with a brief break in the two-hour sessions at the one-hour mark to make seminars more user-friendly. The post-seminar discussion time could be included in the second one-hour session, but splitting the seminar would favor distant discussion at chosen points by pausing the recording. This would give distant programs options to fit seminars into the available time when they do not have a two-hour slot.

**Use of visual aids within the recordings.** The use of slides, video clips, and drawings in the seminars varied greatly. Although multiple camera feeds of the seminar leader, residents, and visual aids were recorded during the seminar so that later editing could be done, only minimal editing was actually accomplished because of the cost. Most of the editing was done on the fly, with an emphasis on providing images of the seminar leader or resident who was speaking. The resulting videos were not as polished as broadcast TV, and both faculty members and residents commented on this. One faculty member stated that “more slides emphasizing key concepts and longer camera time on slides” would improve the quality of the recordings. One resident suggested improving the video by “splitting the [video] screen so one could see both the presenter and the presentation” at the same time; this had been planned but was done only occasionally. Another resident felt that “keeping the camera on the figures longer while being able to hear the lecturer would be great. . . . [There is] no real value to seeing the lecturer all the time. We just need to hear him, which we could, while seeing the figures being talked about.” Multiple residents echoed the sentiment that “we need less time staring at residents or faculty and more time on the slides. . . . The PowerPoint and major info slides are up and gone too quickly to take notes.” To some extent, of course, that reflects lack of preparation by the distant residents, but it is a legitimate concern that can be addressed in future production.

More effort should be placed on visually enhancing and more succinctly editing future seminar recordings. Visual images are helpful for many learners, and editing the video to provide adequate time to display slides and diagrams is important. A split video display between the speaker and slides would allow more screen time for more complex figures.

High-quality video editing equipment is now available for only a few thousand dollars, but using it significantly increases production costs because of the increased time commitment for both faculty and staff at the originating school. Realistic budgets that include more editing will be required for future high-quality productions.

**Technical Quality**

**Video and sound quality.** The advent of high-definition television has raised users’ expectations of image quality. Responding faculty members and residents agreed that the video clarity was acceptable, but both were less pleased with the sound quality. A number of open-ended comments were based on the quality of the visual image and sound quality, for example: “the format for learning worked well, although the quality of the visual materials presented was poor, likely due to limitations in bandwidth”; “it looks like it was filmed in 1985”; and “a low quality of video recording.”

Audio quality was a bigger problem. One faculty member said, “One must continually monitor the volume on the recording as the presenter and residents are not at the same volume, so you either don’t hear the residents or the seminar leader is a bit loud.” Both faculty members and residents stated the background noise related to use of microphones on the table (especially residents turning book pages and moving papers on the table) was sometimes “distracting to an obnoxious level.”

It is surprisingly difficult to obtain good quality audio while minimizing background noise. Multiple microphones on the table usually are part of the set-up for recording a seminar, but they pick up movement of anything on the table (papers, laptop computers, whatever) even better than the voices they are meant to record. It may be necessary to have individual microphones for each seminar participant to overcome this—which adds another layer of complexity and expense.

Video quality is easier to obtain, but wall-mounted cameras that automatically rotate to pick up individuals who are speaking are expensive and not completely reliable. Manual control of cameras from the recording area is better—yet this is another added expense. High-definition video cameras and recorders will be industry standard in the near future and should greatly improve video quality.

**Rewind/fast forward control.** Both responding faculty members and residents thought that having the capability to stop, rewind, and skip through sections of the seminar was extremely beneficial to the learning experience. Forty percent of the programs used this feature to further discuss concepts...
while watching the recorded seminar. One faculty member commented that the “sliding bar” to control what content should be skipped or emphasized was not exact enough: “[You need to] develop a way to move the video to more specific points, allowing intermittent discussion among viewers if they choose to do so.” Multiple residents agreed; one said, “Skipping ahead or rewinding was not very accurate. It seemed to jump too far ahead or behind and wasted more time trying to find an exact location in the lecture. It would be nice to have the lectures broken up into easy-to-find chapters.”

This is partly a problem of the recording equipment and partly a problem of the Internet connection. One of the virtues of the blended approach is that only an ordinary broadband connection, not high-speed Internet 2, is needed, but even minor transmission delays can affect the precision with which a specific point on the recording is selected. The better the Internet connection, the better the control, and vice versa. One possible solution is to subdivide the recording into sections; another is to have questions posed by the presenting faculty member appear above the minute marker of the video for quick reference.

Interactive Seminars in Current Perspective

Although the concept of the blended approach has been validated, it is clear that future production will need greater attention to technical and educational aspects to obtain better video and audio quality, better time management and more visual aids, and a better match between resident’s expectations and experiences. The development of a library of recorded seminars produced by multiple institutions is a current goal of the AAO-supported project from which this evaluation was derived.

Despite the problems outlined in this article, 70 percent of the participating residents said they wanted to use these seminars in preparing for their specialty board examination, and 92 percent thought the post-seminar discussion was an important part of the learning experience. Perhaps the bottom line is now that we have learned to manage distant interactive learning inexpensively, we need to invest a bit more in production to do it better.

REFERENCES