A Video-Based Coaching Intervention to Improve Surgical Skill in Fourth-Year Medical Students

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OBJECTIVE: For senior medical students pursuing careers in surgery, specific technical feedback is critical for developing foundational skills in preparation for residency. This pilot study seeks to assess the feasibility of a video-based coaching intervention to improve the suturing skills of fourth-year medical students.

DESIGN: Fourth-year medical students pursuing careers in surgery were randomized to intervention vs. control groups and completed 2 video recorded suture tasks. Students in the intervention group received a structured coaching session between consecutive suturing tasks, whereas students in the control group did not. Each coaching session consisted of a video review of the students' first suture task with a faculty member that provided directed feedback regarding technique. Following each suturing task, students were asked to self-assess their performance and provide feedback regarding the utility of the coaching session. All videos were deidentified and graded by independent faculty members for evaluation of suture technique.

SETTING: The University of Michigan Medical School in Ann Arbor, Michigan.

PARTICIPANTS: All fourth-year medical students pursuing careers in surgical specialties were contacted via e-mail for voluntary participation. In all, 16 students completed both baseline and follow up suture tasks.

RESULTS: All students who completed the coaching session would definitely recommend the session for other students. A total of 94% of the students strongly agreed that the exercise was a beneficial experience, and 75% strongly agreed that it improved their technical skills. Based on faculty grading, students in the intervention group demonstrated greater average improvements in bimanual dexterity compared to students in the control group; whereas students in the control group demonstrated greater average improvements in domains of efficiency and tissue handling compared to the intervention group. Based on student self-assessments, those in the intervention group had greater subjective improvements in all scored domains of bimanual dexterity, efficiency, tissue handling, and consistency compared to the control group. Subjective, free-response comments centered on themes of becoming more aware of hand movements when viewing their suturing from a new perspective, and the usefulness of the coaching advice.

CONCLUSIONS: This pilot study demonstrates the feasibility of a video-based coaching intervention for senior medical students. Students who participated in the coaching arm of the intervention noticed improvements in all domains of technical skill and noted that the experience was overwhelmingly positive. In summary, video-based review shows promise as an educational tool in medical education as a means to provide specific technical feedback. (J Surg Ed 75:1475–1479. © 2018 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: surgery education, surgical coaching, simulation training, student feedback

COMPETENCIES: Practice-Based Learning and Improvement, Patient Care

INTRODUCTION

For senior medical students pursuing careers in surgery, specific technical feedback is critical for developing foundational skills in preparation for residency. Despite the importance of targeted feedback, medical students are often provided little more than fragmented, inconsistent and pressured experiences in the operating room. Additionally, students rarely receive directed feedback on their skill acquisition, leaving the naïve medical student to repeatedly perform tasks incorrectly.[1] Lack of targeted skill development during medical school hinders the ability for these learners to demonstrate competence as surgical interns and has the potential to affect patient care.

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One innovative solution that provides a directed learning experience to trainees outside of the operating room is the use of video-based coaching. Video-based coaching is commonplace in other professional fields like athletics and education for its effectiveness in optimizing technique. Video-based interventions to improve skills in surgery have gathered increasing attention for their use in education, as well as quality and outcomes research.[2] Prior work has demonstrated that video based coaching can be highly instructive to surgeons at all stages of their careers, from the resident to experienced faculty level.[3] Coaching in this context refers to an individualized, goal directed method of instruction that caters to each learner's shortcomings and brings education closer to the point of care.[2] Coaches review the learner's performance, and work with them to identify specific areas for improvement upon which guidance is provided. This method is emerging as an active learning tool that is different from traditional didactic teaching, which is often generalized to a larger target audience without as much focus on continuous improvement. Unfortunately, these interventions are largely limited to resident and faculty surgeons. Novel, educational interventions involving video-based review and coaching have not received much attention in the medical student population.[4,5] A prior study demonstrated success with coaching medical students on laparoscopic skills, and we seek to expand this to the coaching of open suture skills incorporating multiple perspectives.[6] Understanding the utility of such an intervention is crucial to surgical curriculum design and medical student skill development.

In this context, we piloted a video-based coaching intervention with fourth-year medical students to improve technical performance on a suture simulation task. Students were assigned to either the video based coaching intervention group or a control group. We hypothesize that students who received the coaching intervention will demonstrate greater improvement in technical skills compared to students who did not receive the intervention, as assessed by faculty raters. Using data from self-reflections on the coaching experience, we were also able to assess students' views on the utility of this intervention.

MATERIALS AND METHODS

Study Population

A volunteer group of students were recruited from a list of fourth-year medical students pursuing careers in surgical specialties. In total, 34 students were emailed asking for their voluntary participation, and 16 participated in our study (47% response rate). Prior suturing experience was desired in order to optimize the coaching intervention. Randomization was done based on the order in which students signed up to participate, with every other student receiving the coaching intervention. No activities related to the study or the review of students' video recordings were used for academic assessment. This study was approved by the University of Michigan Institutional Review Board HUM#00129685.

Suture Task

Students were instructed to perform a suturing task on a DASIE suture trainer. The suturing task consisted of an instrument suture tie, followed by a continuous running stitch and terminating with another instrument tie. Standard instructions were provided to each student on how the task should be completed. The task was recorded using two GoPro cameras. One camera was mounted on the student's head and another was held by a member of the study team in a standardized fashion. Baseline footage was obtained for each student performing the suture task. Following their baseline performance, all students completed a survey asking them to reflect on their performance and rate their technical skills in the following domains: bimanual dexterity, efficiency, tissue handling, level of difficulty, and consistency. The evaluation tool was based off of the Global Operative Assessment of Laparoscopic Skills developed by Vassilou et al.,[7] modified to make it more appropriate for our suture task. Neither students or faculty were provided with training on the use of our evaluation tool. The evaluation tool contained anchors that described the skill level corresponding to each numerical value.

Those in the intervention group watched their video with a surgery faculty member and were coached on their performance. Feedback was provided based on the footage of their baseline performance. Those in the control group did not receive this coaching intervention between suturing tasks. Coaching sessions lasted approximately ten minutes and focused on efficiency, tissue handling, and technique.

Following the coaching session for the intervention group and a 10-minute break without feedback for the control group, the same suture task was performed and recorded in an identical manner. After this task, all students completed a survey that again asked them to reflect on their performance, rate their technical skills, and provide subjective feedback regarding the utility of the exercise. As our primary goal of the study was to provide an effective learning experience for all learners, after the follow-up suturing task, those in the control group were also coached on their performance to give each student an opportunity for directed feedback.

Assessment

The video recordings of all the completed suture tasks were compiled and deidentified for assessment by faculty members in the department of surgery. Surgery

faculty were asked to evaluate performances on this suture task using the same rating scale that students used to self-assess after each suturing performance. Videos were presented randomly to faculty members in a deidentified fashion that blinded them to intervention vs. control, baseline vs. follow up, and the identity of the students participating. The goal of this process was to gain an assessment of surgical skills by third-party faculty members with experience in surgical education to assess the effectiveness of our coaching intervention.

RESULTS

Faculty Assessment

Based on faculty assessment shown in Figure 1, students in the control group demonstrated greater average improvements in the domains of efficiency and tissue handling compared to students in the intervention group. Students in the intervention group demonstrated greater average improvements in bimanual dexterity compared to the control group. There was no difference in the magnitude of improvement for consistency between the intervention and control groups. Students in the control and intervention groups demonstrated the following average improvements, respectively: bimanual dexterity (0.13 vs. 0.44, p = ns), efficiency (0.38 vs. −0.19, p = ns), tissue handling (0.56 vs. 0.06, p = ns), consistency (0.25 vs. 0.25, p = ns). Total change in performance is reported as an average of the graded domains and was 0.33 in the control group vs. 0.14 in the intervention group (p = ns).

Student Self-Assessment

As shown in Figure 2, students in the intervention group demonstrated greater subjective, average improvements in all domains compared to students in the control group. Students in the control and intervention groups demonstrated the following average improvements, respectively: bimanual dexterity (0.25 vs. 0.75, p = ns), efficiency (0.25 vs. 0.63, p = ns), tissue handling (0.13 vs. 0.50, p = ns), consistency (0.00 vs. 0.50 vs, p = ns). Students also assessed the level of difficulty for the suture task, and those in the intervention group demonstrated an average decrease of 0.13 on our scale compared to no change in the control group (p = ns). Total change in performance is reported as an average of the graded domains and was 0.16 in the control group vs. 0.59 in the intervention group (p = ns).

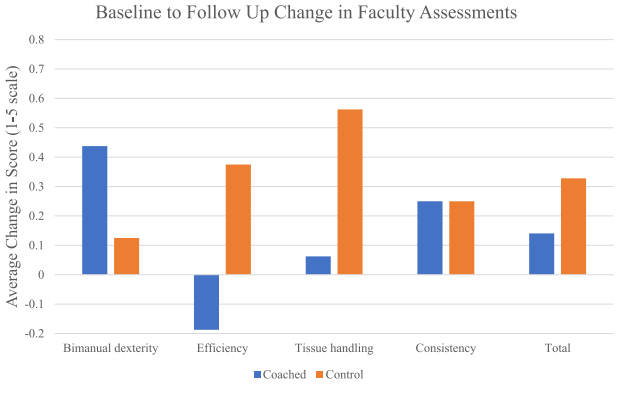

FIGURE 1. Faculty assessment of students' suture technique.

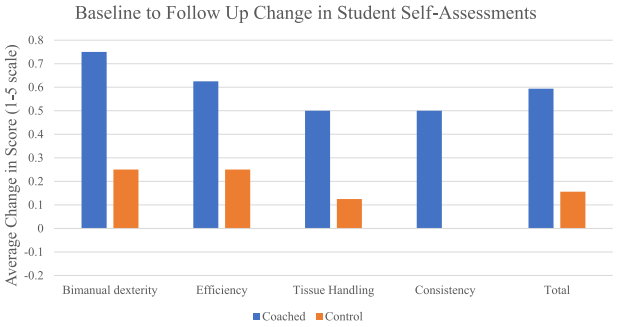

FIGURE 2. Student self-assessment of suture technique.

Subjective Feedback

Subjective responses are summarized in the Table. A total of 94% of all students strongly agreed, and 6% somewhat agreed that the experience was beneficial. Futhermore, 75% of students strongly agreed, 19% somewhat agreed, and 6% neither agreed or disagreed that the experience improved their technical skills, 56% of definitely agreed, 13% probably agreed, 6% neither agreed or disagreed, 19% probably disagreed, and 6% definitely disagreed that watching a recording of themselves changed their perception of their skill level. A total of 100% of the students would definitely recommend the experience to other students.

Selected quotes from free-response questions regarding the utility of the intervention are presented in Appendix A. Comments focused on themes of becoming more aware of hand movements when viewing their suturing from a new perspective, and the usefulness of the coaching advice.

DISCUSSION

This pilot study demonstrated the feasibility of a video-based coaching intervention to improve surgical skill in senior medical students. Although greater average improvements in the efficiency and tissue handling domains of suturing skill were observed for those in the control group, students in the intervention group demonstrated greater improvements in bimanual dexterity as assessed by faculty raters. Our subjective assessments demonstrate that the students were positively influenced by the intervention, and would recommend the experience

TABLE. Student perception of coaching session and the utility of video-based review

Student Perception of Coaching Session (n = 16)	Strongly Agree	Somewhat Agree	Neither Agree or Disagree	Somewhat Disagree	Disagree
This was a beneficial experience for me	94%	6%	0%	0%	0%
This experience improved my technical skills	75%	19%	6%	0%	0%
	Definitely Yes	Probably Yes	Might or Might Not	Probably Not	Definitely Not
Do you feel that watching the recording of yourself changed your perception of your skill level?	56%	13%	6%	19%	6%
Would you recommend this opportunity for other students?	100%	0%	0%	0%	0%

to their peers. We hypothesize that potential differences between coached and noncoached students may be discerned with more time provided for students to practice the skills that they were coached on. This was not an element of our study, but we believe that the positive effect on technical skills provided by the coaching intervention will become apparent after giving students time to practice the skills that they recently learned. In addition, recently coached students may be hampered by the desire to try newly coached skills for the first time, hindering their speed and smooth movement of instruments. Notably, we observed a disparity between student self-assessments and faculty evaluations. This observation may in part be attributed to self-assessments being based on recall vs. faculty evaluations based on video review, and this is addressed as a limitation. Thus, it is possible that coached students gained a false sense of improvement after being coached that was not observed by faculty raters on their video recordings. Meanwhile, noncoached students may reasonably think that their suturing skills should not have changed much between baseline and follow up tasks, as they were not provided with directed feedback. Finally, we demonstrate that both intervention and control groups regarded the experience as overwhelming positive.

Recent work at the University of Michigan have demonstrated that video-based review and rating by peer faculty surgeons correlate with patient outcomes.[8] These findings have implications for surgical skill development and the use of video-based interventions that can reliably identify technical surgical skill accurately. The refinement of foundational surgical skills through video based review and coaching at the medical student level has the potential to ensure a competent base upon which to improve technique throughout a surgeon's career. Prior studies have used cameras mounted in the operating room, or on overhead lights to capture live footage of the operative field.[3] Our team desired the use of multiple perspectives from which to view video recordings, an informative aspect utilized at the faculty and resident level.[3,9] Thus, we utilized 2 cameras to capture both the first-person perspective of the operative field, as well as a third-person point of view that allows the viewer to assess posture, arm position, and other ergonomic factors important in surgery. These are especially important to trainees at the medical student level, where most of the feedback that they receive comes from an instructor located across the operating table.

Although our study enrolled only a small number of students, this pilot demonstrates the feasibility of a video-based coaching intervention in undergraduate medical education. With the advent of high-definition video taping, coaches can visualize an extensive field of view while simultaneously appreciating granular details such as appropriate needle loading or the exact placement of stiches in tissue. Additionally, the tools used in our intervention are easily obtainable and cost-effective. Perhaps most important to the sustainability of this intervention is the enthusiasm for participation by medical students, with 100% of students noting that it was a useful experience. This intervention will continue at the University of Michigan as part of surgery "boot camps." Surgery boot camp is a multiweek, preparatory rotation targeted at fourth-year students who have decided to enter a surgical career. The experience involves both technical and knowledge based educational opportunities for students to prepare for residency.

Several limitations of this study warrant consideration. First, our intervention studied a small sample size, at a single institution. The feasibility of this intervention on a small scale at our institution is promising for similar interventions to be implemented at other medical schools. Second, our study is in part limited by a response rate of 47%. The main barrier to participation was scheduling a mutually agreeable time to complete our study for both busy students and coaches. It is possible that students who participated are different from nonrespondents in the sense that they may have different levels of motivation, or varying degrees of confidence in their surgical skills that lead to their lack of participation. However, we have no reason to believe that the potential differences in these student characteristics would affect the outcomes being studied. In addition, the students targeted by this intervention would be similar to the groups of students that would use this program at other schools. Third, students were asked to self-

assess based on recall of their suturing performance, rather than self-assessing using video review. This method may have impaired the accuracy of their self-assessments and may account for differences observed between self and third-party raters. This method was used intentionally to demonstrate to students how the perception of their own surgical skills may change when they view themselves on video. Students did observe this phenomenon, as evidenced by their responses to our qualitative, free-response questions. Fourth, as a novel intervention the coaching sessions did not follow an established educational model. Instead, the faculty coach provided input based on mistakes and inefficiencies seen in the student's performance. However, this is the method most commonly used the operating room and surgery education to provide feedback for students. Future iterations of this intervention should include a standardized, established coaching approach to maximize learning opportunities. Finally, our coaching intervention was limited to performing one type of technique on a suture task. We believe however, that this 1 task captured many of the technical skills and dexterity requirements seen in many other suture tasks, and is representative of a general proficiency with surgical tools.

The feasibility of this coaching intervention with medical students suggests that technical coaching may deserve increased attention in surgical curricula from the student to faculty level. For students, basic skills such as suturing and knot tying may be the focus of such interventions, with progressively more complex skills being the focus of coaching sessions as the learner advances in their training to the intern and resident level. An advantage of coaching compared to traditional methods of teaching is that is relies on the assumption that one can always improve based on feedback from another. Through this mechanism, coaching may be an effective way to improve quality and patient safety throughout the entirety of one's career. Future interventions may expand to include coaching lessons to include nontechnical skills, such as optimizing teamwork in the operating room to improve patient care.

CONCLUSIONS

This study demonstrates that a video-based coaching session for fourth-year medical students provides a viable opportunity for directed technical feedback. Student feedback was overwhelmingly positive, as the video-based review provided an opportunity for students to gain insight into their own clinical abilities from a different perspective. Video-based coaching and review may provide an efficient way to deliver technical feedback to trainees and to improve the quality of patient care delivered by tomorrow's surgeons.

SUPPORTING INFORMATION

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.jsurg.2018.04.003.

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