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# Implementation of Augmented Reality in Medical Science- Dentistry

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**ABSTRACT:** As there is advanced and rapid development in the field of Information Technology (IT), solutions for dentistry lead by computer and internet technologies have made rapid progress all over the world[4]. Digital dental solutions will be the trend for the professional dental field in the future. The rapid development of AR in dentistry made a great change in both the clinical dental field and the dental education field. AR technology will change both traditional dental clinical practices and dental education learning methods. With the medical image of the increasingly mature can help physicians to identify the patient's affected area and to make a different cure[8]. The new technology which assisted the doctor has gradually been developed. The Image guided therapy (IGT) and Image-guided interventions (IGI) technology development, the image recognition and location of tracking system, coupled with computer computing , combined computed tomography, position tracker, display and PC to achieve tracking location and surgical instruments immediately. By calculating the position of the medical images and surgical tools, to provide more accurate accuracy in the surgical position[3].

**KEYWORDS:** Augmented reality, simulation, simulator, surgery, accuracy, dental, dentistry, medical

## I. INTRODUCTION

Augmented Reality (AR) is one of the technologies that is constantly growing technology in computer science. Research efforts have been consistently working on it and solutions have been developed for various domains such as entertainment, industry, art, communication, education, navigation, architecture and medicine[5]. By extending the real world with virtual, we can interact with the environment more efficiently. In the medical field, more advanced imaging technologies transformed the surgical practice in the last few years which offers a whole new world of capabilities for the AR application systems. AR has the potential to revolutionize medicine. During the medical surgery, AR provides the information of the patient and how the surgery is imposed on them. As AR technology is evolving very rapidly, the relationship between doctor, engineer and industry is developing which is key development for AR technology[11]. Augmented reality combines virtual reality with a 3D environment to a patient via a registration process to achieve an image which augments the virtual scene with the real one. The image is imposed in the environment using semi-transparent glass. In dental surgery, the accurate placement of dental implants is essential to meet the required functional and demands[9].

## II. RELATED WORK

Technologies are rapidly becoming advanced in virtual and augmented reality are enabling the application of the methods in dentistry, oral and maxillofacial surgery is the primary area of application, dental implantology and orthognathic surgery are the applications[1]. Many of the publications were in the need of the accuracy of virtual planning for orthognathic surgery. 3D virtual surgery and reconstruction are the main applications of virtual reality. Virtual planes for maxillary reconstruction can be achieved with an excellent match. This can be demonstrated on cases of complex head and neck[4].

Augmented reality has been applied to determine the implant size, position, direction and proximity. Many software packages are available for the virtual planning of dental surgeries[7]. The 3D planning is given to the surgical field via either the static guide or the dynamic navigated approach. The static transfer of the surgical plan is based on the virtual designing followed by fabrication of a surgical guide using computer-aided-design/computer aided-manufacturing to facilitate the insertion of dental implants. Many types of surgical guides are available based on the type of support, bony, mucosal or dental[13]. A remarkable accuracy can be achieved with the sleeve-in-sleeve template which is used



in multiple sleeves which are applied and fixed to the surrounding bone to improve the precision of insertion of dental implants[2]

Dentistry is very complex area for learning. This is because the development requires the assimilation of knowledge combined with the acquisition of clinical skills and problem-solving ability[5]. The main challenges in teaching of dentistry are to prepare the students for clinical practice with patients. It evaluates the efficiency of augmented reality in gaining knowledge and skill for the students. Cadaveric teaching is one of the teaching methods is very best and efficient and it has many advantages[11].The process of cadaveric teaching gives students an important three-dimensional view of human anatomy and reinforces and elaborates knowledge that is acquired in lectures and tutorials[14]. Many universities across the world and in Australia have also reduced the hours allocated to teaching gross anatomy. On an average medical student can get approximately three hours of anatomy laboratory time each week which they have to share between 10 and 12 students. These sessions are tightly scheduled and, in many universities, students are unable to gain access to the “wet specimens” except schedule times.AR can help students to learn students more efficiently and they can learn as more time they want[19].

### III.METHODOLOGY

#### Creation of physical model for dentistry

The initial step was to create physical models of Class 1 and Class 2 cavities using resin teeth. Two resin permanent mandibular first molars (Frasaco AG-3, Greenville, USA) were used. A simple Class 1 cavity was prepared in one tooth, whilst a composite (occlusal-distal) Class 2 cavity was prepared in the other. The cavities were prepared for the amalgam cavity preparation criteria. It is clearly showing merging of the buccal and lingual walls towards the occlusal side and separation of the mesial and distal walls towards the occlusal side, followed by the obtainment of Malakit type 4 plaster casts. The two models we have are mesio-distally and the buccolingually until the desired characteristics were displayed.[4]

#### Creation of virtual models

The next step was to digitalize the physical models in order to obtain the virtual models. The teeth which has cavities were opacified with Cercon eye Scan-Spray an anti-reflectant spray.[4]A grid of points was obtained and triangulated to yield 3Dl objects which were then exported to STL format files, followed by conversion to .dae type files using Google SketchUp for recognition by the AR creation software.

#### Statistical analysis

The SPSS statistical package is used for analyzing the data. The Mann-Whitney U-test was applied for comparing the correct responses of the questionnaires referred to knowledge before, immediately after and 6 months after the practices between the two groups, and also for comparing the data of cavity width and depth.The Wilcoxon test was used to compare intragroup differences in the number of correct responses of the questionnaires referred to knowledge before, immediately after 6 months after the practices. The chi-square test is used between the groudtoto compare the qualitative parameters of the cavity. The Cronbach  $\alpha$  coefficient was used to measure the internal reliability of the questionnaire. Statistical significance was considered for  $P < .05$  in all cases.

Correct responses (mean $\pm$ SD) as skills before, immediately after and 6 months after the practice for Class 1 cavity preparations



**TABLE 1** Correct responses (mean±SD) referred to skills before, immediately after and 6 months after the practice for Class I cavity preparations

	Initial				Final		6 mo	
	Groups	n	Mean±SD	P	Mean±SD	P	Mean±SD	P
Global skills (maximum score=10)	Control	21	7.52±2.18	.37	8.62±1.59	.82	8.42±1.50	.72
	Experimental	20	6.75±2.59		8.65±1.78		8.75±1.60	
"Vision" skill (maximum score=3)	Control	21	2.67±0.73	.21	3.00±0	.14	2.86±0.02	.23
	Experimental	20	2.3±0.97		2.80±0.61		2.70±0.41	
"Occlusal view" skill (maximum score=2)	Control	21	1.62±.49	.62	1.76±0.43	.09	1.78±0.40	.08
	Experimental	20	1.45±0.75		1.95±0.22		1.97±0.18	
"Bucco-lingual view" skill (maximum score=2)	Control	21	1±1	.52	1.33±0.96	.57	1.31±0.94	.54
	Experimental	20	1.20±0.95		1.55±0.75		1.53±0.72	
"Mesio-distal view" skill (maximum score=3)	Control	21	2.24±1.04	.16	2.52±0.75	.87	2.53±0.72	.86
	Experimental	20	1.80±1.05		2.45±0.95		2.41±0.93	

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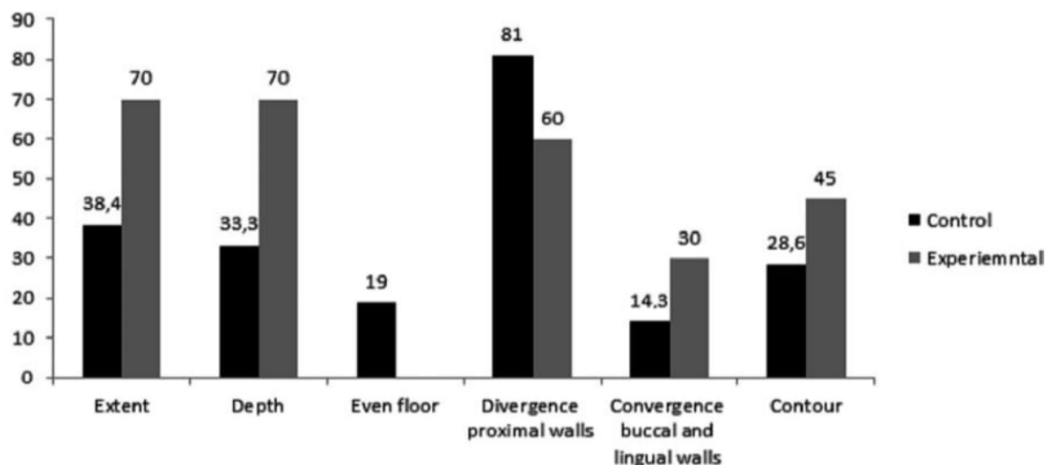
Correct responses (mean±SD) as skills before, immediately after and 6 months after the practice for Class 2 cavity preparations

**TABLE 2** Correct responses (mean±SD) referred to skills before, immediately after and 6 months after the practice for Class II cavity preparations

	Initial				Final		6 mo	
	Groups	n	Mean±SD	P	Mean±SD	P	Mean±SD	P
Global skills (maximum score=10)	Control	21	7.48±3.31	.51	9.10±1.99	.72	9.20±1.89	.73
	Experimental	20	6.95±3.10		9.10±1.65		9.10±1.63	
"Cavities" skill (maximum score=3)	Control	21	2.52±0.92	.52	2.90±0.31	.56	2.92±0.32	.51
	Experimental	20	2.40±0.94		2.80±0.52		2.77±0.51	
"Floor" skill (maximum score=2)	Control	21	1.57±0.67	.66	1.81±0.60	1	1.80±0.59	.98
	Experimental	20	1.40±0.88		1.85±0.48		1.86±0.38	
"Walls" skill (maximum score=3)	Control	21	2.10±1.17	.61	2.76±0.76	.42	2.77±0.71	.40
	Experimental	20	1.95±1.05		2.70±0.65		2.80±0.61	
"Angles" skill (maximum score=2)	Control	21	1.29±0.84	.84	1.71±0.71	.76	1.73±0.69	.71
	Experimental	20	1.20±0.95		1.75±0.55		1.80±0.45	

<https://doi.org/10.1111/eje.12269>

Percentage of qualitative variables related to the design of Class 1 cavities. Data were compared with the chi-square test.



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Percentage of qualitative variables related to the design of Class 1 cavities. Data were compared with the chi-square test.

As the results obtained from the table and questionnaires and cavity preparations, our null hypothesis must be partially accepted, because despite of the absence of a significant improvement in the level of knowledge between both groups, the experimental group improve most of the skills (but only some of them in a significant way).

Both groups had similar initial theoretical knowledge, and both clearly improved their level of knowledge following the practices. The final learning outcome was same inn the two groups, after the practices even after 6 months, the experimental group showed significantly greater improvement in most of the skills referred to Class 1 preparations and in all the skills referred to Class 2 preparations. It should be considered that cavity preparation and understanding of the different parts of the cavity are strongly conditioned to spatial vision, and it was precisely in these areas where the experimental group showed the greatest improvements.

#### IV.RESULTS

One student in the experimental group was excluded from the study due to previous experience in cavity preparation, and one student in the control group was excluded due to failure to participate in the first practice. The final study sample therefore consisted of 41 students.

#### V.CONCLUSION

The findings of the present study revealed that only some of the studied skills were better in the experimental group[4].Further testing in a larger sample size is necessary to evaluate how augmented reality develop the knowledge and skills of the students efficiently.

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