ASSESSMENT OF DENTAL ANATOMY CARVING FOR UNDERGRADUATES IN COMPUTER-ASSISTED LEARNING VS. CONVENTIONAL LEARNING METHOD

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ABSTRACT

Aim: Computer-assisted learning (CAL)has the potential to supplement faculty instruction, especially when there is a need for repeated demonstration of technique. The aim of this study was to test the superiority of CAL over traditional laboratory instruction in the area of dental anatomy wax carving for undergraduates.

Methods: Eighty undergraduate students from the first year at the Faculty of Dentistry / Syrian Private University (SPU) were subjected to 2 lectures with two different methods (conventional learning vs. CAL) explaining wax carving of upper and lower right canines. All students were asked to carve an upper and a lower right canine using the dental wax block. Clinical supervisors evaluated the student's work using a scale from 0 to 5. Independent T-Test as well as paired sample T-Test were used to compare 2 samples evaluated for both conventional and computer-assisted methods.

Results: There were significant differences in evaluation records of upper canine carving between conventional and CAL methods, and those differences were more adhered to the CAL. No significant differences in evaluation records of lower canine carving between conventional and CAL methods were found. Combined together, no significant differences in evaluation records of both upper and lower canines' carving between conventional and CAL methods were found.

Conclusion: CAL showed no significant superiority over conventional learning in terms of wax carving course for undergraduates. However, CAL could be successfully used as a complement to the traditional educational systems in preclinical course of tooth anatomy wax carving.

Introduction

Enhancing learning with computer technologies began in the mid- to late 1960s (1, 2). CAL has shown promise by introducing interactivity and independence into learning experiences.

The literature tracing the historical development of CAL from that time to the present is extensive. Several studies have reviewed the broad spectrum of literature in this area. A previous article by Rosenberg et al. (2003) (3). has reviewed a large portion of the CAL literature with a particular emphasis on dental education. Those authors, limiting their series to twenty-seven randomized controlled trials, recommended CAL be used as an adjunct to conventionalteaching or as a means of self-instruction. Students responded positively to CAL and seemed motivated to learn.

Moreover, it has been suggested that simply exposing the students to a more clinic-like environment should improve their transition from preclinical laboratory to the clinic .Dental anatomy carving is one of the subjects which is taught to first-year students at the Faculty of Dentistry/ SPU in Damascus/Syria,that is the entrance to Dentistry in which students recognize preliminary information of teeth anatomy to learn the structure and internal shape of every tooth. In our opinion, this would enhance the competence and even the practice of professional work later at the dental office.

Through the Faculty's continuous trials to enhance the educational methods, the aim of this study was to test the superiority of CAL over traditional laboratory instruction in the area of dental anatomy wax carving using the supervisors' evaluation of students' tasks at the course.

Materials and methods

Materials related to the study
- Computer device (Toshiba)
- Demonstrating screen (Lg™)
- Demonstration DVD, in which a full demonstration of dental carving is presented
- Learning sheets, in which illustrations of dental carving are explained in details
- Carving tools
- Wax blocks for carving

Methods

The sample of the study consisted of 80 undergraduate students from the first year at the Faculty of Dentistry / SPU.

All students were subjected to 2 lectures at the laboratory at different time points. At the first lecture, wax carving of upper and lower right canines was explained and demonstrated in the conventional method by means of related illustrations and oral instructions.

At the second lecture, wax carving of same teeth, mentioned above, was explained and demonstrated using CAL (i.e. using the demonstrative DVD, computer, and demonstrating screen). Moreover, all students were allowed to have a local copy of the DVDs to be able to review them later on (e.g. at home) for more validation of the carving techniques.

At the end of each lecture, all students were asked to carve an upper and a lower right canine using the dental wax block. The time given to them for this task was 40 minutes, and they had to follow the anatomical standards of teeth being carved (i.e. all anatomical features of mesial, distal, buccal, and lingual surfaces of the canines). The anatomical standards for carving were obtained from those mentioned by Wheeler (1974) (5) which were already explained to students.

After finishing the tasks by students, a committee of 3 clinical supervisors, who used to teach dental anatomy, had to evaluate the student's quality of work using a scale from 0 to 5 that had to be registered on a separate form.

The evaluation achieved by the supervisors depended basically on how much the student had followed the anatomical standards in his/her carving of the canines.

Statistical analysis
Independent T-Test as well as paired sample T-Test were used to compare 2 samples evaluated for both conventional and computer-assisted methods and to find out whether any significant difference did exist or not.

Results
Evaluation of upper canine carving
It was shown that the mean values (Mean ± Standard deviation) of evaluating the upper canine carving were (1.08±1.25) for conventional learning method, and (1.93±1.50) for computer-assisted learning method (Table 1).

Table (1): Evaluation records of upper canine carving

SD	Mean	Lecture type	Evaluation of upper canine carving
1.256	1.08	Conventional learning	
1.501	1.93	CAL	

This encountered a high-valued standard deviation (SD) which reflected a bias in the measurements. For this reason, independent T-test was used to find out any significant difference between both methods, and it was shown that t= -2.910 with a freedom degree df=78 and sig=0.045 which is less than 0.05. Thus, Null hypothesis was rejected and we accepted that there were significant differences in evaluation records of upper canine carving between conventional and CAL methods, and those differences were adhered to the computer-assisted method (Table 2).

Table (2): Evaluation of upper canine carving using t-test for Equality of Means

Differences at confidence degree 95%		Differences at Means	sig	Df	T	Evaluation of upper canine carving
Max.	Min.					
.036	-1.733	-0.848	0.045	78	-2.91	Equal variances assumed
-0.026	-1.671	-0.848	0.044	19.302	-2.156	Equal variances not assumed

Evaluation of lower canine carving
It was shown that the mean values of evaluating the lower canine carving were (2.15±0.98) for conventional learning method, and (2.01±1.39) for computer-assisted learning method (Table 3).

Table (3): Evaluation records of lower canine carving

SD	Mean	Lecture type	Evaluation of upper canine carving
0.987	2.15	Conventional learning	
1.398	2.01	CAL	

Independent T-test was used to find out any significant difference between both methods, and it was shown that t= 0.34 with a freedom degree df=78 and sig=0.73 which is more than 0.05. Thus, Null hypothesis was accepted and there were no significant differences in evaluation records of lower canine carving between conventional and computer-assisted learning methods (Table 4).

Table (4): Evaluation of lowercanine carving using t-test for Equality of Means

Differences at confidence degree 95%		Differences at Means	sig	Df	T	Evaluation of upper canine carving
Max.	Min.					
0.949	-0.671	0.139	0.734	78	0.341	Equal variances assumed
0.807	-0.529	0.139	0.671	22.537	0.431	Equal variances not assumed

General evaluation of canine carving (both upper and lower)
It was shown that the mean values of evaluation for both lower and upper canines' carving were (3.23±2.00) for conventional learning method, and (3.94±2.39) for computer-assisted learning method (Table 5).

Table (5): General evaluation of canine carving (both upper and lower)

SD	Mean	Type of lecture	Evaluation of upper canine carving
2.00640	3.2308	Conventional learning	
2.39242	3.9403	CAL	

Independent T-test was used to find out any significant difference between both methods, and it was shown that t= -1.002 with a freedom degree df=78 and sig=0.32 which is more than 0.05. Thus, Null hypothesis was accepted and there were no significant differences in evaluation records of bothupper and lower canines' carving between conventional and computer-assisted learning methods (Table 6).

Table (6): General evaluation of canine carving using t-test for Equality of Means

Differences at confidence degree 95%		Differences at Means	sig	Df	T	General evaluation of canine carving (both upper and lower)
Max.	Min.					
0.70062	-2.11968	-0.70953	0.320	78	-1.002	Equal variances assumed
0.60483	-2.02389	-0.70953	0.273	19.302	-1.129	Equal variances not assumed

Discussion
CAL has the potential to supplement faculty instruction, especially when there is a need for repeated demonstration of technique. This feature is particularly attractive in a time of faculty shortages(6).

According to McCann et al.(7), about two-thirds of the students under e-teaching found college e-resources effective for learning but they preferred printed text and liked e-teaching as a supplement, not as a replacement for traditional lectures.

Brownel et al. (8)compared lecture and e-learning in new graduates and experienced dental professionals and found that e-learning was more effective in experienced dental professionals while the situation was reverse for new graduates.

In terms of maintaining the gained knowledge, Stern et al. (9) revealed that the students' knowledge level decreased one year after the intervention but the skills did not. Equipping the educational environment with high-tech teaching devices can further encourage and engage students in educational activities.

CDS devices are capable of providing students with instantaneous feedback through visual cues to teach proper eye/hand coordination, acceptable tooth preparation forms, and other necessary procedural skills such as understanding of self-assessment during the procedure.

Additional advantages of computerized simulation in dentistry include 1) twenty-four-hour availability with step-by-step guidance and evaluation; 2) standardized educational experiences that can be used repeatedly with fidelity and reproducibility; and 3) an individualized learning process that allows students to focus on areas that will enhance their level of competence most efficiently(10, 11).

Our study aimed at finding out any possible superiority of CAL over conventional learning in terms of a dental wax carving course related to upper and lower right canines. Choosing canines in this study was related to the fact that the anatomical features of those teeth were more clear and easy to be realized, according to the clinical supervisors through their long experience with students in similar courses.

The results showed that there were no significant differences between evaluation records of both upper and lower canines' carving between conventional and computer-assisted learning methods.

However, Lack of a difference does not mean that the groups were the same; it means that there was not enough evidence to show that the groups were different enough to reject the null hypothesis of no difference(12).

Many previous studies on CAL used a superiority study design to compare CAL programs to traditional teaching techniques, but failed to achieve statistically significant findings because study groups usually had similar scores or outcomes. They sought to test whether or not CAL was better than traditional teaching techniques, which is difficult to prove and usually unnecessary. Some of these previous studies would then conclude, or imply, that the study groups were the same because a statistically significant difference was not found. This was flawed statistical thinking (13).

In our study, evaluating the records of upper canine carving in specific showed that there were significant differences between evaluation records of upper canine carving between conventional and computer-assisted learning methods, and those differences were more adhered to the computer-assisted method.

In 2009, Nance et al. compared the performance of students exposed to two different instructional modalities for dental anatomy wax carving: computer-assisted instruction (CAI) using DVD technology, or traditional laboratory instruction. They concluded that merging CAI and traditional laboratory teaching may best enhance student learning needs.

More recently, Fayaz et al. 2015 (14) conducted a study to determine the effect of a new educational modality by using videotapes on the performance of dental students in preclinical course of complete denture fabrication, and concluded that instructional video tapes can aid in teaching fabrication of complete denture and were as effective as the traditional teaching system.

In our study, no significant differences between evaluation records of lower canine carving between conventional and computer-assisted learning methods were shown (t=0.34, sig>0.05),which might indicate that oral instructions with graphic illustrations as well as the constant presence of an instructor is equal to educational multimedia in this respect. On the other side, lower canines could be among the easiest teeth to carve.

All students were allowed to have a local copy of the DVDs in this study after finishing the requested tasks. However, whether or not there was any effect on the results due to this fact was not investigated. That should be done in further studies.

This study showed that CAL could be more effective when combined with face-to-face teaching. However, similar studies with a larger sample size are required to generalize the results.

Conclusion

Within the limitations of this study, instructional films, in terms of CAL, could be successfully used as a complement to the traditional educational systems in preclinical course of tooth anatomy wax carving. Oral instructions with graphic illustrations as well as the constant presence of an instructor is equal to educational multimedia in this respect.

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