

Original Publication

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# Prep-Along Facilitated Posterior Crown Preparation in the Preclinical Dental Setting: A Multimedia Approach

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## Abstract

**Introduction:** Dental students often seek visual aids and demonstrations when attempting to perform new procedures. This video resource provides an adjunctive teaching tool for a crown preparation on an ivory molar using the “prep-along” method. This method teaches crown preparation in a uniform, step-by-step manner while providing feedback to students after each step. **Methods:** Prior to the daily simulation clinic session, a calibration session was held for faculty. Following didactic instruction—including principles, criteria, and grading rubric—students participated in the laboratory portion of the course. During this laboratory portion, students viewed a segment of the video, the video was paused, and students attempted that portion of the preparation. The project continued in stages until it was completed. Upon completion, using an electronic grading system, each student performed a self-evaluation, the instructor then performed a blind evaluation, and both student and instructor compared assessments. **Results:** To obtain feedback, an electronic survey was sent to 285 third- and fourth-year dental students. Ninety-four students completed the survey; 94% responded favorably to this method of instruction. Individual comments were also predominantly positive. **Discussion:** Preclinical faculty at the Midwestern University College of Dental Medicine—Arizona use this prep-along for instruction of direct and indirect tooth preparations and restorations. Students participate in this step-by-step process while receiving feedback. Faculty are allowed a structured environment in which to give feedback and instruction at each segment of the preparation. The faculty found that this method of instruction created efficiency and excellence in training surgical hand skills.

## Keywords

Operative Dentistry, Simulation, Tooth Preparation, Dentistry, All-Ceramic Crown, Prosthodontics, Posterior Crown, Clinical/Procedural Skills Training

## Appendices

- A. Principles and Techniques for Crown Preparation.pptx
- B. Lithium Disilicate Crown Tutorial.mp4
- C. Crown Preparation Assessment Form.pdf
- D. Prep-Along Student Survey .pdf

All appendices are peer reviewed as integral parts of the Original Publication.

## Educational Objectives

By the end of this activity, the learners will be able to:

1. List the armamentarium required for performing posterior molar crown preparations.
2. Describe the overall features and criteria of posterior molar crown preparations.
3. Use appropriate dental terminology when describing posterior molar crown preparations.
4. Demonstrate proper technique used in the preparation of posterior molar crown preparations.
5. Properly assess and troubleshoot posterior molar crown preparations.

## Introduction

Every dental school teaches crown preparation technique using various modalities. Novice dental students often seek visual aids and demonstrations when learning to visualize and understand tooth preparation concepts and criteria. These learning aids are especially useful when the novice first attempts to perform these procedures. Most dental students prefer a multimodal method of learning.<sup>1</sup> Coupling visual tools with written information and faculty-guided learning provides students with a well-rounded armamentarium of information required to understand specific concepts and criteria of a given procedure. Dental students report that incorporating videos into clinical instruction makes it more interesting and stimulating.<sup>2</sup> We created this instructional video in response to student requests for more audiovisual teaching

demonstrations. However, simply providing a video tutorial for students to watch unguided may have adverse implications.<sup>2</sup> Automaticity is the result of previously established neuronal connections formed in the brain by practice.<sup>3</sup> It is important for novice dental students to receive constant feedback when first attempting a procedure, as it is difficult to change bad habits once they have been established. Our method allows for a stopping point after each step to assess the student's progress and offer suggestions or corrective measures before a bad habit is formed.

A video accompanied by didactic and faculty-guided instruction can assist students in understanding the intricacies of tooth preparation. Therefore, it is also important to calibrate faculty in order to facilitate consistent instruction to student doctors. Our resource allows for faculty calibration and instruction prior to student instruction. Several resources are available that provide instruction regarding tooth preparation for single crowns.<sup>4-6</sup> Most institutions provide some form of reading material or slide presentation but lack multimedia. This publication provides a unique contribution, as it includes a novel "prep-along" video approach to preclinical crown preparation instruction. The faculty coined the term *prep-along* because faculty members either prepare a portion of the project or show a video; then, the students attempt that same portion, therefore, prepping along with the faculty members.

Self-evaluation is critical to novice dental students as they learn to appraise their preparations and restorations.<sup>7,8</sup> This particular educational tool includes a didactic slide presentation and evaluation form along with the video prep-along. We designed this resource for first- and second-year dental students and faculty; however, it can be used as a review for a third- or fourth-year student or for faculty development and calibration. It expands on existing resources by including a posterior, all-ceramic crown preparation, which was not previously available.

## Methods

This 8-minute video resource (Appendix B) provided a demonstration of the preparation of an ivorine molar for a posterior crown and a vinyl polysiloxane putty reduction guide. A PowerPoint didactic slide presentation (Appendix A) and an assessment form (Appendix C) accompanied the video. The prep-along instructional method, introduced in 2015, was used in the simulation clinic to teach both direct and indirect tooth preparations and restorations. Technique using specific dimensions, wall orientation, margin design and placement, and hand and rotary instrument use was presented. The video could be adapted to any dental program, as specific preparation measurements originated from manufacturer guidelines for lithium disilicate. However, preparation parameters and concepts could be applied to all posterior crown preparations. The video tutorial provided a close-up view of all steps of crown preparation using proper dental terminology. The tutorial made note of frequent errors that students might encounter and methods to avoid and correct them. Using the prep-along method described below, students received structured feedback and instruction at every step rather than just upon completion of the project. The assessment form was printed and used by the student for self-evaluation prior to instructor evaluation. The student and instructor then compared their assessments to determine the student's understanding of the criteria. Any corrections required could be individualized for that particular student.

To implement this educational tool, the organization needed the appropriate audiovisual equipment to view online media in a simulation clinic setting. The learner-to-faculty ratio in the Midwestern University College of Dental Medicine–Arizona (MWU-CDMA) simulation clinic was 5:1, and the instruction took place in a one-room simulation clinic. Prior to attempting a new tooth preparation, dental students first received 1-2 hours of specific didactic instruction on concepts and theory. This didactic instruction was part of the overall oral health sciences curriculum at MWU-CDMA and built on previous knowledge of tooth preparation and restoration. The slide presentation (Appendix A) was composed of two sections. Slides 2-29 and 31-57 contained background information on which students were assessed. This was information that the students were expected to apply to the project at hand. Slides 59-96 corresponded directly to the

video tutorial (Appendix B). The slide presentation was designed to accompany this project and did not replace background information regarding principles of tooth preparation, ergonomics, dental materials, and instrumentation. All didactic presentations were uploaded online and made available to students at least 24 hours prior to the lecture. It was recommended that students preview the uploaded PowerPoint presentation prior to the lecture date. The slide presentation was delivered in a lecture hall setting prior to the simulation clinic exercise.

The preclinical faculty also viewed the video (Appendix B) and reviewed criteria and grading techniques in a morning huddle. This ensured faculty calibration and, therefore, less student confusion and frustration. Any questions, comments, or suggestions by faculty were addressed in the huddles prior to student interaction and instruction.

Following the didactic lecture (Appendix A), student doctors prepared the tooth in segments along with the video (Appendix B). This video tutorial or prep-along method of training provided consistent, reproducible instruction for the entire class while allowing students to receive small-group instruction. It is important to stress that the video was used in conjunction with conventional lecture prior to simulation clinic and did not replace hands-on instruction. At MWU-CDMA, all instructional materials and didactic lectures were available for faculty and students via an online library.

The preclinical session began with a brief introduction outlining the goals and details of the upcoming experience. The armamentarium was introduced, and students readied their workspace. It was important that all students had their workspace prepared so that they could follow along without distraction. The first portion of the video was shown, then paused. Student doctors attempted that portion of the project while receiving additional instruction and feedback from faculty. The timing of each pause coincided with the video:

1. Occlusal reduction.
2. Mesial and distal proximal reduction.
3. Buccal reduction.
4. Lingual reduction.
5. Connecting the mesial and distal walls with the buccal and lingual walls.
6. Finishing the margins.
7. Final preparation finish.

The duration of each pause was determined by the working speed of the students. Some steps required more time than others; faculty were polled throughout the session to determine the progress of the students. This process continued in segments until the project was completed. The process was completed in approximately 1 hour. This method of instruction allowed faculty to evaluate the students' understanding of each step within the given project.

The video also included methods of assessment using instruments and a putty reduction guide. At MWU-CDMA, students and faculty used electronic grading. Each student performed a self-evaluation; then, the instructor performed a blind evaluation. Included in this publication is the printable student assessment form (Appendix C) that the student and instructor printed out and used to evaluate the student's project. The student assessment form included ideal descriptors as well as errors commonly encountered by the novice dental student.

The student and the faculty member scored each category on a 5-point Likert scale. A score of 5 was "ideal," with no errors. A score of 3.5 was "clinically acceptable," with some errors. Anything below a 3.5 had errors causing the restoration to be "clinically unacceptable." A total passing score of 31.5 out of 45, or 70%, was considered minimally acceptable. However, if in any category a student received a 1, this was

deemed a critical item, and the preparation would not pass. The assessment form could also be adapted to other dental programs with minor adjustments to fit different preparation measurements. When both the student and faculty member completed the assessment, they compared scores. This comparison was an integral portion of the teaching tool, as it determined the student's understanding of the criteria. The assessment and comparison took approximately 10 minutes to complete, with some variation due to the nature of faculty and student feedback and interaction.

An electronic survey was created using SurveyMonkey to gain student feedback on this method. The survey was considered exempt by the Midwestern University Institutional Review Board. This 10-question survey (Appendix D) used a Likert scale to assess students' feelings about the instructional methods and asked for comments. A link to the survey was sent to the classes of 2019 and 2020, as they both were exposed to this teaching modality.

## Results

Students responded with positive feedback to this method of instruction. This project was performed in the winter quarter of the second year. Quarterly anonymous course evaluations consistently contained positive comments about the prep-along method. Some examples of student comments are as follows:

- “The prep-along really tied the lecture and the project together.”
- “Being able to see Dr. Lukas prepare a section of the tooth and then letting me do it saved a lot of time. It also prevented me from making mistakes.”

Of 285 surveys, there were 94 respondents, a 33% response rate. Respondents were predominantly in favor of the prep-along method. Less than 6% of the students had an unfavorable response regarding the prep-along method (Table 1 and Table 2). Comments were mostly positive:

- “I strongly feel the ‘prep-along’ method was an effective way to learn how to prep a crown. It is safe to say most students have followed some type of online tutorial to successfully complete a task. I feel like the live ‘prep-along’ resembled an online tutorial, but even better because we have instructors right by our side to guide us through in case we get stuck. I believe this method would be helpful for many other restorative/fixated procedures.”

One consistent critique of the method was that some students felt the time between steps was too long and slowed them down. Examples of such comments include the following:

- “Prep along is great as long as the process is not too long. A quick visual of the work flow is great.”
- “I absolutely love the instructional videos that were available on Blackboard. I wish there were these types of videos for every procedure done in SIM clinic.”
- “Sometimes the prep-along method took extra time in SIM when it was live, but I realize now that doing it that way really reinforced my learning and was very helpful.”
- “I know it's difficult with a group of students at different paces, but the prep-along day was a little slow for my speed personally so I think it could be done a little faster!”

Others remarked that having this instruction in smaller groups would be more efficient.

- “The prep-along method was effective in self-evaluation after each step. The only downfall was the amount of students participating and ‘waiting’ on those students. Bench prep-alongs would alleviate the problem of too many people participating at one time.”
- “It was open panel to the entire class, which is really big.”

**Table 1.** Survey Response Results by Number (Ns = 92-94)

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Total
The prep-along method allowed me to establish a crown preparation protocol.	51	36	5	1	0	93
The prep-along method allowed me to better understand the necessary steps in crown preparation.	56	35	0	1	0	92
The prep-along method allowed me to better understand the purpose of each crown preparation step.	51	38	1	4	0	94
The prep-along method allowed me to better adapt the procedure to other crown preparation procedures regardless of the material requirements.	49	32	10	2	0	93
The prep-along method allowed me to understand which instruments and burs to use for a crown preparation.	44	42	4	2	0	92
The prep-along method allowed me to better self-assess my crown preparation.	35	37	16	5	0	93
The prep-along method allowed me to perform the procedure in an efficient manner.	48	34	6	3	2	93
The preclinical faculty should use the prep-along method for other new projects in the Simulation Clinic.	47	38	7	0	1	93
The prep-along method is a useful teaching methodology for a preclinical curriculum.	49	40	2	1	1	93
Regarding the prep-along method, I prefer a different method of instruction when learning a new procedure in the Simulation Clinic.	8	11	22	42	11	94

**Table 2.** Survey Response Results by Percentage (Ns = 92-94)

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	N
The prep-along method allowed me to establish a crown preparation protocol.	55%	39%	5%	1%	0%	93
The prep-along method allowed me to better understand the necessary steps in crown preparation.	61%	38%	0%	1%	0%	92
The prep-along method allowed me to better understand the purpose of each crown preparation step.	54%	40%	1%	5%	0%	94
The prep-along method allowed me to better adapt the procedure to other crown preparation procedures regardless of the material requirements.	53%	34%	11%	2%	0%	93
The prep-along method allowed me to understand which instruments and burs to use for a crown preparation.	48%	46%	4%	2%	0%	92
The prep-along method allowed me to better self-assess my crown preparation.	38%	40%	17%	5%	0%	93
The prep-along method allowed me to perform the procedure in an efficient manner.	52%	37%	6%	3%	2%	93
The preclinical faculty should use the prep-along method for other new projects in the Simulation Clinic.	51%	41%	7%	0%	1%	93
The prep-along method is a useful teaching methodology for a preclinical curriculum.	53%	43%	2%	1%	1%	93
Regarding the prep-along method, I prefer a different method of instruction when learning a new procedure in the Simulation Clinic.	9%	12%	23%	44%	12%	94

## Discussion

Before implementing the prep-along method of preclinical instruction, students received a didactic lecture, then viewed drawings and photographs depicting the ideal preparation and criteria prior to attempting the project. Students typically spent up to 3-4 hours on the first preparation regardless of whether a direct or indirect preparation or restoration was scheduled. There were no structured intervals for feedback, and some students would not seek feedback until their project was completed. The faculty were instructed on grading techniques and rubric during a morning huddle. However, preparation sequence and technique were not always consistent. By integrating this multimodal learning tool, students now receive consistent, calibrated instruction. The learning curve has been greatly diminished, with students completing their first preparations in about an hour. There is more instructor feedback, and students are less likely to develop undesirable habits because each step is checked.

The prep-along also allowed students to have a finished or almost finished project at the end of 1 hour. This had the benefit of showing the students that they could perform efficiently as well as effectively. Giving them a limited yet adequate amount of time per preparation step showed the students that they were capable of a crown preparation in a reasonable amount of time. As a result, this significantly

decreased the students' learning curve. Because we posted the video online, students could review the technique at any time, giving them the opportunity to grasp a concept or nuance that they might have missed in a onetime demonstration. The faculty learned that by providing a multimodal learning tool, student engagement and understanding improved. The faculty also learned that requiring systematic checks and feedback during initial projects decreased or prevented frustration among students. The faculty now incorporate more multimedia within their didactic lectures and, through calibration exercises, increase small-group instruction while maintaining consistency.

Feedback regarding the time between steps was taken into consideration. The prep-along was shortened by approximately 15 minutes, and the students were allowed to fine-tune the preparations at the conclusion of the instruction.

Videos provide a valuable adjunctive tool in the simulation clinic; ultimately, we would like to create a video library that can be accessed by faculty and students. However, it is very time-consuming to produce a quality video. Many faculty member hours are needed for setup, filming, editing, and narrating. Each video requires approximately 100 hours to create, and the process has taken longer than expected. We hope that with time and experience, the process can be shortened.

Both full-time and part-time faculty at MWU-CDMA use various instructional methods in the simulation clinic. The prep-along method is by far the most popular among students and faculty when first attempting a preparation or restoration. The method is used for instruction on direct and indirect tooth preparations and restorations. Because the video is available for student viewing outside of simulation clinic hours, students can receive instruction at their own pace. The video is meant to enhance, not replace, didactic lectures and one-on-one faculty instruction. Prep-alongs have become a valuable tool for both student instruction and faculty development and calibration at our institution.

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#### Ethical Approval

Midwestern University Institutional Review Board Committee approved this study.

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