

## Virtual Reality Technology in Dentistry

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### Introduction

Computer-based technologies has a real effect in dentistry as it does in our daily life. As a result of digital dentistry evolution, the use of virtual reality in the training of students in this field was widely appeared. many clinician start to dealing with CAD/CAM subgroup of computer-based technologies since many years, but VR and augmented reality (AR) techniques, which are used in learning and instruction of dental skills, are still unknown.

### What is Virtual Reality?

Virtual reality technology can be defined as “a three dimensionally environment which is simulated to give the user sensation of being inside it, controlling of it, and to interact with it by himself”. They are mostly generated with computers. Technology has widely used in many aspects of our life such as building construction by providing a precise virtual (3D) model of the building to verify each part of the plan, the cost and design. Regarding medical field, VR can be used to instruct the surgical procedures, patients’ education and students’ training. Furthermore, it is used in the treatment of psychological disturbances by providing a good controlled non-real environment which assess the behavior and rehabilitate cognitive and functional abilities objectively. Also it is used for treating the complex regional pain syndrome successfully. The 3D virtual views help in progressing the dental experience by intervention of the distraction. This can be get by a 3D models of teeth or a human head that used by the trainee dentists to learn and training on a lot of dental technologies without harming the virtual patient. They can make any errors, discover the cause of it and know the proper way to correct them.

Immersion and interaction are the two basic features of VR.

Immersion “can be defined as the sensation of being inside a virtual world that created by synthesizing 3D images, sound and other stimuli, which surround the users and make them feel as being really existing in a (non-real) environment. The degree of immersion (how much the user believes that he or she being inside a virtual world) is not the same. Based on the ability of the system, it is ranging from fully immersive to non-immersive. While Interaction “is the ability of user to make changes in the virtual environment In VR worlds, the user can interact with this world by making different actions like moving around it, seeing it from different angles, reach-

ing, grabbing and reshaping it. This can be achieved by means of head mounted video goggles, fiber-optic data gloves and wired clothing as well as Position-tracking devices and real time update of visual, auditory displaying systems.

Depending on the amount of immersion and type of components used in the system, three groups of Virtual reality systems are present which are non-immersive, semi-immersive and immersive (Figure 1-3).

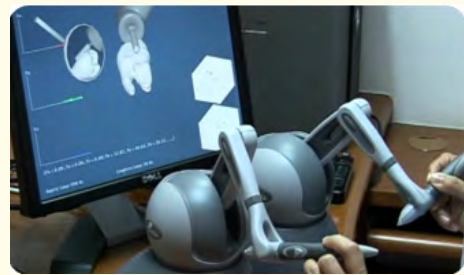


Figure 1

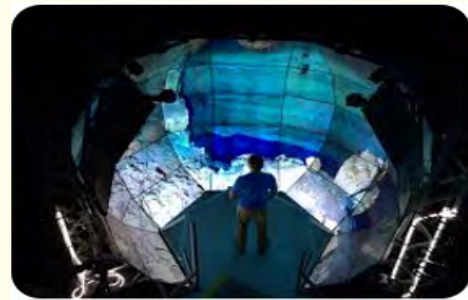


Figure 2



Figure 3

## Applications of VR in Dentistry

Using VR in dentistry is not an easy task due to the complexity of dental instruments and the diversity of oral tissues. In surgery, haptic devices permit operator to be in touch with the objects and feel of it such as surgical tools and human organs in a virtual environment as well to carry out surgery with different actions and by realistic force feedback like pushing, pulling, and cutting of soft or/and hard tissue. Also VR simulators can be designed to identify any error then assessing the quality of performance will be done. Unlike classroom education, in VR system It is also possible to practice and receive assessment as many times as wanted and in any time.

“3D dental patient” is the most popular application of VR in training, this system make the trainees capable of understanding the anatomy of the teeth and mouth in general, it is provided in the form of a haptic input device or ‘Phantom’ controller which controls the virtual drilling of teeth. With time, the trainees will become more familiar with the anatomy of teeth that give them the experience, knowledge and trust to treat the actual patients.

Dental Chair system or ‘HapTEL’ (haptics technology enhanced learning) is another application of Virtual Reality in training, it is designed to learn a range of dental technics to students and clinicians. The system consists of a mirror and a haptics based drill which make the operator able to carry out diverse processes, so the operator can ‘feel’ the pushing of the virtual drill which is due to “force feedback”.

## Conclusion

Recently, computerized technologies are well used in styling and fabricating dental prostheses. However, simulation systems for the dental skills learning until now consider as a new style and not much known or used by the schools of dentistry. These technologies are continually develop but are still too expensive. But using computer assisted skill with ordinary training make the students capable of exercising many times with constant estimation and force feedback. Simulation systems give the operators the ability to practice in real way on non-real models.

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