Coming closer to simulating teeth

Dental education is a discipline in which a significant proportion of preclinical training requires trainees to depend primarily on tactile sensations to achieve a high level of precision. This makes haptics ideally suited for all kinds of dental training systems that will teach, provide practice in and improve tactile skills.

The ideal dental training simulators should provide sensations similar to those felt when executing the same procedure on a real tooth. Manikin-based dental training simulators, such as DentSim, allow procedures to be performed using real dental instruments; therefore, tactile feedback involved in simulated procedures is naturally provided. However, most manikin-based dental simulators use only disposable plastic teeth for training. While they are becoming more realistic and coming closer to simulating the real feel of actual teeth, it is still difficult to provide its level of detail and material properties. Using real teeth with such systems might be possible, but there are still problems regarding availability of extracted teeth in various conditions, sales and regulations about how they can be used, and standardisation.

The alternative dental simulation currently being developed and investigated by few research groups is haptically enabled virtual reality dental training. In this kind of system, the trainer holds a haptic device stylus, which is a virtual representation of real dental tools and executes movements over virtual models of projected or on-screen human teeth. Some of these simulators use reconstructed virtual teeth from CT images of real teeth to simulate the tissues that form the tooth structure or even cavities. However, simulating realistic force sensations for different dental materials, instruments, and procedures is very challenging and still an active area of research. Force-computing techniques currently used vary from basic spring force models to sophisticated methods involving CT density values and torque.

There is still room for improvement for both types of simulator in terms of haptic sensation. The manikin-based simulators will benefit from much more realistic plastic teeth that are not prohibitively expensive, and the virtual reality simulators need a novel, high-fidelity force-computing algorithm.

With the Snowden revelations about the mass surveillance of online communication by the US National Security Agency and other intelligence services around the world, this perception has changed fundamentally. It clearly demonstrates that anything we produce online can be stored, analysed and probably shared by forces we have no personal or legal control over.

For professionals like you who increasingly have to deal with digital client or patient data, it is more important than ever to exercise extreme caution regarding what you may inadvertently make available to the public.

It is more important than ever before to exercise extreme caution regarding what you may inadvertently make available to the public. This also poses a valid concern.

Restricting sales of all tooth whitening products that contain 7 per cent hydrogen peroxide or more is logi-
cal, given that the well-accepted threshold level for soft-tissue adverse effects is 6 per cent. Higher-strength products with 7–12 per cent hydrogen peroxide should be limited to the control of a registered dental practitioner, who will take responsibility for appropriate diagnosis, product administration and monitoring, as well as appropriate follow-up care after bleaching. In my view, the restriction makes sense for the even higher-strength products, which are those typically used for in-office bleaching.

Advice on peroxide products not being recommended for children younger than 16 is appropriate, given the limited need for their use in this group of patients and the greater likelihood of pulpal responses to reactive oxygen species. A period of two years to prepare for the change would seem more than ample for the required labelling changes to be made to dental products. Overall, these changes will protect the public from the indiscriminate and inappropriate use of bleaching products by aestheticians and others outside of dentistry, and are a good model for other jurisdictions to consider.