Effect of Implementing Instructional Videos in a Physical Examination Course

An Alternative Paradigm for Chiropractic Physical Examination Teaching

Niu Zhang, MD, MS, and **Sudeep Chawla**, BS, Palmer College of Chiropractic Florida

Objective: This study examined the effect of implementing instructional video in ophthalmic physical examination teaching on chiropractic students' laboratory physical examination skills and written test results. **Methods:** Instructional video clips of ophthalmic physical examination, consisting of both standard procedures and common mistakes, were created and used for laboratory teaching. The video clips were also available for student review after class. Students' laboratory skills and written test results were analyzed and compared using one-way analysis of variance (ANOVA) and post hoc multiple comparison tests among three study cohorts: the comparison cohort who did not utilize the instructional videos as a tool, the standard video cohort who viewed only the standard procedure of video clips, and the mistake-referenced video cohort who viewed video clips containing both standard procedure and common mistakes. **Results:** One-way ANOVA suggested a significant difference of lab results among the three cohorts. Post hoc multiple comparisons further revealed that the mean scores of both video cohorts were significantly higher than that of the comparison cohort ($p < .001$). There was, however, no significant difference of the mean scores between the two video cohorts ($p > .05$). However, the percentage of students having a perfect score was the highest in the mistake-referenced video cohort. There was no significant difference of written test scores among all three cohorts ($p > .05$). **Conclusion:** The instructional video of the standard procedure improves chiropractic students' ophthalmic physical examination skills, which may be further enhanced by implementing a mistake-referenced instructional video. (J Chiropr Educ 2012;26(1):40–46)

Key Indexing Terms: Association Learning; Chiropractic; Instructional Films and Videos; Physical Examination

INTRODUCTION

Physical examinations (PEs) are basic objective competencies of clinical skills conducted by medical and other health care professionals.[1] Chiropractors, like other health care professions, whose clinical specialty is to detect and diagnose musculoskeletal and nervous system problems, heavily rely on the ability to accurately perform and interpret PEs. Recent studies conducted in the medical profession have shown an increasing awareness of the deficiency of medical students in their performance of basic PE protocols. One study showed a deficiency in performing basic ophthalmoscope examinations,[2] while another suggested poor detection and knowledge of thyroid examinations.[3] A survey of medical students, interns, and residents portrayed that only a minority considered themselves "skilled" in conducting a thorough PE.[4] This study also revealed that competence rates remained static even with more years of training. Unfortunately, similar studies are scarce in the chiropractic educational literature. However, the perceptions of PE insufficiencies by chiropractic students do exist.[5] Therefore, effective PE teaching presents a challenge for faculty at chiropractic schools.

Traditionally, the teaching of PEs to chiropractic students at chiropractic colleges is similar to that of medical colleges using lectures, demonstration, and peer interaction from the beginning of the curriculum. Perhaps peer interaction is the most

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common method used in PE laboratory teaching. The advantage of early peer interaction is that it provides alternative methods of enhancing students' clinical skills, increases student communication, and uses peer interaction as a valid assessment of clinical skill before encountering patients. Nonetheless, there may be uncomfortable experiences among small groups of students[6] as well as other ethical issues.[7] Some studies suggest that traditional methods for teaching PEs do not produce competent results.[8]

With the development of cutting-edge technology, innovative educational intervention has been undertaken at many medical schools to strengthen students' performance on PEs.[9] Some studies show positive outcomes of improved clinical PE skills as a result of implementing innovative technologies.[10] Nevertheless, we found no similar studies about implementing innovative methods in classrooms of chiropractic colleges.

At the authors' institution, the PE instructors are experiencing significant challenges in teaching students to conduct proper physical exams. These challenges include (1) a diverse faculty body (MD, DC, PhD, and DP) and (2) a limited budget for developing and acquiring innovative educational technology. A diverse faculty may prevent students from learning a consistent, uniform, and standard PE protocol due to the wide range of teaching styles and variety of techniques.

In order to improve the quality, consistency, and efficiency of teaching PEs, we conducted a diagnostic survey asking previous students, based on prior experience, their opinion on chiropractic PE courses. The survey examined the most common difficulty they encountered just preceding an impending objective structured clinical examination (OSCE) and what educational tools would have been helpful to strengthen their performance on conducting a PE OSCE (data unpublished). The first question had the following possibilities: (1) feeling anxious, (2) working with others, or (3) reporting the results in a respective amount of time. The highest percentage of choice was "feeling anxious" (71.4%). The second question had the following possibilities: (1) more practice, (2) more lecture, (3) instructional videos, or (4) a small group study session. The highest percentage of choice was "instructional videos" (65.7%).

Based on feedback from the survey, we thought the implementation of an instructional video in PE classes might minimize the inconsistency of PE teaching and help students in mastering PE skills. We developed instructional video clips containing both standard procedures and mistake-referenced video vignettes in ophthalmic PE instruction. The objectives of this study were to measure the effectiveness of using instructional standard and/or mistake-referenced videos and to compare the outcomes of students' laboratory PE performance as well as classroom written examination. We hypothesized that this program would enhance students' ophthalmic PE skills and their written test results when assessing them at the end of the class. Also, we anticipated this paper would add a piece of evidence to the current literature of chiropractic PE teaching, with the hope to inspire other faculty members to perform a similar study.

METHODS

Study Participants

A convenience sample of 191 students in the 3rd quarter of a 13-quarter curriculum across several different academic terms participated in the study and were assigned randomly into three cohorts based on the classes. Sixty-two students represented the comparison cohort who did not view any videos. Seventy-six students were assigned to the standard video cohort viewing videos of standard procedures of ophthalmic PE. The remaining 53 students were assigned to the mistake-referenced video cohort, who viewed both standard procedures and the mistake-referenced videos. During the lab, these students were asked to identify the mistakes made in the videos after watching them. The Institutional Review Board of Palmer College of Chiropractic granted this study an exemption from formal review.

The demographics of the students were similar among the three cohorts, including age, gender, and main academic requirements for admission (Table 1). The teaching ophthalmic PE was conducted by the same instructor and there were limited discrepancies among classroom time and teaching materials in all three cohorts.

Instructional Video Clips

We created 21 short instructional video clips based on teaching objectives of the ophthalmic PE. The checklist for the instructional video is included in Figure 1. The duration of each video clip was from

Table 1. Demographic information of participants

Demographic	Standard (%)	Mistake-Referenced (%)	Comparison (%)
Gender			
Male	63.64	69.24	72.58
Female	36.36	30.76	27.42
Age			
20–30	92.20	86.54	83.87
>30	7.80	13.46	16.13
Race			
Caucasian	72.73	90.40	77.43
Hispanic	11.69	5.76	8.06
African American	9.09	1.92	6.45
Other	6.49	1.92	8.06
Degree			
Bachelor only	94.81	94.23	96.77
Master or PhD	5.19	5.77	3.23

30 to 120 seconds. At the beginning of each video, the names and purposes of the examination were introduced, followed by the specific examinations that were performed in a step-by- step fashion. The videos included two parts: (1) PE textbook standard procedures of performing an ophthalmic PE and (2) common mistakes while performing the ophthalmic PEs. In order to get an idea of common mistakes while performing ophthalmic PEs, we utilized evidence-based processes which included mistakes made by our prior students and a literature review of common mistakes made by medical students performing an ophthalmic PE. The videos were displayed to other PE faculty members and a consensus was reached before creating a final edition. These video clips were shown in corresponding ophthalmic PE class sessions. The different parts of the videos were used in different cohorts. They were also available for students to review after classes.

Evaluation and Data Analysis

Before the end of the ophthalmic PE course, all students were expected to perform a complete ophthalmic PE OSCE, created by a standardized procedure, and then undergo a written multiple-choice examination during corresponding lecture hours. There were two assessments of the practical: (1) the mean scores based on a 15-item PE checklist (Fig. 1) and (2) the percentage of those students who had perfect scores. One-way analysis of variance (ANOVA) was performed to explore the significance among the cohorts, followed by post hoc comparison with Bonferroni correction to explore if there was a significant difference between any cohorts. Statistics were performed using SPSS 15.0 software (SPSS Inc, Chicago, IL).

RESULTS

The one-way ANOVA suggested that the mean scores based on the checklist of ophthalmic PE laboratory practical had statistical significance for at least two of the three cohorts ($p < .001$). The comparisons of mean scores among the three cohorts showed statistically significant higher mean scores for students who were in both the standard video and mistake-referenced video cohorts than for those in the comparison cohort ($p < .001$, Table 2). We also noticed that the scores of students in the comparison cohort portrayed a larger range of standard deviation in comparison with that in both video cohorts (Table 2).

When comparing the mean scores based on the checklist of ophthalmic PE laboratory practical between both video cohorts, although the mean score was higher in the mistake-referenced video cohort than that in the standard cohort, there was no sufficient evidence to indicate that the mean scores for the mistake-referenced video cohort differed from the mean scores of the standard video cohort ($p >$ .05, Table 2).

S	US	ND	
			Look at the alignment of the eyebrows.
			Inspect the eyelashes and eyebrows: the quantity and the distribution of hairs, the direction of the eyelashes.
			Inspect the eyelids: edema and dropping.
			Inspect the conjunctiva and the sclera: discoloration and discharge.
			Inspect pupil and iris: size, shape, discoloration, and lesion.
			Inspect and palpate the lacrimal apparatus: edema and pain.
			Assess the visual acuity using the Snellen chart [CN II].
			Assess the cardinal fields of gaze (visual field).
			Test the extraocular eye movements [CN III, IV,VI].
			Perform the cover-uncover test looking for strabismus.
			Test the pupillary and convergence responses to accommodation [CN II and III].
			Perform the corneal light reflection looking for asymmetry.
			Test the pupillary response to direct light [CN II and III].
			Test the pupillary response to indirect light [CN II and III].
			Perform an ophthalmoscopic examination: • having dimmed the lights • after instructing the patient to focus on an object over your shoulder • red reflex • lens • vessels • optic disc, physiologic cup • retinal surfaces including macula and fovea centralization

S = Satisfactory, US = Unsatisfactory, ND = Not Done.

Figure 1. Ophthalmic physical examination checklist.

We further calculated the percentage of students who received perfect scores on their practical (which indicates the accuracy of performing PE). The mistake-referenced video cohort had the highest percentage of students (91%), followed by the standard video cohort (80%) and then the comparison cohort (70%).

The one-way ANOVA for the classroom written test did not show sufficient evidence to indicate that the mean scores differed among all three cohorts ($p > .05$). Nonetheless, the students in the mistake-referenced cohort performed the best when compared with the standard video cohort and the comparison cohort (Table 3).

DISCUSSION

To our knowledge, this is the first study to explore the influence of instructional video on PE instruction at a chiropractic college. It is noteworthy to mention that the chiropractic health care profession, like medical and other health care professions, understands that performing PE is a cornerstone of the first part of clinical skills, because inaccurate PE can place patients at risk who may be insufficiently diagnosed and/or misdiagnosed. Therefore, it is imperative for faculty of chiropractic schools to develop the most effective teaching model to train chiropractic students in their PE skills. It is not

Table 2. Range and mean ± SD scores of lab practical based on PE checklist

Cohorts	Range	Mean ± SD	*p* Value
Comparison (C)	17.5–20	19.49 ± 0.83	C vs. S: <.001; C vs. M: <.001
Standard (S)	18–20	19.91 ± 0.28	S vs. C: <.001; S vs. M: >.05
Mistake-referenced (M)	18.5–20	19.93 ± 0.24	M vs. C: <.001; M vs. S: >.05

overstating that PE skill is one of the most important objectives for prospective doctors during their school years. Surprisingly, chiropractic educational PE studies are scarce, especially when compared with the numerous studies published by medical schools and other health care professions. It seems our colleagues take comfort in the current situation of PE education and do not try even to communicate this topic. We believe it is imperative for chiropractic faculty to evaluate and assess the quality, efficiency, and consistency of PE instruction in order to develop more advanced teaching methods to teach students. We hope this article can shed a light on this awareness and may create more discussions on chiropractic educational PE studies in future.

In the current study, the influence of educational videos on ophthalmic PE teaching was evaluated. We found overall that implementing the educational video would improve students' lab performance on ophthalmic PE. Many studies by other health care professions have demonstrated positive and significant benefit in students' performance on PE after implementing a video-based curriculum.[11,12] In our study, we feel that part of the reasons for the effectiveness of these educational videos is that these videos demonstrate complex procedures and skills and show the actual situation of events that would not be adequately represented through lectures only. When we delivered these videos in lab sessions, we used "stop," "play back," and "repeat" functions to emphasize complex and key procedures of correct ophthalmic PEs. Students appreciate this approach, which adds visual cues in their learning.

Another benefit of implementing instructional videos is that this approach can minimize the variance inherent in PE from class to class and from individual to individual, which is commonly seen in teaching PE. This was manifested in our study, in that the standard deviations of the scores of both video cohorts were less than that of the comparison cohort. Also, the finding of the highest percentage of perfect performance in video cohorts, especially the mistake-referenced cohort, might be relevant. Our study suggests that by applying the instructional videos, students' performances are more uniform and the discrepancies are reduced.

The last benefit of utilizing instructional video is that students can practice independently outside of class and view the procedures performed correctly, especially before the lab practical. This may be the reason that the video cohorts had higher scores than the comparison cohort. Students often find it difficult practicing PEs with limited lab time. Conversely, the lack of reference materials hinders the willingness of students to practice after lab time. We made the instructional videos available for students after lab time. This provided an effective alternative for students to view and practice on their own, especially before their PE class and practical.

A unique aspect of this study is that the instructional videos did not only include the standard procedures but also the potential mistakes. The positive results of this study suggest that the mistake-referenced video can further enhance students' ability on conducting thorough and accurate PEs.

Table 3. Range and mean ± SD scores of classroom written examination

Cohorts	Range	Mean ± SD[a]	*p* Value
Comparison (C)	40–80	64.18 ± 10.62	C vs. S: >.05; C vs. M: >.05
Standard (S)	40–80	65.45 ± 8.71	S vs. C: >.05; S vs. M: >.05
Mistake-referenced (M)	50–80	68.64 ± 10.60	M vs. C: >.05; M vs. S: >.05

[a] 80 being 100%.

When students watched the mistake-referenced videos, they were requested to identify the mistakes embedded in the videos. They would then compare the mistake-referenced videos with the standard procedures. This process may explain why the highest percentage of students with perfect performance was in the mistake-referenced video cohort. One of the benefits of mistake-referenced videos is that utilizing real mistakes made by prior students acted as reminders for current students to minimize their chances of making potential similar mistakes during the PE. Students in the mistake-referenced cohort expressed that they had a clearer understanding and could precisely conduct the PE after knowing the potential mistakes that might occur while practicing the PE.

The mistake-referenced videos and standard procedure videos could also be used as a tool for self-evaluation, which is very effective for students when it comes to categorically depicting mistakes that they are not aware that they may be making. This allows students to visualize and describe mistakes, making it easier for students to understand and remember them in the future. Subsequently, after viewing these videos, students are able to transfer and apply their understanding, constructing a firm mental presentation of how the PE should be performed. Accordingly, this helps students to avoid possible errors and gives them further confidence to overcome anxiety on their next performance.

It should be reiterated that instructional videos for PE performance did not have a significant impact on students' written multiple-choice exam scores. Therefore, the video-based instruction is not recommended as method for improving written examinations.

LIMITATIONS

We acknowledge several limitations to our study. First, this video-based tool was only implemented at one chiropractic college. Since our school exhibits a unique curriculum, there may be limited applicability in comparison to other chiropractic college curricula.

Also, although our study used a prospective design, the students assigned into different cohorts were based on the matriculating classes. Nonetheless, students assigned to each class were random, and the selection of which class to which cohort was random. The demographic information and academic performance among the three cohorts were comparable. The reason we used this approach was to treat each student in each class equally. However, a prospective, randomized, controlled study design may more accurately reveal the effects of our innovative intervention.

Another limitation is the study duration. The current study assessed the influence of instructional video in a relatively short period of time (3 months). It is unclear at this point how well students can retain acquired skills and knowledge over a longer duration. It may be worthwhile to perform a follow-up study in the future.

Last, we acknowledge that the students with improved ophthalmic PE performance in our study may portray different results conducting other PEs. There have been no studies of other PE assessments, such as an orthopaedic PE, which requires not only the standard procedure, but also personal hands-on experience. In these PEs, the influence of video instruction may be limited. Further research would be beneficial in examining courses, noting if any intervention is sustained throughout.

CONCLUSION

This study suggests that utilizing instructional videos for ophthalmic PE teaching had a positive impact on students' lab performance. The mistake-referenced video can further enhance students' ability to accurately perform ophthalmic PE.

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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About the Authors

Niu Zhang is an Associate Professor and Sudeep Chawla is a student at Palmer College of Chiropractic Florida. Address correspondence to Niu Zhang, Palmer College of Chiropractic Florida, 4777 City Center Parkway, Port Orange, FL 32129 (e-mail: niu.zhang@palmer.edu). This article was received April 20, 2011, revised August 1, 2011, and accepted September 11, 2011.

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