Smart dentin replacement

Dr Ludwig Hermeler presents a clinical case study using SDR

SDR, developed by Dentsply, is the first posterior composite for dentin replacement combining the handling properties of a flowable composite with minimal shrinkage stress. As a result, it can be placed in increments of up to 4 mm. The ‘Smart Dentin Replacement’ layer is applied as a base in Class I and II cavities following the use of a conventional dentin/enamel adhesive. It is chemically compatible with all methacrylate-based universal/posterior composites used to replace the occlusal enamel layer and complete the adhesive filling. SDR offers interesting advantages in everyday practice, because it allows dentists to provide their patients with high-quality aesthetic posterior restorations in a cost-effective way.

Product technology

Dentsply’s new restorative is based on ‘Stress Decreasing Resin’ technology. This means that a substance described as a ‘polymerisation modulator’ is chemically embedded in the backbone of the polymerisable resin. The polymerisation modulator synergistically interacts with the camphorquinone photo-initiator to result in a slower elasticity modulus development, allowing for stress reduction without a decrease in the rate of polymerisation or degree of conversion. SDR has the required physical and mechanical properties for use as a posterior bulk-fill flowable base. Moreover, the integration of these modifications in the well-proven methacrylate chemistry makes SDR compatible with methacrylate-based adhesives and composites, which are widely used in dental practice.

Clinically relevant in-vitro properties

In 2004, the polymerisation stress of a prototype of SDR and several conventional flowable and universal/posterior composites was measured using a National Institute of Standards and Technology (NIST) Tensometer. The data obtained show the stress developed by SDR to be significantly lower than that of all other materials tested. In 2009, Professor Ernst performed photoelastic stress measurements at the University of Mainz, Germany. He confirms the shrinkage stress of SDR is lower than that of the reference composites and states that the material seems to have clinical advantages in terms of handling properties, particularly in cavities with undercuts. In tests using a Stress-Strain-Analyzer, SDR also showed the lowest stress build-up — consistently with the other two independent trials. The ATR-NIR method was used to evaluate SDRs degree of conversion at various increment thicknesses. Both this and a similar study show the conversion of SDR to be excellent, even at a thickness of 5 or 6 mm.

Clinical Case

Figures 1 and 2 document the initial situation, with unsatisfactory restorations in teeth 14 and 16. The filling in tooth 15 was not associated with any pathology in the bitewing radiograph (Figure 3) nor with any marginal defects on staining with a caries detector dye, so it was left in situ. The removal of the old fillings revealed undercuts in the proximal boxes (Figures 4 and 5). After caries excavation with the aid of a detector dye and prior to final cavity preparation, BiTine rings of the Palodent Sectional Matrix System were applied (Figure 6) and left in place during definitive matrix finishing with fine-grit diamonds, so that the separation needed for the sectional matrices was ensured without prolonging the treatment. Figures 7 and 8 show the final cavity preparation after the removal of the BiTine rings. Sectional matrices were adapted to the proximal tooth circumferences as far as possible by bending them with the fingers. Hence, they could easily be inserted with tweezers from occlusal. The gingival margin was closed with anatomical wedges. The BiTine rings were repositioned in the proximal plane, to stabilise the matrices and wedges. For optimal adaptation and contouring, the matrices were slightly smoothed with a ball plunger. Proximal matrix management is successful if the matrix fits tightly and, after concave pre-contouring, the proximal contact is located about one millimeter apical to the highest point of the marginal ridge (Figures 9 and 10). This minimises the need for proximal finishing of the restoration. Then the actual restorative procedure began: the cavity was gently air-dried and the one-bottle adhesive Xeno V was applied (Figure 11), rubbed in for 20 seconds and also gently air-dried. The adhesive was light-cured for 10 seconds. SDR was dispensed directly after filling removal from the Compula Tip (Figure 12) into the cavity at a light, steady pressure, starting at the deepest point of the cavity and filling it up to an increment thickness of 4 mm (Figures 13 and 14). The slender design of the metal cannula of the Compula Tip ensures good visibility and allows the user to reliably and quickly fill up proximal boxes even if there are undercuts. SDR self-levelled easily to a homogeneous surface (Figures 15 and 16) and was placed approximately up to the level of the dentin-enamel union.
Dr Ludwig Hermeler earned his doctorate (University of Münster, Germany) and was licensed to practise in 1988, established his own dental practice in Rheine, Germany, in 1991. Publications in the fields of aesthetic dentistry, endodontics and implantology.