Emerging technologies: a hypothetical case study

The exciting range of new technologies in dentistry offers a number of major advantages for clinical patient care. The ability to diagnose and detect disease at the earliest stages provides the opportunity for less invasive interventions, and allows us to conserve as much tooth structure as possible. If caries removal is required, optical technologies can provide a number of benefits for hard tissue procedures such as caries removal. The following case can be thought of as a “dental hypothetical” which illustrates how a number of contemporary technologies can be applied in everyday dental practice.

A seventeen year old female, who is a new patient to the practice, attends for an initial examination. She attends a local private school, but is new to the area. She is concerned about the aesthetic appearance of her incisor teeth, and she complains of cervical dentinal sensitivity affecting the buccal surfaces of several of the lower premolar teeth (Figure 1). She has had relatively little experience of dental caries in the past.

Saliva testing with the Saliva Check Buffer kit (GC Corp) revealed problems in the resting salivary flow and pH, and a lifestyle analysis showed sub-clinical dehydration. This problem was linked to a relatively high daily caffeine intake, and her involvement in the school’s rowing team. Following training sessions she has an inadequate intake of fluid, and tends to use acidic sports drinks excessively. The saliva testing identifies the underlying problem of dental erosion that has led to sensitive dentine becoming exposed.

A chairside test for real-time plaque fermentation was undertaken using the Plaque-Check+pH kit (GC Corp), which showed a highly acidogenic microflora in the samples of proximal plaque that were tested. This heightened concerns regarding incipient proximal caries, and digital radiographs with the Sopix cordless (bluetooth) digital X-ray system (Sopro) indicated the presence of a number of early proximal lesions on the molar teeth. Assessment of the proximal surfaces with the periscope tip of the DiagnoDENT pen (KaVo) showed that these were not cavitated. Assessment of the occlusal surfaces by laser-induced fluorescence using the DiagnoDENT conical A-tip (Figure 2) showed incipient fissure caries in the lower premolar teeth and occult lesions at the DEJ on several of the molar teeth. The lateral fissure wall lesions in the premolar teeth were opened up without the need for local anaesthetic, using a particle beam (air abrasion) device (Figure 3), and the preparations treated with ozone (Healozone, KaVo) (Figure 4) before placing a composite resin. A deeper area of caries on a maxillary second premolar tooth was opened using a pulsed middle infrared laser, (Waterlase, Biolase) again without the need for local anaesthetic, in this instance because of bioresonance analgesia. This removed the caries and also prepared the area for bonding an adhesive restoration. One larger carious lesion was noted on a mandibular second molar, and in light of its relative depth, the finished cavity preparation was treated with photo-activated disinfection (Savedent, Denfotex) to kill any persisting “pioneer” microorganisms which may have been present in the deepest aspects of the tooth structure, before placing a glass ionomer-composite sandwich restoration. (Ozone could have also been used for disinfection).

A homecare program using contemporary remineralization technologies to achieve sub-surface remineralization of the early enamel lesions was undertaken (Recaldent), and a number of lifestyle changes were advised, using a personalized oral health prescription. Included in this advice was salivary stimulation with a sugar-free chewing gum (Extra, Wrigleys). The erupting third molar teeth which were judged to be at risk of fissure caries developing were treated using tooth surface protection with a high...
fluoride-releasing glass ionomer cement material (Fuji VII, GC Corp.). The at-risk surfaces for dental erosion were treated by laser-activated fluoride to increase their resistance to dental erosion.

The unaesthetic areas of enamel hypomineralization on the maxillary incisor teeth were treated using enamel microabrasion followed by GC Tooth Mousse. This employs subsurface regeneration to convert the water deposits in the hypomineralized areas into enamel mineral. A computer simulation of the effect that this would achieve after 4 weeks is shown in Figure 6, as a reversion to the optical properties of normal enamel occurs. By this stage, the patient’s changes in lifestyle and diet had led to a reduction in plaque fermentation and a corresponding improvement in her salivary parameters.

The patient’s attention now turned to the overall appearance of the maxillary incisors. She is missing both maxillary lateral incisors, and the adjacent canine teeth are darker. The two canine teeth could be treated by in-office laser photothermal whitening (Smartbleach, High Tech Laser), so that their shade would match that of the maxillary central incisors. Small composite resin restorations would then add mesial incisal corners to the canines to replicate the appearance of lateral incisor teeth. A computer simulation of the expected end result of these two treatments is shown in Figure 7.

The patient thus far has been able to have her problems of dental erosion, dental caries, and an uneven incisor smile line addressed with minimal chairside time, and without the need for local anaesthetic. This case also illustrates how techniques for diagnosis and detection of early disease, conservative caries removal, microbial modification and biophotonic technologies can be applied in a relatively simple clinical case in order to achieve optimal oral health for the patient, at minimal biological cost.

It is the author’s view that the use of these types of technologies will become more common-place in clinical practice. Indeed, each of the technologies mentioned above is included in the fourth year dental program at The University of Queensland School of Dentistry, and cases very similar to the one described above have been treated by students, who are gaining experience using these technologies. Educational institutions have a responsibility to train students for contemporary practice, and also to prepare them for the challenges of the future. There is no doubt that what is regarded today as a new or emerging technology will over the course of the decades to come, form a greater part of the overall practice of the current dental students and the practitioners of today.

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Prof. Walsh will present information on all this topics and more at Emerging Technologies in Dentistry in April and May. For more information or to register, contact Denteventson (02) 9929-1950 or info@dentevents.com. Register online at www.dentevents.com/mtech2006.html

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