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CONGRESS PROCEEDING

Evaluation of Dental Students' Knowledge and Opinion About Learning with Virtual Reality

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Abstract

Purpose: The purpose of this survey study is to learn the knowledge, opinions, and thoughts of dental students in our country on the use of VR-based dental simulators in education, and to raise awareness on this issue.
Methods: Questions testing participants' knowledge were based on the data from peer-reviewed dental journals. The survey questions consisting of 25 questions were delivered online via Google Forms (Google Inc., USA) to students who had preclinical training in the dental faculty before the Covid-19 pandemic. The data obtained were evaluated using the descriptive statistics and Pearson chi-square test.
Results: 422 of the 662 students in the study were female and 240 were male students. 82.3% of the study participants were studying at a state university. 74.6% of the participants in the study stated that they needed more preclinical education. While 89.9% of the students participating in the survey stated that they do not have information about preclinical education with virtual reality, 97.4% stated that they have not used a VR-based dental simulator before. 85.5% of them stated that they feel positive about training in virtual environment with VR-based dental simulator and 86% of them prefer using both VR-based training and phantom models in preclinical training.
Conclusion: Dental students had overall positive attitudes towards VR-based dental simulator despite their lack of knowledge and experience. In our country having knowledge about VR-based dental simulators will increase awareness for the development of such technologies and their inclusion in dentistry education.

Key words: dentistry; students; preclinic; virtual reality

Introduction

In dentistry education, pre-clinical laboratory lessons are very important for students to gain sufficient manual skills and to learn basic dental practices. Phantom head models provide the opportunity to learn appropriate ergonomic working conditions and to practice on the appropriate use of hand tools such as mirrors and probes.[1] Typodonts have many limitations including different physical properties than real teeth (such as stiffness, friction), high cost and environmental pollution in the manufacturing process. Teeth that can be extracted from animals or humans and mounted into a phantom head provide more realistic physical properties, but they are not always easy to attain.[2]

Various technologies are included in the dentistry curriculum to ensure a smooth transition to the clinical environment and to improve fine motor skills and hand-eye coordination in preclinical settings.[3] In recent years, virtual reality-based dental simulation training has become an active field. In the past two decades, haptic-based virtual reality has been suggested as an alternative methodology to provide the sensor-motor training needed. The future of VR-based dental simulation is promising due to both its technical advantages and social requirements.[4]

According to historical development of dental simulators, in 1998, the DentSim (USA) was presented as a VR-based pre-clinical training by transferring phantom jaws and teeth to computer environment. With development of American dental simulators in 1999 and 2001, it became possible to diagnose, drill and fill decayed teeth in a virtual environment. Cavity preparation and decay removal procedures can be simulated with the German Voxel-Man dental simulator developed in 2007. It is possible to experience surgical procedures such as impacted tooth extraction with the Swedish origin Cobra dental simulator developed in 2008. The PerioSim, designed especially for periodontics, can simulate three typical operations including pocket probing, calculus detection and calculus removal. The Simodont dental simulator developed by ACTA in the Netherlands in 2009; restorative, endodontic and prosthetic appli-

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cations can be performed via this simulator. The HapTEL which is another simulator from UK allows tooth drilling and decay removal procedures. Prosthetic procedures can be simulated with VirDenT simulator developed in Romania in 2011. Endodontic and prosthetic applications can be simulated with iDental produced in China in the same year. The VirTeaSy simulator system, originating in France, gives practitioners experience in the field of implantology as well as prosthetics. [2]

The purpose of this survey study conducted on the students who have received or are receiving pre-clinical training at the faculty of dentistry in Turkey is to determine the level of knowledge, and opinions of the students about VR-based dental simulators in pre-clinical education and to raise awareness on this issue.

Methods

The present study was approved by the "Trakya University Faculty of Medicine Scientific Research Ethics Committee" (. The survey was created using the Google Docs Form (Google Inc. Mountain View, California, USA). It was delivered online to 2.-5. grade students of the faculty of dentistry. Participation in the study was anonymous and voluntary. The data obtained were evaluated using descriptive statistics and Pearson Chi-square test.

The questionnaire consisted of 25 multiple choice questions. First, the participants were asked questions such as age, gender, academic year, institution, class size, pre-clinical hours, types of materials used in pre-clinic, and the number of instructors per person. Later, they were asked whether the education they received was sufficient or not, whether they had difficulties in the clinic. Afterwards, questions were asked about their knowledge levels and experiences with VR. Finally, the participants were asked questions about their desire to receive training via VR, whether VR training could have a positive effect on learning time, and what materials they would like to use in training.

Results

When we evaluated the findings of our study, we determined that 662 students participated in the survey and approximately 64% of the participating students were girls and 82.3% were those studying at a state university. Approximately 63% of the class sizes were between 50-100. When we asked the students about the type of material they used while studying in the pre-clinic, 67.4% stated that acrylic/plastic teeth were used. When asked the students whether they need more pre-clinical education, the need seems to be decreased as the grade level increased. However, more than half of the 5th grade students who participated in the study stated that they needed more pre-clinical education. Approximately 75% of 4th grade students and 60% of 5th grade students answered the question "Did you have difficulties in the clinic after pre-clinical training?" as "Yes". Most of the students participating in the study stated that they did not use a VR-based hardware technology. One of the questions we asked the participants was whether the students had information about pre-clinical education with a virtual reality-based technology, and approximately 90% of their answers to this question were "No". Approximately 98% of them stated that they have not experienced these technologies before. The majority of respondents reported that they want to use virtual reality based dental simulator in their preclinical practice (85.5

Approximately 85% of the students thought that the use of this technology could shorten the pre-clinical learning time. The majority of respondents prefer training with both phantom head models and virtual simulators in the pre-clinic (Table 1).

In the current study, the students' desire to train in pre-clinical education with phantom heads or virtual simulation or a combination of both learning models was evaluated. The learning models were grouped under two headings, only phantom head and only virtual simulation/combined VR and phantom head. According to the analyzed results; the students with a class size above 100 students, compared to those below 100 students, and those who had phantom head numbers below 50 compared to those who had above 50 in their faculties, and those studying at public school compared to those studying in private schools chose virtual simulations or combined training at a significantly higher percentage (Table 2).

Table 1. Question 25 and the answers.

Which one would you prefer while taking pre-clinical education?	n	%
Phantom head	66	10
VR	27	4
VR + phantom head	569	86

Abbreviations: n; number, VR; virtual reality

Discussion

The purpose of the present study was to evaluate the knowledge, opinions, and thoughts of dental students on the use of VR-based dental simulators in education. Studies on virtual reality based developing technologies in dental education show increase in learning and psychomotor skills with the use of digitalization among students in rising generation. [5] The application of virtual reality-based dental simulator in dental curriculum is assumed to be more common in the future as it allows to repeat and standardize the pre-clinical training procedures, reduce the material consumption, and observe student unbiased. Using digital technology in clinical diagnosis, imaging, and treatments also shortens chair time in evaluation and detection of potential pre-treatment malfunctions. [6]

In a research of 121 participants in 35 countries, 90% of the participants showed a positive attitude for virtual reality-based training in the future. [7] In another study conducted among dentists in our country, approximately 87% of the dentists stated having positive attitude for use of virtual reality-based technology in clinical use in the future. [8] Results in our study also support the outcomes aforementioned as 85.5% of the students were willing to use these technologies.

Gottlieb et al. [9] evaluated the effectiveness of virtual reality simulation in pre-clinical education, they concluded that the ergonomic development and technical performance of students using VR simulation were positively affected by VR simulation training. These results support the use of VR simulation in the pre-clinical dentistry curriculum.

In a study investigating educational models in dentistry, it was suggested that the main reasons for the slow progress of virtual reality applications in the field of dentistry were the high cost and limited training hours. [6] At the same time, several uncertainties are currently limiting the widespread application of virtual reality technologies for the clinical routine. It is anticipated that most of these uncertainties will be overcome by the continuous advancement in information technology. [10]

Regarding VR-based learning in dental education in our country, it can be suggested that the advanced use of such technologies requires increased awareness and experience on existing simulators. Evaluating the perspectives of our educators on this issue and supporting the production of domestic virtual reality-based dental simulators will lead the way on developing our educational technology more functional and cost-effective.

In most of the studies that made evaluations about the usage of VR-based dental simulators, it was reported that the volunteers who participated in the study were the ones who experienced VR-based dental simulators before. [6–9] In future studies can be planned

Table 2. Material preferences to be used in preclinical education according to various factors.

	Phantom head	VR/Combined VR and phantom head	p
Type of university			
Public	8.4%	91.6%	0.005
Private	17.1%	82.9%	
Class size			
0-100	11.5%	88.5%	0.033
Over 100	6.0%	94.0%	
Number of Phantom heads			
0-50	17.3%	92.7%	0.003
Over 50	14.6%	85.4%	

that evaluate the experiences of students about VR-based dental simulators after these technologies are used in our country.

Conclusion

According to the results of our survey study, it can be concluded that the students who have less opportunity to practice in their pre-clinical training are more willing to use virtual simulation even if they have not experienced VR simulation training. In our country having knowledge about VR-based dental simulators will increase the possibility of the development of such technologies and their inclusion in dentistry education.

Author Contributions

All authors have contributed to; conception and design of the study, data collection and analysis, writing the manuscript, approval of the final version to be submitted.

Conflict of Interest

Authors declare that they have no conflict of interest.

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