



Comparison between Video Podcasts and Traditional Learning in Osteoporosis for Orthopedic Resident Physicians During the COVID-19 Pandemic in Thailand

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Purpose: The coronavirus pandemic has posed challenges for medical education, including the loss of lecture hours. Resident physicians were offered video podcasts to compensate for the loss of lecture hours but without proven efficacy. This study aimed to investigate the effectiveness of video podcasts related to osteoporotic and metabolic bone diseases during residency training.

Methods: Orthopedic residents were voluntarily allocated to the video podcast or traditional group. Twenty-two video podcasts covering major topics in osteoporosis and metabolic bone diseases were developed by experts and offered to the podcast group. Each podcast was approximately 20-30 minutes long. Pre- and post-exposure examinations, comprising 60 multiple-choice questions, were conducted and compared. Confidence, perceived ability, and preferences were assessed using questionnaires.

Results: A total of 37 residents were recruited, 18 in the video group and 19 in the traditional group. With numerically lower pre-test scores ($47.59\% \pm 9.77\%$ in the video group, $53.95\% \pm 9.77\%$ in the traditional group, $p = 0.056$), students in the video group significantly outperformed the traditional group in the post-test ($89.81\% \pm 3.83\%$ and $76.93\% \pm 10.92\%$, $p < 0.001$). Junior residents watching videos scored higher than senior residents. Videos led to a greater gain in confidence and perceived ability. However, students still preferred live lectures to videos.

Conclusions: This study showed greater performance scores and confidence when using video podcasts, with junior residents improving more with podcasts. We suggest providing supplemental video podcasts in non-surgical-based subspecialties during the early training years as a supplement during the pandemic and a new normal residency training method.

Keywords: Video podcasts, e-learning, osteoporosis, metabolic bone disease, residency training, hybrid learning

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The coronavirus disease 2019 (COVID-19) emerged in 2019 and hastily became a global pandemic⁽¹⁾. To prevent the spread of the virus, lockdowns, social distancing, and quarantine facilities were put in place in various countries. Notably, traditional teaching in clinical medical education involves classroom lectures, textbook and article reading, case discussions, outpatient care, and ward work. However, COVID-19 restrictions discouraged face-to-face lectures. Apart

from this, the number of outpatients was also limited. With fewer lectures and reduced caseloads, medical education became highly challenged⁽²⁾. To compensate for the hampered learning experience, supplemental video podcasts have been offered for training physicians.

Theoretically, video podcast episodes offer various benefits. Videos allow students to watch lectures at any time and place. These recordings can also be replayed and repeated, making them useful for better understanding^(3,4). Students also save time traveling to attend classes⁽⁵⁾. Moreover, they can adjust the speed of the lesson proceeds⁽⁶⁾. However, without strict attendance rules, students are required to be more self-disciplined and may need more motivation⁽⁷⁾. Furthermore, they might feel less connected to instructors and peers.

The effectiveness of video lectures compared with face-to-face lectures is still debated. Paegle⁽⁸⁾ and Schreiber et al.⁽⁹⁾ found no differences in the test scores of medical students attending classic and video lectures. The participants, however, felt that they learned more from traditional classroom lectures and preferred them to video lectures. In addition, a study by Ramlogan et al.⁽¹⁰⁾ found that participants in the video group scored less in an examination than the live group but also found improvement in their clinical ability.

Currently, available studies on video lectures are generally based on short lessons and focus only on short, specific topics. Previous studies have primarily involved undergraduate students. According to Barteit et al.⁽¹¹⁾, only 2% of the participants involved in research on this subject were residents, whereas 72% were medical students.

Our study aimed to address this knowledge gap by evaluating the effectiveness of a whole module of video podcasts in osteoporosis and metabolic bone disease (MBD), delivered online to orthopedic residents, and its preference compared with traditional learning modules.

METHODS

A quasi-experimental design was used to compare the effects of video podcasts and traditional learning systems on orthopedic residents.

Sample recruitment and allocation

Upon approval of the Research Ethics Board (omitted for review purposes), orthopedic residents at the hospital were notified of the study. As training related to osteoporosis and MBD had previously not been incorporated into the curriculum, and residents had not received formal teaching on these topics, all residents, regardless of training experience, were invited. The participants voluntarily allocated themselves to either the video or the traditional group.

Pre-exposure assessment

Following the allocation, a pre-exposure test was conducted to assess baseline knowledge. Participants were given 60 minutes to complete 60-item multiple-choice questions measuring their knowledge of osteoporosis and MBD. The test was designed by four course-specialist instructors to include recall, analytic, and application competencies stemming from the videos and lecture notes given to participants. It was then evaluated and revised by three independent experts. After the test was completed, the participants were asked to rate their confidence and clinical ability in managing patients with osteoporosis and MBD on a scale of 0-5, where 0 is "very poor" and 5 is "very well." All participants underwent a pre-exposure examination at the same time to avoid instrumental bias due to leaked examinations. Three proctors were employed for this examination.

Learning resources

Video Group

The video podcast consisted of a Microsoft™ PowerPoint slideshow accompanied by recorded audio. The whole module comprised 22 video podcasts, each of 20-30 minutes duration, discussing integrative and holistic management of primary and secondary osteoporosis, sarcopenia, MBD, fracture liaison service (FLS), and patient optimization for surgery. The videos were carefully prepared by four instructors at the institute to be appropriate for orthopedic residents. Each podcast was evaluated by three independent experts. Once finalized, they were uploaded to cloud storage, where they could be accessed at any time from any

computer, tablet, or mobile phone. There were no restrictions on the number of pauses or plays. Each participant in the video group was provided with a username and password to access the videos. They were given one month to review all the material provided.

Traditional Group

In the traditional group, the participants were given study materials, including articles and lecture notes on related topics, with a reading list. The participants were also given one month to review all the material.

Both groups participated in a weekly grand round, 2-hour case-based small group discussion, outpatient sessions, and daily ward rounds. They were also given opportunities to ask questions about topics during face-to-face contact and on social media. All participants were allowed to search freely for relevant articles or reading material as a learning aid.

Post-exposure assessment and preference evaluation

After one month, another examination was conducted to assess the efficacy of both groups, using identical questions arranged in different orders. A self-assessment questionnaire was administered to evaluate confidence and perceived clinical abilities. Additionally, another questionnaire was administered to investigate students' preference if traditional classroom lectures were to be replaced completely with video podcasts. This was assessed using a 6-point bipolar rating scale, where 0 is "video very much preferred," and 6 is "live lecture very much preferred."

Statistical analysis

Pre- and post-exposure assessments and improvement in performance scores were compared within and among the groups using the t-test. Subgroup analysis was performed to compare junior (Years 1 and 2) and senior physicians (Years 3 and 4). The self-assessment scores were also compared using the same statistics. Preference for each learning resource is shown as the mean \pm SD. Statistical significance was set at $P < 0.05$.

RESULTS

Participants

Notifications about candidate recruitment were delivered to 39 orthopedic residents (*omitted for review purposes*). Of the 37 physicians who agreed to participate, 18 (48.6%) were allocated to the video group and 19 (51.4%) to the traditional group. The details of the participants, according to their training experience, are shown in [Table 1](#). All participants completed the pre- and post-exposure tests, self-evaluation assessments, and a preference questionnaire.

Table 1 Participants' training experience.

Year	Video podcast (n=18)	Traditional learning (n=19)
1	9	1
2	4	6
3	3	6
4	2	6

Performance score

Before the course, the performance scores of the video group were not statistically inferior to those of the traditional group ($47.59\% \pm 9.77\%$ in the video podcast group and $53.95\% \pm 9.77\%$ in the traditional group, $p = 0.056$). However, the post-exposure performance scores differed significantly ($89.81\% \pm 3.83\%$ in the video podcast group and $76.93\% \pm 10.92\%$ in the traditional group, $p < 0.001$). A comparison of the two groups showed that the mean scores increased more in the video group ($42.22\% \pm 10.13\%$ in the video group and $22.98\% \pm 11.37\%$ in the traditional group, $p < 0.001$). The performance scores of the groups are listed in [Table 2](#).

When comparing training experience, junior residents scored better than seniors in the post-exposure evaluation ($91.03\% \pm 3.57\%$ in junior residents and $86.67\% \pm 2.64\%$ in senior residents, $p = 0.025$) in the video podcast group. Despite the numerical difference, the improvement in scores did not differ significantly between the junior and senior residents in the video podcast group. However, this was not observed in the traditional group. [Table 3](#) compares the performance scores of junior and senior residents.

Table 2 MCQ results of the video and traditional groups.

Examination	Group		p-value
	Video podcast (n=18) Mean ± SD	Traditional learning (n=19) Mean ± SD	
Pre-exposure	47.59 ± 9.77	53.95 ± 9.77	0.056
Post-exposure	89.81 ± 3.83	76.93 ± 10.92	<0.001
Improvement	42.22 ± 10.13	22.98 ± 11.37	<0.001

Table 3 Subgroup analysis of MCQ results by years of experience.

Group	Examination	Junior (n=13)	Senior (n=5)	p-value
		Mean ± SD	Mean ± SD	
Video podcast	Pre-exposure	47.56 ± 10.77	47.67 ± 7.60	0.985
	Post-exposure	91.03 ± 3.57	86.67 ± 2.64	0.025
	Improvement	43.46 ± 11.23	39.00 ± 6.30	0.419
Traditional	Pre-exposure	56.67 ± 13.02	52.36 ± 7.50	0.369
	Post-exposure	79.05 ± 11.94	75.69 ± 10.62	0.534
	Improvement	22.38 ± 11.01	23.33 ± 12.04	0.866

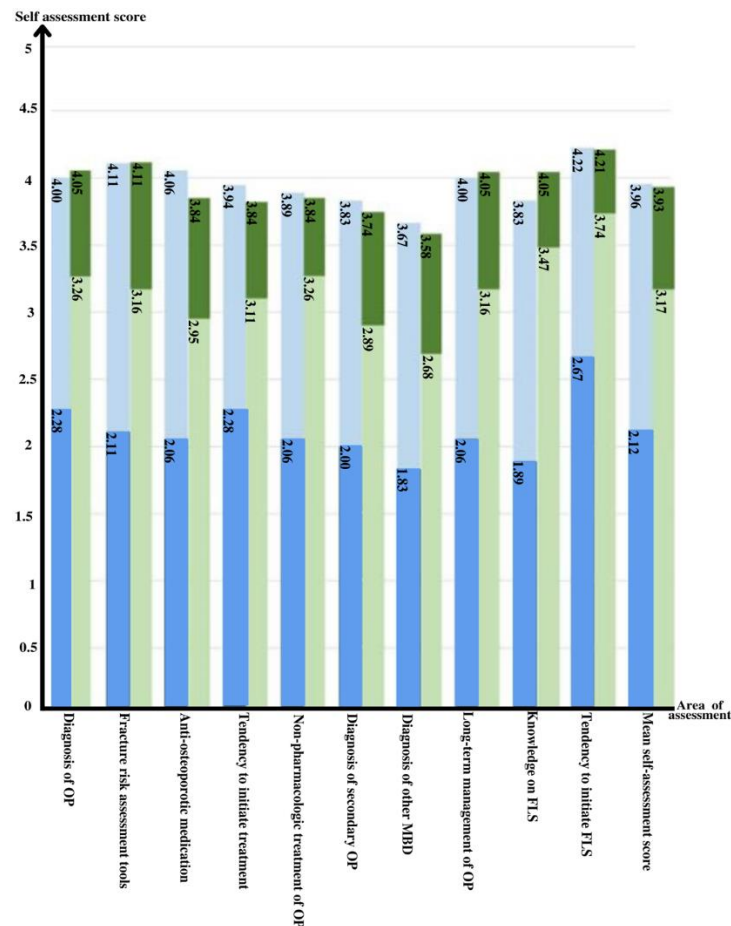


Fig. 1. Pre- and post-exposure confidence and perceived clinical ability.

■ Video group's pre-exposure score
 ■ Video group's post-exposure score
 ■ Traditional group's pre-exposure score
 ■ Traditional group's post-exposure score
 OP = Osteoporosis, MBD = Metabolic Bone disease, FLS = Fracture Liaison Service

Self-assessment score

Pre-exposure self-assessment questionnaire showed less overall confidence in the video group (overall score = 2.12 ± 1.22 in the video podcast group and 3.17 ± 0.82 in the traditional group, $p = 0.004$). Despite no significant difference detected in post-exposure self-assessed scores, improvement in confidence and perceived ability was more pronounced in the video podcast group on all aspects taught (overall self-assessment improvement = 1.83 ± 1.26 in the video group and 0.76 ± 0.61 in the traditional group, $p = 0.002$, $p < 0.05$ in all aspects evaluated).

Students' preference for video podcasts and live lectures

When asked to rate whether they would prefer a course of entirely video podcasts or entirely live lectures, the participants preferred live lectures more. Overall, the mean rating was 3.66 ± 1.15 , indicating a greater preference for live lectures. There was an inclination toward live lectures in all the aspects investigated. The overall scores did not differ between the groups.

DISCUSSION

COVID-19, a newly emerging coronavirus disease, has caused a global pandemic⁽¹⁾. In early 2020, a strict lockdown was enforced in many countries worldwide, including Thailand. As a result, classroom teaching was canceled in countless institutions. Medical education was profoundly affected especially undergraduate clinical year study and residency training. Grand rounds were canceled to avoid crowding and gatherings in poorly ventilated areas. Ward rounds were performed only by the residents on duty. Elective surgeries were performed with unplanned postponements⁽¹²⁾. The outpatient department also restricted the number of patient visits per day and encouraged medical home delivery in chronic cases, including for patients with osteoporosis and MBD. Resources and workforce were reallocated to respiratory clinics and wards. Several months later, as the situation gradually improved, ward rounds and small-group discussions were allowed. However, classroom lectures have been discouraged. As

the outbreak would take a long time to control, concerns arose regarding the expertise of training physicians. To compensate for the loss of lecture hours, our department created video podcasts for residents to study in their self-directed learning periods.

The effectiveness of video podcasts compared with traditional learning has always been debated. Consistent with previous studies, our results show a significant improvement in performance scores in residents with supplemental video podcasts⁽¹³⁻¹⁷⁾. We also found that students in the video group perceived that their knowledge and clinical ability had improved. Video podcasts provide many tangible advantages, including the ability to pause and replay, schedule flexibility, convenience, and easy access⁽¹⁸⁻²⁰⁾. From a pedagogical standpoint, successful learning using multimedia, dual channels, understanding limited capacity, and active processing is key⁽⁹⁾. By displaying Microsoft™ PowerPoint slides, accompanied by the instructor's voice, both auditory and visual learning was stimulated. Because learning capacity is limited, pausing and repeating podcasts can aid learning. Lastly, students may recall, integrate knowledge, summarize, and take notes after pausing or watching podcast episodes, allowing for active processing.

Conversely, Brockfeld et al.⁽²¹⁾ found no difference in performance between video and live lectures given simultaneously in adjacent halls for 41 four-hour lessons. In this study, students were not allowed to repeat or pause the video and the schedule was fixed, thereby obviating the benefits of videos. Moreover, the duration of each lesson was long. Pi⁽²²⁾ suggested that students reached maximal fatigue at 22 minutes, and video podcasts should not be much longer. Podcasts of 30 minutes or less were found to be preferred by medical students⁽²³⁾. Therefore, we limited the duration of video podcasts to 20-30 minutes, which was approximately the same as the duration of classroom lectures in our institution.

Junior residents tended to improve more in the examination than seniors and performed better in the post-exposure examination. This can be explained by the juniors' lower obligation and

greater interest in non-surgical knowledge. Generally, orthopedic residency training in Thailand takes four years. During the first two years, residents are given more time to read textbooks and articles on general orthopedic knowledge, conditions, and trauma. The last two years have been dedicated to complex conditions related to each subspecialty and surgical skill training. Senior residents also bear more responsibilities as team leaders. As a result, they probably had less time to study and review the materials from the videos. In contrast to other subspecialties, osteoporosis and the MBD module place more emphasis on lectures, readings, and case-based discussions than on improving specialized surgical skills. Owing to the non-surgical nature of the module, prerecorded video podcasts on core knowledge of osteoporosis and MBD can be added to the juniors' curriculum not only during the pandemic but also in the post-pandemic period in order to provide flexibility for students while minimizing classroom lectures and allocating more face-to-face sessions to clinical application.

Online learning methods can be divided into synchronous and asynchronous learning methods. Video podcast episodes in our study were asynchronous, in which the interaction between students and instructors was not instantaneous⁽²⁴⁾. While asynchronous learning offers flexibility for both students and instructors to participate in their own suitable time, the main disadvantage of asynchronous learning is the lack of an immediate response and explanation of difficult and incomprehensible topics. Therefore, students might have had a hard time trying to understand the lessons on their own. They may feel less engaged and connected. With no strict schedule, students require more discipline to complete all lessons on time.

When asked to rate the entire replacement of classroom lectures with videos, the residents indicated a slight preference for live lectures over video podcasts. One possible explanation is that Asians are relation-oriented, and the presence of instructors and peers is more reassuring⁽²⁵⁾. There is less two-way communication, live patient demon-

stration, and recognizable clinical applications in video podcasts, making them less engaging. As a result, students may require more motivation to complete the module. Indeed, videos have been suggested to supplement traditional learning to create hybrid learning and not replace it.

Hybrid learning, which includes both traditional learning and videos, has proven beneficial. Kim et al. conducted a study of 4th-year medical students rotating in radiation oncology during the COVID-19 pandemic, in which students were required to watch one prerecorded video lecture before the case discussion the next day⁽²⁶⁾. All students watched the video before coming to class. Students' motivation and satisfaction were high. A study of Malaysian postgraduates in medical physics found that internet-based video recording was a flexible way to help students better understand the topics and was beneficial. However, a shift from face-to-face activities to complete online learning would lead to a loss of motivation and focus, as well as clinical experience and laboratory skills⁽²⁴⁾. The author concluded that e-learning activities, including online video prerecords, complemented traditional classroom activities. Videos can effectively prepare students with basic knowledge before attending face-to-face discussions, ward rounds, or outpatient sessions, allowing them to study in their free time. In contrast, clinical applications can be taught face-to-face during case-based discussions or clinical settings. This strategy will not only help students to be more prepared for clinical sessions and discussions but might also save time during classes, as they can be more focused on clinical aspects and applications. Another possibility to utilize the advantage of videos is during intense preparation for knowledge-based examinations when students spend long hours reviewing on their own at their own speed to maximize knowledge gain and retention. Afterward, they can discuss with their peers and instructors during face-to-face classes to better understand and apply their knowledge.

To the best of our knowledge, this is the first experimental study covering a whole module of a complex and specific subspecialty performed by resident physicians. The strengths of this study

include the considerably large number of video podcasts and topics covered, optimal duration of videos, presence of a control group, and pre-exposure assessment. The limitations of this study were that it was subject to observation bias and possible selection bias because the participants would have voluntarily chosen a learning style that they deemed more effective for them. The presence of a pre-exposure test primed the participants. The sample size was small. The examination in this study was in the “knows” and “knows how” levels of Miller’s pyramid of assessment⁽²⁷⁾. Therefore, post-test scores may not reflect learners’ true competency. Adding a greater variety of assessments to evaluate a higher level of competency (“shows how” and “does”) would be helpful and is an interesting area for further studies. Trials involving more participants and other subspecialties are warranted. Furthermore, future experiments involving videos of surgical skills may provide a more comprehensive understanding of resident education. The video podcasts used in this study did not include pictures or videos of instructors. Adding videos of the instructors to the screen might be more student-friendly and reassuring for Asian students who are relation-oriented and is of interest for future research.

CONCLUSION

Orthopedic residents achieved not only better knowledge performance when supplemented with video podcasts but also greater confidence and perceived ability. Junior residents benefitted more than seniors, with higher post-test scores. However, resident physicians prefer live lectures to video podcasts. Therefore, we suggest providing video podcasts during the early years as a supplement for new-normal residency training during and after the pandemic.

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