An Randomised Interventional Study Investigating the Effect of Video Feedback by Mini-Clinical Evaluation Exercise (Mini-CEX) Method Compared to Conventional Directly Observed Feedback Method by Mini-Clinical Evaluation Exercise (Mini-CEX) on Final Year Medical (Internship Year) Students' Clinical Competence in Shiraz University of Medical Sciences, Iran

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Abstract

Introduction:

Video feedback (VF) patient encounter is a novel approach that has been developed, which involves videotaping doctor-patient consultations and subsequently an assessor watching the consultation and providing feedback. The aim of our study is to evaluate the effect of mini-CEX by video feedback method on the clinical competency of final year medical (internship year) students in Shiraz University of Medical Sciences, Iran.

Methods:

Our study is a prospective randomized, controlled double-blinded interventional study which involves a total of 40 internship year students of Shiraz University of Medical Sciences. The 40 participants were then assessed using OSLER checklist in order to ascertain baseline clinical competency (OSLER1). The 40 participants were randomly allocated to two groups of 20 students each, a control group who underwent traditional directly observed Mini-CEX feedback and an intervention group who underwent video Mini-CEX feedback. Following the participation of interns in the feedback workshops, a post-intervention assessment of clinical competency was undertaken (OSLER 2). This interventional trial is registered in the ISRCTN Registry [ISRCTN47543844] (16/02/2022).

Results:

The mean age of participants in the video feedback group was 24.8 years compared to 24.9 years in the traditional directly observed feedback group ($p=0.687$). There was no significant difference between the mean number of months students had completed of their internship year (final year) studies ($p=0.906$). Comparison between the OSLER 1 and OSLER 2 score of the Video Feedback group showed there was a significant improvement of OSLER 2 scores ($p<0.001$). The mean difference between the OSLER 1 and OSLER 2 scores in the Video Feedback group was 18.6 compared to a mean difference score of 2.4 in the traditional directly observed feedback group ($p<0.001$).

Discussion:

Mini-CEX is an effective tool in improving clinical and communication skills when conducted by either the traditional method or by video feedback. However, the use of mini-CEX in combination with video feedback methods significantly improved the clinical and communication skills competency of internship year students in comparison to traditional directly observed feedback methods.

Conclusion:

Our results demonstrate that video Feedback more effective in improving clinical skills competency learning among medical students. Therefore, greater use of video feedback based formative assessments (mini-CEX) for medical students' clinical and communication skills is recommended.

Introduction

Medical education is a process that requires a variety of assessment methods that measure the skills, attitudes and knowledge of medical students to ensure that competencies expected of future practicing medical professionals are attained.

Medical assessments that are used in medical programs can be divided into 2 types of assessments, which are; summative and formative(1). Summative assessments evaluate a student's progress and evaluate the progression of the student at the different stages of the medical course, for example Written Examinations or OSCEs. On the other hand, formative assessments provide feedback and improve the learning behavior of the students. Typically, formative assessments are performed during patient encounters on the student's clinical attachments. Examples of formative assessments are Case Based Discussions (CBD), Direct Observation of Procedural Skills (DOPs) and Mini-Clinical Evaluation Exercises (Mini-CEX).

The Mini-Clinical Evaluation Exercise (Mini-CEX) involves the student being observed during a clinical encounter with a patient in which either or both clinical communication and physical examination are assessed by faculty members. The faculty members then rate the performance overall and in six specific domains interviewing, physical examination, humanistic qualities/professionalism, clinical judgment, counselling, and organization/efficiency, feedback comments are also written on the Mini-CEX assessment form.

In 1972, the American Board of Internal Medicine abandoned the oral examination of residents, since then the Mini-CEXs has been developed and used as a reliable method of assessment in order to assess a large volume of residents in training programs across the United States(2). The Mini-CEX serves as a standardized format for an assessor to observe a student in the clinical environment and evaluate the patient encounter in a nonthreatening, non-graded situation. Several studies have shown that providing effective feedback is an effective strategy to enhance the effectiveness of the clinical teaching-learning process(3, 4). In a study by Haghani et al. it was shown that providing written feedback versus verbal feedback improved student performance in subsequent Mini-CEX assessments(5). Therefore, feedback plays an important role in Mini-CEX effectiveness in developing medical students' clinical skills.

Video feedback (VF) patient encounters is a novel approach that has been developed, which involves videotaping doctor-patient consultations and subsequently an assessor watching the consultation and providing feedback(6). Several studies have shown that VF is both effective in skills training and formative assessments(7, 8). There are several advantages of VF. Firstly, Video feedback is the only method in which the student can observe their skills from the point of view of an assessor allowing critical analysis of their own communication skills(8, 9). Secondly, the video can be analyzed and assessed by multiple assessors therefore giving greater feedback to the student. Furthermore, when observed by the student and assessor together VF can facilitate reflection, self-assessment and engagement in solving problems that were observed on the video(10, 11). Moreover, VF allows the assessor to rewind and repeat the observed video consultation, therefore allowing the assessor to both

write feedback and not to miss a portion of the clinical consultation. In addition, a copy of the video along with feedback can be given to the student to allow self-directed reflection on the consultation. Finally, disagreements between the assessor and student can be decreased as both can observe the video and provide justification for their evaluation of the consultation.

The aim of our prospective interventional study is to evaluate the effect of different feedback methods and its effect on the clinical competency. We compared the traditional way in which the medical student's clinical patient encounter is directly observed and feedback given by clinical tutors to a novel approach where the medical student's patient encounter is recorded by a video camera and subsequently the patient encounter is observed and assessed by a clinical tutor in front of the medical student and feedback is given. Therefore, it evaluated the effect of video feedback and whether this approach can be applied to clinical skills teaching. Our study, is the first to investigate the effect of VF by Mini-CEX on clinical competency of interns in Iran.

Materials And Methods

Our study is a prospective randomized controlled double-blinded interventional study which involved a total of 40 final year medical (internship year) students of Shiraz University of Medical Sciences who were on a family medicine rotation at the Rasool Azam Family Medicine Clinic, Shiraz, Iran. All final year medical (internship year) students were assessed according to the OSLER checklist in order to ascertain the baseline clinical competency ability of each participant (OSLER 1). The 40 participants were subsequently randomly allocated to two equal groups of 20 students each, a control group who underwent traditional directly observed feedback and an intervention group who underwent video feedback (Fig. 1). The statistical advisor calculated this sample size based on previous similar research articles using the statistical formula below:

$$n_1 = \frac{(r + 1) \sigma^2 (Z_{power} + Z_{(\alpha / 2)})^2}{r \text{ difference}^2}$$

n_1 = size of smaller group,

r = ratio of larger group to smaller group,

σ = standard deviation of the characteristic,

difference = the clinically meaningful difference in terms of the outcome,

Z_{power} = corresponds to power,

$Z_{\alpha/2}$ = corresponds to two-tailed significance level (1.96 for $\alpha = .05$)

Random allocation was ensured by writing each participant name in a sealed envelope, mixing and shuffling the envelopes and then randomly assigning enveloped participants to each of the study groups.

Each OSLER assessment lasts 10–20 minutes. A standardized simulated patient was used in both OSLER 1 and OSLER 2 assessments. A newly diagnosed diabetic type 2 patient was used in OSLER 2 and a patient suffering from primary hypertension was used in OSLER 1. The simulated patient who played the role of the patient received instructions on how to play the role and respond to questions from the interns during the patient encounter. The assessor filled in the OSLER checklist. The OSLER assessor was an academic clinical skills tutor of Shiraz University of Medical Sciences who was not a member of Faculty of Family Medicine of Shiraz University of Medical Sciences and who was not involved with this study. Furthermore, only one assessor was used to assess OSLER 1 and 2, in order to ensure reliability and validity of the assessment by reducing observer bias. In addition, the OSLER assessor received training on how to assess the students and to the standard that the students will be assessed. The domains assessed were communication skill, history taking skills, physical examination, professionalism, clinical judgement, health promotion and overall clinical approach. Each item was assessed by assigning a score of 1 mark for a yes response if a skill is demonstrated and a score of 0 for a no response. The total maximum mark of the OSLER checklist was 35 and the minimum was 0 marks. Prior to the OSLER assessment the examiner assigned a clinical case difficulty rating and recorded this on the OSLER checklist. The OSLER checklist is based on a questionnaire of 10 faculty members of the Shiraz University of Medical Sciences (clinical faculty members) and staff in the Educational Development Center of Shiraz University of Medical Sciences has been determined to have a content validity index (CVI) of 100% and a CVR of 93%.

Participants in the control group of our study took part in a four-hour workshop. The workshop was conducted by a clinical skills coach who is a member of the Faculty of Family Medicine of Shiraz University of Medical Sciences. In order to ensure standardization of teaching sessions across the study both control and intervention feedback sessions were conducted by the same faculty member. Simulated role plays took place where a final year medical (internship year) student played the role of a physician and another internship year student played the role of patient. The simulated patient encounter took approximately 15 minutes and was observed by the clinical tutor who also was an assessor by giving feedback and assessing the clinical competency on pre-made Mini-CEX feedback forms. Following the patient encounter the assessor gave verbal feedback on the patient encounter that was observed, to the final year medical (internship year) students which lasted 15 minutes, domains that were assessed were communication skill, history content, physical examination, professionalism, consultation structure, clinical judgement, health promotion, self-directed learning skills and overall clinical approach. Each participant within the tutorial had an opportunity to play the role of physician and obtain feedback.

Participants of the intervention group took part in a small workshop session of four interns. Each session lasted approximately 4 hours each. This session contained the same topics and contents as the control group workshop. The intervention group small workshop session was given a pre made simulated patient scenario. A final year medical (internship year) student within the tutorial played the role of the patient and another final year medical (internship year) student played the role of the physician. The simulated patient scenario clinical encounter was recorded. The clinical coach observed their encounter. Following the simulated patient encounter, the clinical coach watched the recorded simulated patient encounter

video and gave verbal and written feedback on Mini-CEX feedback forms. The feedback forms contained a series of questions regarding the patient encounter and the assessor was asked to rate different aspects of the clinical competency out of four possible responses in domains that were assessed which are communication skills, history content, physical examination, professionalism, consultation structure, clinical judgement, health promotion, self-directed learning skills and overall clinical approach. Furthermore, the feedback form contained an opportunity to write the strengths or weaknesses of the clinical encounter. In order to ensure the content validity of the Mini-CEX feedback forms used within our interventional study, the content validity index was assessed by 10 faculty members of the Shiraz University of Medical Sciences (clinical faculty members) and staff in the Educational Development Center of Shiraz University of Medical Sciences and the content validity index (CVI) was calculated. The CVI index was 95%. The questionnaire was structured so that responses were in the form of yes or no which if the response was yes, it was given a score of one, the total score of hours assessment checklist was 20 and the minimum score was 0. Each simulated patient encounter within the workshops lasted 30 minutes comprising of 15 minutes of role play and 15 minutes of video feedback and was repeated in order to ensure that each intern participant had the opportunity to play the role of physician and receive feedback.

One month following the group discussion and video feedback workshops an OSLER assessment was performed (OSLER 2). The OSLER assessor was blinded as to whether the intern being assessed had received either video feedback workshops or traditional directly observed feedback workshops. The OSLER assessor was an academic clinical skills tutor of Shiraz University of Medical Sciences who is not a member of Faculty of Family Medicine of Shiraz University of Medical Sciences and who is not involved with this study. Furthermore, only one assessor was used to assess OSLER 1 and 2, in order to ensure reliability and validity of the assessment by reducing observer bias. In addition, the OSLER assessor received training on how to assess the final year medical (internship year) students and to the standard that the students will be assessed. Interns were also unaware of whether they or other final year medical (internship year) students' colleagues had received either the intervention or control method of feedback and were therefore blinded in this study.

Following the OSLER 2 assessment the results of the OSLER 1 and OSLER 2 assessments were collected. SPSS was used to analyze the results in order work out statistical distribution and statistical significance. In order to compare the OSLER 1 and 2 results within each group the paired t-test was used. In order to compare the OSLER results between the intervention and control group the independent t-test was used.

This interventional trial is registered in the ISRCTN Registry [ISRCTN47543844] (16/02/2022).

Results

Table 1 Demographic details of participants

	Traditional Feedback [Mean (SD)]	Video Feedback [Mean (SD)]	P-Value
Age	24.9 (0.71)	24.8 (0.83)	0.687
Sex	M (15), F (5)	M (15), F (5)	0.642
Month of Internship	8.2 (3.55)	8.05 (4.37)	0.906

Study Population:

A total of forty final year medical students (internship year) participated in our study. The forty students were divided into two groups of 20 students which were the video feedback intervention group and the traditional directly observed feedback control group. As shown in table 1 the mean age of participants in the video feedback group was 24.8 years compared to 24.9 years in the traditional directly observed feedback group which were not statistically significant ($p=0.687$). In terms of the sex distribution of participants in both groups, both groups had an equal number of females to males which were not significant different ($p=0.642$). Table 1 demonstrates no significant difference between the mean number of months students had completed of their internship year (final year) studies. As shown in table 1 the mean month of internship completed by participants in the video feedback group was 8.05 months compared to 8.2 months in the traditional directly observed feedback group which was not statistically significant ($p=0.906$).

Table 2 – OSLER 1 Score comparison

	OSLER 1 Score	t- value	p-value
Traditional Feedback [Mean (SD)]	10.4(1.98)	0.639	0.527
Video Feedback [Mean (SD)]	10(1.97)		

Comparison of OSLER 1 Scores:

The mean OSLER 1 score in the Video Feedback group was 10 compared to a mean score of 10.4 in the traditional directly observed feedback group. Table 2 shows that statistical analysis of OSLER 1 scores demonstrated no significant difference between the Video Feedback group and traditional directly observed feedback group ($p=0.527$).

Table 3 - OSLER 2 Score comparison

	OSLER 2 Score	t- value	p-value
Traditional Feedback [Mean (SD)]	12.8(1.47)	32.1	p<0.001
Video Feedback [Mean (SD)]	28.6(1.64)		

Comparison of OSLER 2 Scores

The mean OSLER 2 score in the Video Feedback group was 28.6 compared to a mean score of 12.8 in the traditional directly observed feedback group. Table 3 shows that statistical analysis of OSLER 2 scores demonstrated a statistically significant difference between the Video Feedback group and traditional directly observed feedback group (p<0.001).

Table 4 – Comparison between OSLER 1 and OSLER 2 scores within each study group

	Traditional Feedback [Mean (SD)]	Video Feedback [Mean (SD)]
OSLER 1 Score	10.4(1.98)	10(1.97)
OSLER 2 Score	12.8(1.47)	28.6(1.64)
t-score	7.71	41.9
p-value	p<0.001	p<0.001

Comparison between OSLER 1 and OSLER 2 Scores of Each Study Group:

Table 4 shows that on statistical comparison between the OSLER 1 and OSLER 2 score of the Video Feedback group there was a statistically significant improvement of OSLER 2 scores (p<0.001). Furthermore, statistical comparison between the OSLER 1 and OSLER 2 score of the traditional directly observed feedback group there was a statistically significant improvement of OSLER 2 scores (p<0.001).

Table 5 – Comparison of OSLER score differences between the two study groups

	OSLER 1 Score	OSLER 2 Score	Difference	t-score	p-value
Traditional Feedback [Mean (SD)]	10.4(1.98)	12.8(1.47)	2.4	29.8	p<0.001
Video Feedback [Mean (SD)]	10(1.97)	28.6(1.64)	18.6		

Comparison of the mean differences between OSLER 1 and OSLER 2 Scores of Each Study Group:

The mean difference between the OSLER 1 and OSLER 2 scores in the Video Feedback group was 18.6 compared to a mean difference score of 2.4 in the traditional directly observed feedback group. Table 5 shows that statistical analysis of OSLER score differences between the two study groups demonstrated a statistically significant difference between the Video Feedback group and traditional directly observed feedback group ($p < 0.001$).

Discussion

The aim of our prospective interventional study was to evaluate the effect of different feedback methods and its effect on clinical competency. Our results demonstrate that Mini-CEX is an effective tool in improving clinical and communication skills when conducted by either the established traditional directly observed method or by video feedback. However, our results demonstrated that the use of mini-CEX in combination with video feedback methods statistically significantly improved the clinical and communication skills competency of final year medical students (internship year) compared to traditional directly observed feedback methods previously used. To our knowledge this study is the first study to investigate the effect of using mini-CEX combined with video feedback methods on clinical and communication skills competency of medical students in Iran.

Reliability and validity of video feedback-based approaches:

Video Feedback has been demonstrated to be effective in communication skills learning in a number of studies. In a meta-analysis of 217 experimental comparisons from 33 experimental studies involving a total of 1,058 people, Fukink et al. demonstrated that VF methods have a statistically significant effect on the interaction skills of professionals in a range of contact professions(8). Furthermore, in a study by Epstein et al. of 95 2nd year medical students from the University of Rochester, USA demonstrated that review of videos of encounters with patients offers a powerful means of evaluating and providing feedback on trainees' skills in clinical interactions(12). In addition, in a cross-sectional study by Ram et al. from the Maastricht University of 93 GPs whose clinical consultations were video recorded and assessed using a questionnaire, video assessment was shown to be a valid and reliable method for education and quality improvement(13). In an interventional study by Dohms et al. from the University of Sao Paulo, Brazil involving 54 medical residents, VF taken from real-life settings was shown to be associated with a significant increase in self-perceived empathy(6). In a cross-sectional study of 162 medical students by Eeckhout et al. from the University of Leuven, Belgium which involved medical students completing a questionnaire on their experience of using VF, they believed their communication skills and attitudes were positively modified by self and peer observation(14). In contrast, a considerable number of students judged that simulated role playing was most effective to improve communication skills. Direct supervision by a GP trainer during consultation was also highly appreciated in terms of self-determined learning outcome.

Mini- CEX as an effective tool for clinical skills teaching:

Correspondingly, a number of studies have shown that Mini-CEX is effective in clinical skills acquisition. In a meta-analysis of 26 studies conducted by Lorwald et al. from the University of Bern showed the overall positive perceived educational learning impact of Mini-CEX on students(15). Furthermore, in the same meta-analysis it was shown that the proper conducting of Mini-CEX, including a realistic reflection of trainee performance during direct observation, followed by a constructive feedback conversation, seems to be a prerequisite for its educational impact. In a meta-analysis by Hejri et al. from the University of Tehran involving 58 studies it was shown that Mini-CEX had reasonable validity, reliability, and educational impact(16). In another meta-analysis of 17 included studies by Lee et al. noted three subcategories of internal factors: intrinsic rater factors, judgment-making factors (conceptualization, interpretation, attention, and impressions), and scoring factors as affecting the scoring of Mini-CEX evaluations and therefore the validity and reliability of Mini-CEX as an assessment method(17).

Limitations of Study:

There were several limitations in this study, firstly the study was conducted in one clinical site with a group of medical students. Given that the medical students were not observed outside of the clinical environment there could have been an opportunity for medical students who had been assessed to share information regarding the assessments undertaken with those students awaiting assessment. Furthermore, the clinical coach may have not interpreted the clinical consultation item as was intended. In order to minimise this bias our study design included a training program for the clinical coach and only one clinical coach and OSLER assessor was used in our study in order to standardize the feedback and the assessment results. Finally, there was no process in place for a student to appeal the assessor's feedback if they felt they had demonstrated this skill during the clinical encounter feedback session. This shortcoming may have been more prominent in the traditional directly observed feedback session as the clinical encounter was not videotaped which may have led the clinical coach to miss certain items on the feedback checklist.

Implications of study results:

It has been generally shown that direct observation and feedback on clinical practice is crucial for clinical competency progression during medical education. Our study results demonstrate mini-CEX combined with video feedback as a novel method for observing and providing feedback for medical students during medical training leading to clinical and communication skills competency improvement during medical training. During this study we observed that students demonstrated greater critical reflection in the video feedback sessions, often collaborating and discussing with the clinical coach about the strengths and weaknesses of their clinical role play consultation. Furthermore, the mini-CEX feedback forms provided structure to the assessment and feedback given by the clinical coach to the student. The examination style conditions regarding time limits for clinical consultation allowed a greater opportunity for the clinical coach to directly assess the clinical judgment of the medical student, because the student was expected to prioritise and time manage multiple presenting complaints of the patient during the simulated patient encounter.

Further evaluation of this novel mini-CEX method will help to determine the full applicability and reliability as both a learning tool for feedback and critical reflection of clinical and communication skills, and possibly as a formative assessment tool for the assessment of medical students in determining their clinical competency.

Conclusion

Our results demonstrate that video Feedback more effective than traditional directly observed feedback in improving clinical skills competency learning among medical students. Therefore, greater use of video feedback based formative assessments (mini-CEX) for medical students' clinical and communication skills is recommended for the acquisition and development of clinical and communication skills-based competencies within the medical curriculum.

Declarations

Ethics approval and consent to participate:

Informed consent was obtained from all participants of this study, in case of deceased participants informed consent was obtained from legally authorized representatives. This study was approved by Shiraz University of Medical Sciences Ethical Committee, with ethics code IR.SUMS.REC.1399.619. In addition, all methods were carried out in accordance with the relevant hospital clinical and ethical guidelines and regulations.

Consent for publication: Not applicable

Written informed consent was obtained from the patient for publication of this prospective study. A copy of the written consent is available for review by the Editor-in-Chief of this journal

Availability of data and materials: The datasets used and/or analysed during the current study are not publicly available due to restrictions, but are available from the corresponding author on reasonable request and with permission of Shiraz University of Medical Sciences

Competing interests: the authors have no competing interests

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Authors' contributions:

data collected by: SEM, KT, NP

Manuscript written by: KT

Editing: SEM, FM and KT

All authors have read and approved the final manuscript

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This interventional trial is registered in the ISRCTN Registry [ISRCTN47543844] (16/02/2022).

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Figures

Figure 1

Flow chart of study design