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Abstract

Objective The purpose was to analyze the effect of an instructional video on practical tutorial and to ascertain whether an instructional video improves students' performance on practical performance and reduces the stress associated with learning.

Materials and Methods A randomized controlled trial was conducted on a group of 78 first-year students. A pretest was conducted by administering questionnaires to evaluate the interest in the use of videos as well as the level of stress. Students were randomly assigned into two groups: control and test. Students assigned to the control group received conventional teaching, while the experimental group received both conventional teaching and watched a video. Thereafter, a satisfaction questionnaire was distributed to each of the groups, and they were awarded a grade.

Results A total of 98.7% of students wished to learn fixed prosthodontics through instructional videos, as they believed that the videos could reduce their worry and stress levels. At the end of the first tutorial, the total grade was significantly lower for the test group ($p = 0.003$). However, the subjective value of stress was significantly lower in the test group ($p = 0.0007$) as well as the subjective value of tutorial difficulty ($p = 0.0004$). Students felt that they better understood the objectives of the tutorial "thanks to the video" ($p = 0.0001$).

Conclusion The study did not reveal any improvement in terms of performance when an instructional video was used for tutorials in comparison with the conventional teaching method. However, the results show a reduction in the level of stress.

Keywords
- dental students
- fixed prosthodontics
- instructional video
- practical tutorial

Introduction

The use of technologies for teaching and learning in universities has increased dramatically in recent years. As new technologies are invented, they are integrated into the educational system to make teaching and learning easy and produce higher learning outcomes. In recent years, the pedagogical use of notable technologies such as instructional videos and computer simulations have started being implemented in some universities across the globe.

Globally, today's universities are crowded with a new generation of students; a generation who grew up in a world dominated by the internet (Generation Y). These students tend to think and learn differently because they have

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different cognitive capacities compared to those who grow up in a nondigital environment.[1] However, is this really true? There is an ongoing debate between believers and nonbelievers around the existence of the species known as "digital natives."[2] Clearly, information and communication technologies (ICTs) for learning, particularly video aids, are important elements for the education of this generation.[3]

Numerous studies in the medical field have shown the positive effect of a video as a tool in the understanding and retention of cognitive knowledge or the learning of doctor–patient communication.[4-6] In the field of medicine, traditional classes have been compared to different forms of video-based learning, including multimedia and streaming, with comparable results.[7,8] Various studies have highlighted the growing attraction of learning complemented by ICTs regarding dental students, and more studies are available on the value of using videos for students.[9,10]

To date, there have been few articles on the effect of instructional videos on the teaching of dentistry. Most of the available articles are concerned with the contribution of videos to cognitive learning,[11,12] doctor–patient communication,[13] removable dental prostheses,[14,15] or comparisons with previous year groups.[16-18] However, there is little research on the significant contribution of videos to motor learning during fixed prosthodontics tutorials. We hypothesize that videos can enhance students' results during practical tutorials on fixed prosthodontics by improving their understanding of objectives and reducing their stress.

Materials and Methods

This study did not require an institutional review board.

Design of the Study

A randomized controlled study was used to include the students from our university during their fixed prosthodontics practical tutorial. All the first-year students were randomly assigned into two groups: control group A and test group B. The two groups had two tutorials: preparation of a maxillary incisor (tutorial 1) and preparation of a maxillary canine (tutorial 2). Usually, the basic program of the preclinical tutorials includes a t-presentation with the objectives to be achieved at the beginning of the session. Both groups (control group A and test group B) received t-information, including iconographic and photographic support, which focused on different steps and instructions such as the respect of the axis of preparation and occlusal reduction. The students had access to this PowerPoint presentation throughout the tutorial. The test group (group B) received a video showing the making of a dental crown on manikin-mounted typodonts according to a methodology identical to the PowerPoint presentation during the tutorial. We ensured that all students in the test group watched the video until the end. The duration of the tutorial was the same for each group. The control group received the videos at the end of the study.

Study Participants

All the first-year students were included in the study (79 students). The exclusion criteria include all the students who did not consent to participate, were absent during the tutorial, and who did not fill out the questionnaires correctly. All participants completed a written consent form based on the Helsinki Declaration during their first visit.

Instrument for the Study

A pretest was conducted by administering a 5-item questionnaire to students to evaluate their interest in the use of videos and level of stress. The rating scales were between 1 and 5, with 1 representing no stress and 5 representing maximum stress. The questionnaire included 4 other dichotomous closed questions on the implementation of video as a digital tool.

At the end of the tutorial, an assessment questionnaire was distributed to evaluate criteria such as the subjective value of stress (1 "no stress" to 5 "maximum stress"), the subjective value of tutorial comprehension (1 "very easy" to 5 "very difficult"), students' capacity to evaluate the quality of their work (5 grades from 0 to 20), and appreciation of the video.

All these standard questionnaires have been validated by the school's pedagogical commission.

Video

The video was made with a Panasonic Lumix DMC-FZ300 camera mounted on a tripod, and it illustrated the preparation techniques on the incisor and canine tooth. It summarizes the protocol seen in class in a step-by-step manner: buccal preparation, proximal surface preparation, palatal surface preparation, occlusal reduction, and surface texture. The length of the video was 5 minutes. The students watched the video on a screen in the tutorial classroom after the PowerPoint presentation with the teacher's explanations (test group). Then, the video was played in repeat mode throughout the tutorial.

Assessment Criteria

Principal

The principal assessment criterion was student's grade. The grade was determined by a single assessor (blind) using a standardized assessment sheet, which has been used for the past 12 years (►**Table 1**). The overall grade was made up of several components: compliance with the preparation axis, correct axial and occlusal reductions, compliance with finish lines, and surface texture.

Secondary

The secondary evaluation criterion were determined by the assessment questionnaires (4-Likert scale).

Anonymity

Anonymity was achieved by attaching a random 4-digit number to the teaching models as well as to the questionnaires. The test and control group models were mixed for correction.

Table 1 Assessment sheet

		Tooth n°	Tooth n°	Tooth n°
Preparation axis (2 points)				
Axial reduction				
	Anatomic reduction (2 points)			
	Occlusal convergence (2 points)			
	Total			
Occlusal reduction depth				
	Morphology (2 points)			
	Reduction (2 points)			
	Quality of axial/occlusal line angles (2 points)			
	Total			
Finish line				
	Location (2 points)			
	Form (2 points)			
	Continuity (2 points)			
	Total			
Surface texture (2 points)				
Total mark out of 20				

Note: The overall score takes into account different evaluation criteria for each of the steps of the crown preparation.

Statistical Analyses

We used Stata V14.1 software to perform statistical analyses and Microsoft Excel 2013 for graphic production. Two tests were used: Student's *t*-test allowed the comparison between two groups, and Chi-square test allowed the verification of a relation between qualitative variables. All tests were validated with a *p*-value fixed at 0.05.

Results

A total of 78 out of 79 students consented to participate in the study (one student did not participate in the study due to absence). The study population comprised 54.5% males and 45.5% females. The average age of the participants was 20.5 years.

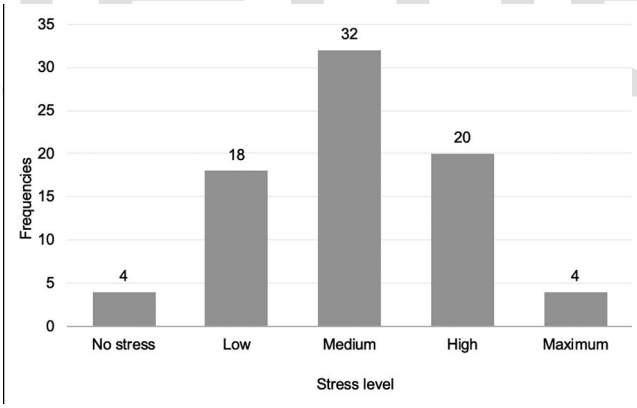

Fig. 1 Distribution of the stress level in the sample before the tutorials.

Results of the Survey Prior to the Experimental Study

The stress levels before the tutorials were distributed in an approximatively Gaussian manner, with a very low proportion of students presenting maximum/minimum levels of stress (n = 4) (►**Fig. 1**). A total of 35% of the students reported having a high or maximum level of stress, and 98.7% of students wished to have access to the instructional video, as they believe the video could reduce their worry and stress levels.

Analysis of Principal Assessment Criterion

At the end of the first tutorial, the average grade for the test group was significantly lower than that of the control group (group B 7.97 vs. group A 9.38, p = 0.008; ►**Table 2**). There was no significant difference between the average grade of the two groups at the end of the second tutorial (group B 8.13 vs. group A 8.00, p = 0.76).

The performance of the individuals in the two groups on both exercises is given in ►**Table 3**. There was a decrease in the overall average of the control group between the two tutorials, while the average of the test group improved. The score on the preparation axis and axial reduction did not improve for both groups. The three notes on the occlusal reduction depth improved in the test group, but not in those who did not watch the video. The latter also did not show any improvement in ratings on the finish line. The note on the form and continuity of lines improved for the

test group, but the location of the line did not. Finally, both groups had improved surface texture.

In terms of gender (►**Table 4**), the average grade was significantly lower for the test group (group B 7.90 vs. group A 9.48, $p = 0.04$) among females. Moreover, there was no significant improvement among males.

Analysis of Subjective Secondary Criteria

We hypothesize that the video would have a beneficial impact on stress. To verify our hypothesis, we studied the difference between the stress value of the student in each group after each tutorial. The statistical tests showed that there was a significant difference between groups A and B. The subjective

Table 2 Principal assessment criterion on student's grades: test/control group comparison during the first tutorial

	Averages		*p*-Value
	Control group	**Test group**	
Grade 1: preparation axis	1.1	0.83	0.003
Grade 7: quality of axial/occlusal line angles	0.88	0.68	0.04
Grade 11: continuity of finish lines	0.82	0.64	0.04
Total grade	9.38	7.97	0.008

Table 3 Principal assessment criterion on student's grades

Performances of test/control group for the first tutorial				
		Without video (A)	**Video (B)**	***p*-Value**
Preparation axis (2 points)		1.1	0.83	0.003
Axial reduction				
	Anatomic reduction (2 points)	0.92	0.83	0.26
	Occlusal convergence (2 points)	0.82	0.74	0.56
Occlusal reduction depth				
	Morphology (2 points)	0.96	0.83	0.12
	Reduction (2 points)	0.91	0.79	0.21
	Quality of axial/occlusal line angles (2 points)	0.88	0.68	0.04
Finish line				
	Location (2 points)	0.99	0.89	0.3
	Form (2 points)	1.01	0.85	0.1
	Continuity (2 points)	0.82	0.64	0.04
Surface texture (2 points)		0.97	0.87	0.15
Total mark out of 20		9.38	7.97	0.008
Performances of test/control group for the second tutorial				
		Without video (A)	**Video (B)**	***p*-Value**
Preparation axis (2 points)		0.96	0.75	0.01
Axial reduction				
	Anatomic reduction (2 points)	0.76	0.76	1
	Occlusal convergence (2 points)	0.70	0.72	0.89
Occlusal reduction depth				
	Morphology (2 points)	0.81	0.91	0.12
	Reduction (2 points)	0.79	0.82	0.69
	Quality of axial/occlusal line angles (2 points)	0.72	0.82	0.24
Finish line				
	Location (2 points)	0.79	0.72	0.29
	Form (2 points)	0.73	0.86	0.2
	Continuity (2 points)	0.70	0.76	0.3
Surface texture (2 points)		1.05	1.01	0.55
Total mark out of 20		8	8.13	0.76

Table 4 Principal assessment criterion on female's grades: test/control group comparison during the first tutorial

	Averages		*p*-Value
	Control group	**Test group**	
Grade 1: preparation axis	1.14	0.79	0.008
Grade 5: anatomic occlusal reduction	0.98	0.75	0.04
Grade 11: continuity of finish lines	0.86	0.61	0.03
Total grade	9.48	7.9	0.04

value of stress was significantly reduced in the test group who were taught with video ($p = 0.0019$).

Therefore, in teaching with a video, the subjective value of the difficulty of the tutorial decreased significantly (p-value = 0.0004), and conversely, the understanding of the tutorial improved (p-value = 0.0001).

In terms of student perception, after the two tutorials, most students thought that the video was beneficial to them, with 83% in tutorial 1 and 91% in tutorial 2.

Discussion

Fixed prostheses are taught in the first year to enable beginner students to acquire and master a unitary dental preparation technique intended to secure full-coverage crowns. Practical work is a preclinical teaching that prefigures clinical practice with patients. Thus, students receive several lessons in the form of PowerPoint slideshows prior to the practical sessions. The first lesson determines the preparation method, objectives, interests, and limits. Then the operating protocol of the chosen method is detailed. This method then demonstrates step by step the preparation of the tooth with details and explanations of the various instruments used. The PowerPoint slideshow allows the beginner students to sequence their work with as many pauses as they wish, mastering the sequences at their own pace of learning. The video shows an operator carrying out the preparation and perfectly mastering the technique and its protocol. It matched the slideshow on every point, adding only the three-dimensional visualization of the gestures and refining the positions and precision of the instrumental use. As each tooth is anatomically different, the slideshows and videos focus on the treatment of each tooth's singularity.

Video tools are perceived by the students as useful and stimulating, with the potential to improve learning and skills performance. However, the lack of face-to-face contact decreases interactivity and is one of the main pitfalls.[19] Previous studies on learning a surgical procedure highlight the benefit of videos for different elements, such as a faster learning curve or longer retention of information regarding the most effective procedure.[20,21] However, the benefit of videos for the motor learning of a surgical procedure is less evident than the benefit for cognitive learning.[22] As an example, the performance of a surgical knot shows that learning with video support leads to a poorer quality result for the student, compared to conventional learning in the form of a slideshow.[23] In a study very similar to ours, with a comparable number of students and similar parameters, videos were compared with demonstrations. No significant difference in the parameters studied was highlighted.[18]

A reflection on the quality of the main evaluation criterion was made prior to the study. The aim was to create an evaluation system that was as objective as possible. Therefore, we chose to use a visual assessment with the help of an assessment sheet. The visual evaluation, according to certain predetermined parameters (hence, the requirement for a previously established assessment sheet), is a consistent evaluation, even if it is difficult to guarantee standardization between the different examiners (for this reason, we chose a single corrector). The singularity of this study prevented us from using standard questionnaires used and validated by other studies.

Concerning the principal judgment criterion, our study did not validate our initial hypothesis. The test group did not perform better than the control group. This leads us to put forward the following suggestions. The first suggestion concerns the target population. Indeed, the students are all beginners that are making their first preparations. Thus, whatever the educational support, it seems normal that in a learning curve, one observes better results over the course of practical exercises. This is due to an increasing mastery of the preparation technique. All in all, we note a drop in performance for the control group between the two tutorials, whereas there was no change for the test group (►**Table 3**). Due to its anatomical peculiarities, we consider the preparation of a maxillary canine tooth more difficult for beginners than that of a maxillary incisor. A better prior understanding of the preparations, thanks to the use of the video, may explain these results. It would therefore be interesting to repeat this study in the long term to confirm this hypothesis. The second suggestion concerns the familiarization of their new work environment. In addition to understanding the tutorials, beginner students have many satellite elements to deal with that are not considered aggravating factors of results, grades, and stress. These factors are, for example, work ergonomics, management of the use of spray rotors, and management of aspirations. In this sense, the first year of study may not be the best choice for assessing the advantage of one educational tool over another. The third suggestion concerns the groups themselves. Indeed, even if the groups have been randomized for this study, we note each year that some groups have better results overall than others.

Concerning the subjective secondary criterion, the results showed that the students found the tutorial simpler thanks to the video. The generational appeal of videos assimilated with tutorials contributes to a decrease in stress in the

presence of a known medium. Students describe it as useful and effective as well as enjoyable, motivating, and stimulating. They felt that their stress was significantly reduced. The video improved the students' understanding but was insufficient to compensate for the lack of practice, as this was their first year of preclinic. These results are found in other studies.[24,25] With self-completed questionnaires, it is common to encounter bias of honesty in response to questions. As these questionnaires were anonymous, this bias was minimized: students had no reason to falsify their responses because they were not evaluated.

From a technical point of view, the screening by video projection was not satisfactory. This mode of screening was chosen for the study to prevent bias and stop the students from sharing the video among themselves before the tutorial. However, it would have been preferable if students had access to a video before the tutorial. This would have enabled them to take the time to assimilate the different steps.

Conclusion

The study did not show any improvement in terms of performance when a video was used for the tutorial. The parameters concerning the quality of preparation and the design of the study do not allow us to conclude an obvious advantage or disadvantage, and consequently, it is difficult to evaluate the contribution of videos for motor learning in dentistry for beginners. Nonetheless, the questionnaires convey the students' desire to have video support to complement their learning. It has a positive effect on subjective stress and on the comprehension of the tutorial's objectives. Students, therefore, felt less stressed, which is a crucial factor demonstrating the importance of putting new pedagogical tools in place to reduce the stress levels of dentistry students.

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Conflict of Interest
None declared.

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