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Original Article

Effect of Video Reflection On Surgeon's Operative Performance

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Abstract

Objective: Attaining operative skills is a core component of surgical training. Conventional teaching strategies are deprived of a systematic feedback method and scope for self-reflection. Video-based reflective learning has emerged as an effective method for cultivating technical competencies through standardised, guided feedback and self-evaluation. This study aimed to evaluate the effectiveness of video-based reflection on surgeons' operative performance.

Methods: A pre-post quasi-experimental study was conducted at the Department of Surgery at IIMCT–PRH, Rawalpindi, after obtaining ethical approval. Using convenience sampling, 50 participants were enrolled; however, only 32 participants appeared on the pre-assessment day. Participants first performed suturing on a synthetic pad, which was video-recorded as baseline, followed by a training session after which they reviewed their own recordings for self-reflection. After 48 hours, the suturing task was repeated and video-recorded again. Both baseline and 48-hour recordings were scored by a blinded evaluator using OSATS, and pre- and post-scores were compared using a paired t-test.

Results: Most participants were medical students with minimal previous suturing experience and were less confident in their suturing skills. The frequent difficulties included handling the instrument, knot-tying, and proper spacing of sutures. The mean Objectively Structured Assessment Technical Skills (OSATS) score demonstrated a substantial improvement from 5.84 ± 1.08 to 9.46 ± 1.26 ($p < 0.001$).

Conclusion: Continuous improvement in medical and surgical sciences requires a transition in educational strategies from conventional to modern teaching methods. Video-based self-reflection with a systematic feedback mechanism has proven to be a promising learning and skill acquisition method, specifically among young trainees and medical students.

Keywords: Video Recording, Education, Medical, Clinical competence, Cognitive reflection, Surgical procedures, Audiovisual aids.

Introduction

Reflective learning is a distinctive educational activity that promotes professional growth through the critical analysis of personal behaviour and experiences. It is a complex mental process and a way to address the learner's strengths and weaknesses.1 In medical education, systematic and organised reflection on individual knowledge and skills can positively impact future cognitive and psychomotor abilities.2 There are two components of reflective learning: the thinking process during the experience or procedure, called reflection-in-practice, and assessment and rethinking post-experience or post-procedure, called reflection-on-practice, to identify errors and plan steps for future improvement. According to the literature, the latter is more beneficial for skill development in the training process. The use of various digital tools would facilitate better outcomes. Amid rapid technological advancements, video-based reflective learning is an innovative approach in which individuals systematically review their skill levels through standardised video recordings. Visualisation can provide opportunities for skill development and improve technical proficiency.[3] In addition to self-reflection, structured feedback often improves performance. Feedback is a tool through which personal and

professional development can be promoted if it is thoughtfully considered and separated from formal assessment techniques in clinical education.[4,5]
Reforms in medical education and clinical training programs have gained attention in the 21st century.6 Current educational strategies are still based on lecture-based passive learning,7 and are deprived of an organised self-reflection and constructive feedback mechanism that requires a revolution. In the field of surgery, acquiring and assessing technical competencies is a core component of a training program.8 The surgical operating room is not a standard setting for training and evaluation of operative skills, attributed to economic and ethical factors.9 Moreover, feedback provided by supervisors through direct observation has limited effectiveness, as it may be influenced by subjective judgment.[10] Subsequently, the lack of objective data for self-assessment can create a gap in improving technical performance.
Many challenges are faced globally in clinical training and medical education, including reduced training time and increased competency attainment. Therefore, traditional curricula are being transformed into competency-based curricula relying on Procedure-Based Assessment. The main purpose of this transformation was to provide trainees with objectively structured feedback for skill improvement and assessment. This feedback process is aided by video recordings to reduce the limitations of real-time feedback. A feasibility study on synchronised video reviews and feedback demonstrated a positive effect on enhancing reflection.[11]
Historically, in Pakistan, the apprenticeship model was used for surgical training and education, with direct observation followed by repetition of similar actions in both the ward and operating theatre as the main learning method. This model was unstructured and lacked guidelines regarding the knowledge and skills to be taught to the trainees. Over time, a more formal, institutionally based training model was adopted to improve understanding and skills development. Although many competent surgeons have been produced, a lack of uniformity in training persists in the existing system. Today, surgeons are expected to be more knowledgeable and skilful to meet the increasing demand for patient safety and accountability; they are expected to learn more in a limited time. Integrating new learning tools for competence-based progression is the need of the hour.[12] Surgical skills encompass a broad range of technical competencies, from basic procedures, such as simple suturing, which includes knot-tying, suture spacing, and instrument handling, to more advanced operative techniques and decision-making.
These critical gaps can be addressed by incorporating new digital tools into the existing clinical training system.[13] Video-based reflection is an emerging approach that allows learners to independently analyse their performance. Video recordings of individual performances help trainees identify their errors and comparatively analyse them with standardised practices to strengthen their surgical skills.[14] Previously, it was not possible to collect, store, and use individual performance data for reassessment. High-quality video recordings are a valuable tool that can be revisited for assessment and learning. In addition to basic surgical skills, it is helpful in complex laparoscopic and robotic procedures. Video recordings allow learners to improve the quality of their reflections by enabling them to focus on specific steps in their performance without relying on memory. Previous research has suggested that immediate verbal feedback, whether intra- or post-operatively, is limited due to cognitive overload and recall bias and may not produce the required outcomes.[15] Verbal feedback from supervisors during real-time performance may overlook small but important technical errors.
A literature search demonstrated that personalised video reflection and feedback can improve skill attainment in both incoming and current surgical trainees,16 However, limited data are available specifically for developing countries. Most previous studies compared video-based skill attainment in two independent groups, which may introduce between-subject variation bias. This study aimed to evaluate the effectiveness of video-based reflection on technical skill improvement in surgical trainees and medical students by quantifying pre- and post-intervention scores using an objective structured assessment of technical skills (OSATS)-based suturing checklist.

Materials And Methods

This pre-post quasi-experimental study was conducted in the Department of Surgery at IIMCT-Pakistan Railway General Hospital, Rawalpindi, in February 2026, after ethical approval from the Institutional Review Board, approval letter Ref. Riphah/IIMC/ IRB/26/1030.
The sample size was calculated using G*Power software 3.1.9.4, referring to a meta-analysis focusing on the comparison between simulation-based medical education and traditional clinical education, which concluded an effect size (Cohen’s d) of 0.71. Keeping the confidence interval at 95%, α-value at 0.05, and power of the study at 95%, the obtained sample size was 28 participants.[17] A total of 50 participants were initially enrolled using a convenience sampling technique, considering attrition and enhancing the strength of the study. Random sampling was not feasible owing to limited logistics, participant availability, and clinical training commitment. The study population

encompassed the entire available pool of junior postgraduate trainees, house officers, and final-year MBBS students on surgical rotation, excluding postgraduate trainees who had any formal training in suturing skills in the past 3 months and final-year MBBS students who did not attend the suturing skill lab. However, out of 50 enrollees, only 32 participants attended the scheduled intervention day, and the remaining 18 were excluded from the analysis before the pre-intervention phase. This exclusion of 18 (36%) participants occurred before any intervention was delivered due to non-availability, attributed to academic commitments and clinical schedules.

After providing written informed consent, each participant completed a pre-assessment form focusing on their name, current level of medical training, previous suturing exposure, self-confidence in suturing skills, and perceived difficulties while suturing. The participants then performed three simple interrupted sutures on a standardised synthetic skin pad, under uniform conditions. The procedure was recorded using a fixed camera setup.

A senior surgical resident conducted a training session to guide the participants in reflecting on their video-recorded performances. The participants in the intervention group then reviewed their own video recordings and performed guided self-reflection using the OSATS-based suturing checklist.

After an interval of 48h, the participants repeated the suturing task, which was again video recorded. The 48 hours were opted to accommodate scheduling constraints of real-world training programs and classes so the trainees and students get adequate time to receive, download, review, and reflect on their performance before the post-intervention assessment. All recordings were assessed by a blinded senior surgeon who did not participate in any other activity of this study using the Objectively Structured Assessment Technical Skills (OSATS)-based suturing checklist**.** The 11-item OSATS checklist used in this study is a well-established, validated tool for the objective and structured assessment of basic technical skills and is widely used in the literature. The checklist assesses the procedure by dividing it into distinct components. The components include preparation of equipment, maintenance of aseptic technique, correct loading of the needle in the needle holder, symmetry of suturing, approximation of wound edges, appropriate eversion of wound edges, proper suture spacing, correct knot tying, safe instrument handling, and overall appropriate time and economy of motion. Each correctly performed component was scored 1, and 0 was scored for incorrect or non-performance. Pre- and post-intervention scores were compared using a paired-sample t-test after checking the normality of the data using SPSS (version 27). The flow of participants from enrolment to analysis is shown in Figure 1.

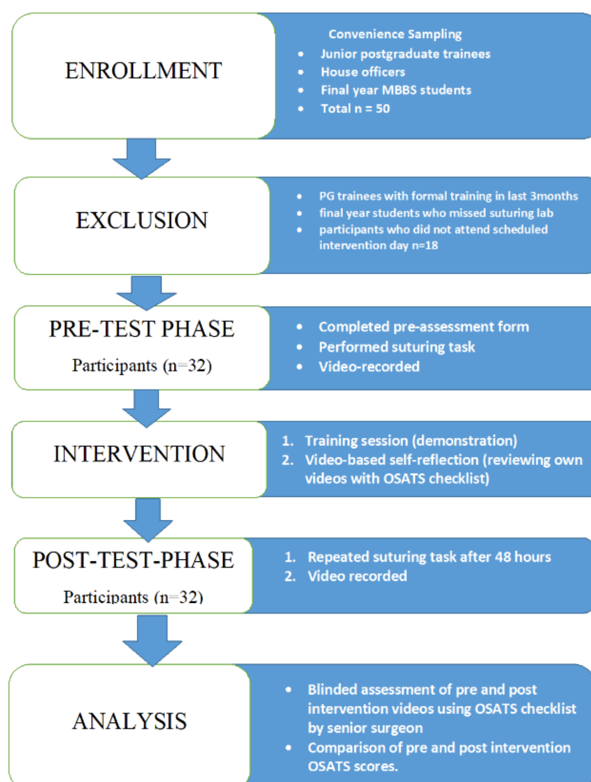

Figure 1: Flow diagram of participants from enrollment to analysis.

Results

A total of 32 participants completed both pre- and post-intervention assessments and were included in the final analysis. The normality of the data was assessed using a histogram of the difference between the pre- and post-intervention scores, which showed approximate normality; therefore, parametric tests were applied.
Of the 32 participants, the majority were medical students, 21 (65.6%). Most participants had limited prior suturing experience, with the majority reporting 1–10 previous attempts. Only two (6.3%) participants reported being extremely confident in their suturing skills. Difficulty in suturing tasks was commonly reported in instrument handling and knot tying, either alone or in combination with suture spacing. The detailed baseline characteristics of the participants are presented in Table 1.

Table 1: Baseline characteristics of participants at pre-assessment

Variable	Category	n(%)
Training level	Medical student	21(65.6)
	House Officer	9(28.1)
	Postgraduate trainee	2(6.3)
Previous Suturing exposure	1-10times	26(81.3)
	11-20	2(6.3)
	>20	4(12.5)
Confidence level	Not confident at all	4(12.5)
	Slightly confident	4(12.5)
	Somewhat confident	18(56.3)
	Quiet confident	4(12.5)
	Extremely confident	2(6.3)
Difficult task in suturing	Knot tying	6(18.8)
	Instrument handling	9(28.1)
	Knot tying + suture spacing	7(21.9)
	Suture spacing + instrument handling	6(18.8)
	Knot tying + instrument handling	2(6.3)
	knot tying+ suture spacing + instrument handling + needle loading	2(6.3)

One-way analysis of variance (ANOVA) was used to compare the improvement in suturing scores across training levels, and homogeneity of variance was confirmed (Levene's test, $p = 0.976$). No statistically significant difference was observed in the improvement among the house officers, medical students, and postgraduates ($p = 0.371$). Similarly, baseline confidence levels did not differ significantly between the groups, although a borderline trend was noted ($p = 0.085$).
The overall mean OSATS score improved from 5.84 ± 1.08 pre-intervention to 9.46 ± 1.26 post-intervention, indicating a clear increase in performance following video-based reflection. The mean difference (pre- and post-) was -3.62. This improvement was statistically significant (paired t-test, $t(31) = -12.35$, $p < 0.001$). Results shown in Table 2

Table 2: Comparison of OSATS scores before and after video-based reflection

Variable	Pre-Intervention Mean ± SD	Post-Intervention Mean ± SD	Mean Difference	t-value (df)	p-value
OSATS score	5.84 ± 1.08	9.46 ± 1.26	-3.62	−12.35 (31)	<0.001

OSATS: Objectively Structured Assessment Technical Skills

Discussion

The present study provides objective and quantitative evidence that video-based reflective learning following structured assessment plays a substantial role in surgical skill acquisition among medical students and surgical trainees. This highlights that guided self-reflection based on video review is an effective educational strategy that can enhance technical competence and contribute meaningfully to training.
Most participants in the present study were medical students with limited previous exposure to suturing, which supports the low self-reported confidence in their skills. This is consistent with the profile of beginner learners, who lack both experience and confidence in performing technical procedures, specifically suturing. Furthermore, Difficulty while suturing was most commonly reported in instrument handling, followed by knot tying and suture spacing.14 In a previous study evaluating video self-assessment of basic suturing skills by novice trainees, the pre-

course confidence level was between “reasonably confident, some guidance needed” and “highly knowledgeable and confident, independent”,[18] These findings are in contrast with our results reflecting real-world conditions of inadequate exposure to surgical skills as early-year trainees.[19]
A study evaluating surgical residents for the acquisition of suturing skills by reviewing their previous practice sessions reported improved scores by an average of 11.6 points on a 27-point suturing and knot-tying scale. Acknowledging the dissimilarities in the assessment tool and time interval between pre- and post-assessment from the present study, the results highlighted the importance of reflective analysis of recorded performance.20 Similarly, in a randomised controlled trial on medical students, the intervention group received both verbal feedback and a video for self-assessment on a basic suturing task, while the control group only received verbal feedback. The results of this RCT demonstrated an increase in the overall OSATS score by 3.125 points in the video plus verbal feedback group. Although the study used a different OSATS scoring version and randomisation was performed, the results are still aligned with our study, providing evidence for video-based self-reflection as a good approach for skill acquisition.[21]
Moreover, a randomised controlled trial among medical students to evaluate video-guided learning in suturing skills and evaluated using the global scale OSATS checklist reported a pre-assessment mean score of 12.2 and a post-assessment mean score of 15.7, with a p-value <0.001. Although the study design and assessment tool were not identical, the findings were in the direction of the results of the present study, further supporting the effectiveness of video-assisted learning strategies in enhancing technical skills.[5]
In a systematic review including RCT (randomised controlled trials) studies, quantitative assessment of video-based reflection on operative skills attainment demonstrated improvement among both medical students and surgical residents. Data analysis showed an increase in post-intervention OSATS scores, with a mean difference of 3.02 (95% CI: 0.82 to 5.23; p = 0.007), providing evidence that video-based self-reflection is a beneficial teaching approach for acquiring surgical and operative skills. These findings are in agreement with the results of the present study and further substantiate the role of video-based reflective learning as a valuable adjunct to surgical training.22 Although the results of the present study provide strong evidence that personalised video reflection is associated with improvement in suturing skills, supporting the literature, it also has certain limitations. The small sample size, which mostly comprised medical students, and the conventional sampling approach may limit the external validity across different levels of surgical training. Operative performance was only measured by the suturing technique; therefore, its effectiveness beyond basic suturing skills and in more experienced trainees remains unclear. Additionally, the study was conducted in a simulated environment; therefore, it is uncertain whether the observed improvements are as effective in real-life patients. Moreover, the use of a single rater for OSATS assessment can limit interobserver reliability.

Conclusions

The present study concluded that video-based reflective learning with objectively structured constructive feedback is an effective and feasible method for improving technical skills among learners at an early stage of skill acquisition, thereby assisting them in improving their operative performance in the future. Despite several limitations, the consistency and magnitude of the improvement strongly support the hypothesis. These findings suggest that the integration of video-based reflection into medical education and clinical training programs can be a valuable, economical, and powerful strategy that will ultimately contribute to better preparation for clinical practice. Video-based reflection is a practical and relevant method for acquiring surgical skills, where an inconsistent postoperative feedback mechanism exists. It enables learners to repeatedly review recorded procedures to identify technical strengths and weaknesses more effectively. However, further studies with larger sample sizes and multicentre clinical settings are needed to confirm these findings. The establishment of its broader applicability across various training environments, as well as its long-term effectiveness and sustainability, should be investigated in future studies.

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