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CAD/CAM

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Digital technology

determines daily routine in modern dental practice

_Digital dental procedures are increasingly becoming an essential part of the daily routine in the modern dental practice. They render patient management and treatment planning processes more economical and increase time efficiency. At IDS 2015, digital technologies thus became a core subject, many exhibitors presented their latest product solutions in the field.

At IDS 2015, the digital technology offerings available for dental practices formed a focal point for all visitors in the fields of dentistry and dental technology.

The exhibited product ranges contribute to simplifying workflows and, as a result, to reducing treatment times. They create synergies with the digital range for dental laboratories, yielding positive implications for practice management and therapeutic procedures. That is why the state of the art in digital technology for dental practices was a major topic at IDS 2015, said Dr Martin Rickert, Chairman of the Association of German Dental Manufacturers. Presented products included software for efficient patient management and integrated treatment planning, as well as digital imaging devices, including CBCT and CT, which have been used alongside conventional radiographic techniques in recent years.

IDS 2015 gave also special attention to digital scanners, which offer a wide range of advantages for patient-specific restorations and implant planning. In particular, intraoral scanners were in the spotlight, as they have contributed significantly to making prosthetic treatment workflows simplifier and more precise.

Overall, both patients and dentists benefit from the use of digital technologies. They help shorten treatment time and reduce the number of work stages, and enable the dentist to immediately examine and explain preparations on screen. Furthermore, the data gained through digital procedures can be quickly processed in the dental practice and sent to dental laboratories.

You will find more information about this year's IDS inside the issue.

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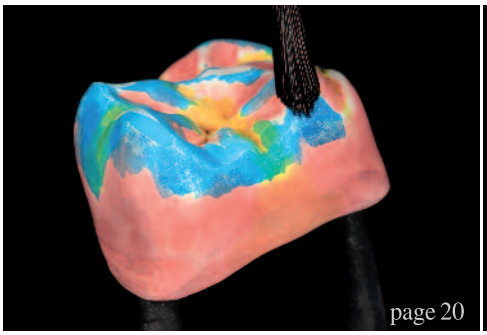
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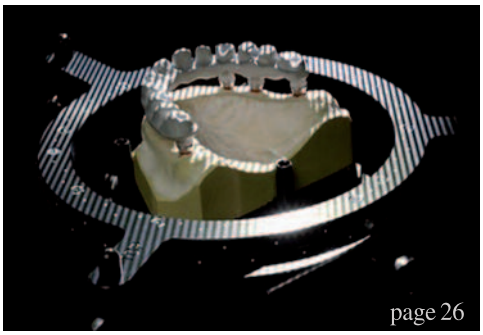
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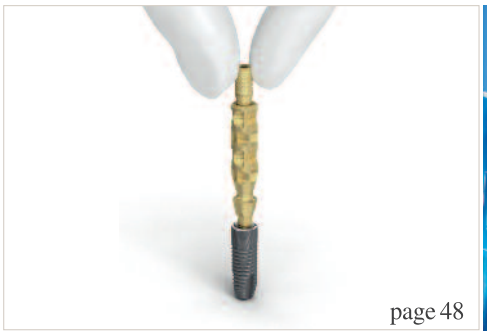
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...By mis

Virtual reality simulation

Indications and perspectives for the technology in the field of dental education

Authors_ Dr Susan Bridges, Suzanne Perry & Prof. Michael Burrow, Hong Kong & Australia

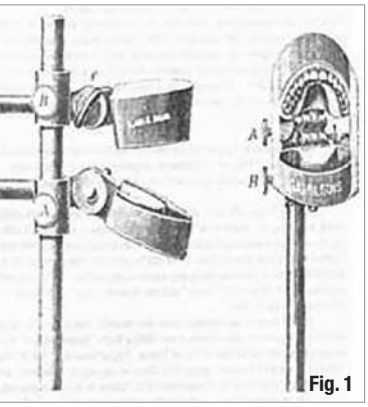

Fig. 1

Fig. 1_A sketch of an early phantom head simulator.

Fig. 2_ The Simodont Dental Trainer (Moog) haptic VR simulator.

_Virtual reality (VR) simulation inevitably conjures up images of futuristic technology, imaginary worlds or complex robotic devices. What it may not initially suggest is the use of virtual technology as a means of training dental students and dentists, facilitating the development of skills in a safe and relaxed environment.

An increase in demand for simulation units over the last ten to 10 years has indicated growing interest from dental schools, suggesting a certain confidence that simulation systems have potential as a recognised form of dental skills training in the future. Using technology inspired primarily from the flight simulation industry, dental simulators are now able to create an environment in which users can practise clinical procedures, such as restorative dentistry, endodontics, periodontal assessment, implant placement and even dental extractions.

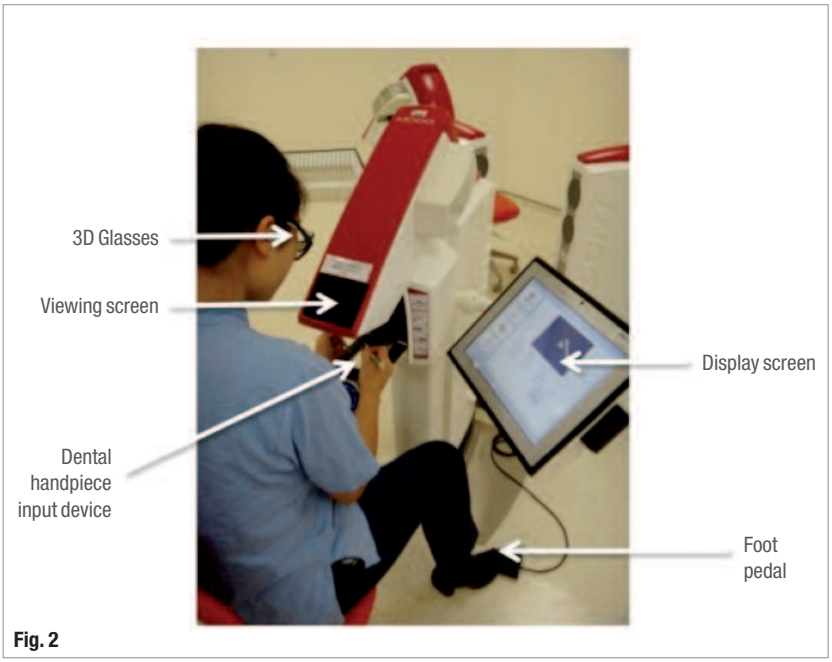

Fig. 2

These systems are a far cry from the first phantom head simulator created in the early 1900s that attempted to represent the oral cavity with a relatively primitive set of upper and lower dental casts mounted on a metal pole (Fig. 1). Although phantom head systems are now the mainstay for undergraduate training, educationalists are becoming more aware of the additional benefits of VR simulation, such as the ability to repeat the same task many times, providing real-time feedback leading to a reduction in supervision, and the benefits of students being able to practise in their free time without laboratory supervisors. Other benefits of VR simulators include the reduction of consumable costs incurred with plastic teeth and the elimination of water system management issues, reducing the possibility of water-borne infections such as Legionella.

Undoubtedly, the initial cost of the VR simulators is a major deterrent and, with additional concerns regarding possible lack of realism to the clinical situation, it is natural that many suggest the need for more evidence-based research prior to committing to such an investment.

In the limited literature on VR dental simulation, studies have been mixed but, in general, are positive about the use of the technology for dental training. Research has shown that procedural learning on VR simulators may be more effective than with the traditional phantom head and may reduce the number of staff–student interactions without a reduction in the quality of the practical work.

In contrast, other research has shown that dental performance may be no better using VR simulation and that some students prefer their training to be on phantom heads. Naturally, further research will be needed to establish the effectiveness of the technology.

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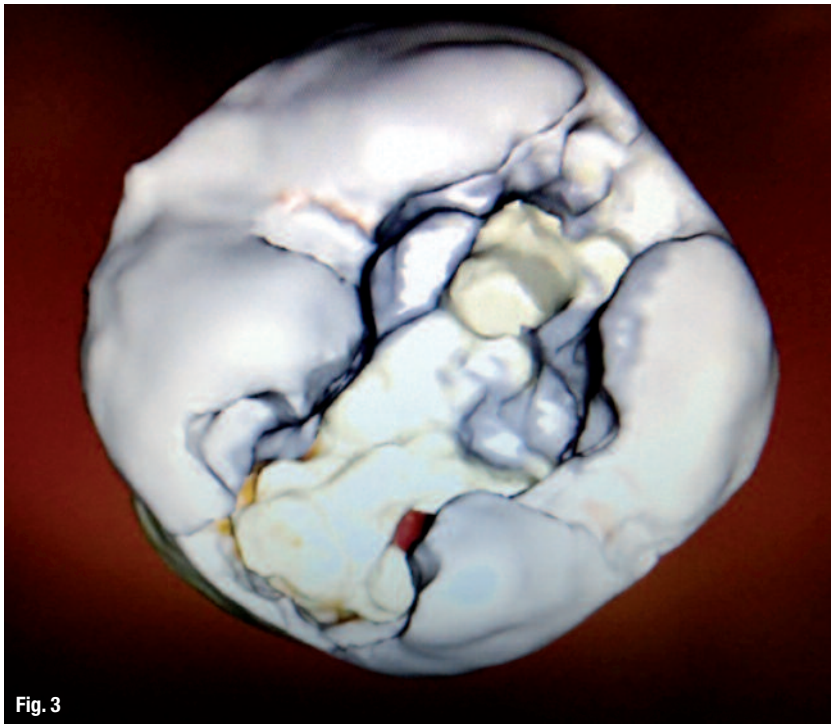
Fig. 3

Fig. 3_An image of a cut tooth from the Simodont haptic VR simulator.

_What are haptics?

The addition of haptics to VR technology creates a dimension of sensory feedback for the user. The word itself originates from the Greek work haptikos, which means "to touch or grasp". There are many examples of haptic simulation in modern-day technology, such as in gaming and the vibration component of a mobile phone. The aim of haptics in many cases, and especially simulation, is to improve the realism of the virtual experience. In dentistry, for example, when carrying out a cavity preparation on a haptic VR simulator, there is a difference in hardness felt when cutting from enamel to dentine, and if the pulp is damaged an instant loss of resistance occurs, producing a realistic sensation of drilling through the roof of the pulp chamber (Figs. 2 & 3).

Naturally, the important question is, does the addition of haptic technology really make a difference when learning using VR simulation? To answer this, we have to delve into surgical research for which a stronger evidence base exists, specifically in the area of laparoscopy. A review of the use of haptics in surgery suggested that the addition of haptics to simulation can reduce surgical errors and is especially beneficial in the early stages of learning a new skill task.[1] Other studies have shown that the addition of haptics may improve overall performance of surgical skills and may be beneficial when a trainee is first exposed to a clinical situation. In dentistry, small-scale studies of haptic VR simulators suggest that they are at least as good as phantom heads in training undergraduates.

_The future of VR simulation in dentistry

Currently, exciting research involving the universities of Hong Kong and Melbourne is looking into gaining solid evidence concerning the use of haptic VR simulation in the dental undergraduate curriculum. By utilising neuroimaging techniques, identification of the traits an expert usually displays can occur, which in turn can be built into training pathways to enhance the effectiveness of procedural learning.

Initial findings have suggested that distinct differences may be apparent in the brains of dental experts and novices during a simulated clinical task when using a dental haptic VR simulator. Further work in this area is to be carried out, with additional investigation into the positioning of haptic VR simulation within a curriculum and considering its effectiveness compared with traditional phantom head training techniques.

Already it can be seen that the area of VR in dentistry and especially that of haptic VR simulation is proving an interesting development, offering encouraging prospects for the future skills-based training of dentists. The evidence is limited, however, so, prior to commending this technology as the mainstay of training in dental undergraduate curricula, there is a compelling need to expand the current research base._

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