Protocol on how to use SDR
Prof Peet van der Vyver presents a pictorial essay on the use of Dentsply’s SDR

Recent developments in composite resin materials and bonding technology have made possible the routine use of these materials in posterior teeth (Van der Vyver & Bridges, 2002). Direct posterior composite restorations are now predictable and durable, and in many instances their superior aesthetic and tooth-supporting properties make them the optimal treatment option when restoring the posterior dentition (Liebenberg, 1997). The main shortcomings of composite resin materials are polymerisation shrinkage (Dietschi, Magne & Holz, 1994) and polymerisation stress. Polymerisation stress can result in contraction forces on the cusps that can result in cuspal deformation (Pearson & Hegarty, 1989), enamel cracks and ultimately decrease the fracture resistance of the cusps (Wierzchowski et al, 1988). This article aims to provide clinicians with a protocol on how to use SDR (Dentsply) as a flowable base material for direct and indirect restorations, by means of a pictorial essay illustrating the benefit of this new innovative restorative material.

Cavity configuration and the method of insertion of composite resin into the cavities can influence the gaps at the interface between the dentine/enamel and the restoration (Walshaw & McComb, 1996). According to Davidsson and De Gee (1984), the parallel walls of a box shaped cavity may restrict the flow of composite during polymerization, causing stresses at the resin dentine interface (Feilzer, De Gee & Davidson, 1987). The present generation of chemically or light activated flowable composites undergo free volumetric shrinkage of 4-9 per cent as compared to regular viscosity and packable composites at 2-5 per cent, with an average of 3.5 per cent. According to Jensen and Chan (1985), polymerisation shrinkage stresses have the potential to initiate failure of the composite-tooth interface which could cause deformation of the tooth, which might result in post-operative sensitivity and could even open pre-existing enamel micro-cracks (Jensen & Chan, 1985).

SDR is marketed as a low stress flowable base material that can be placed in layers of up to 4mm in thickness and each bulk increment light-cured for only 20 seconds, as long as you leave at least 2mm on the occlusal surface for regular viscosity composite resin. According to the manufacturer, a polymerizable modulator was chemically embedded into the flowable resin material that allows extended polymerization without a sudden increase in cross-link density. This extended “curing-phase” maximizes the overall degree of conversion, minimizing the polymerization stress by up to 60 per cent compared to conventional flowable composite resins (Inside Dentistry, 2009). The volumetric shrinkage is 3.6 per cent but more importantly, the stress generated during the polymerization is 1.4 MPa, whereas many other flowable composites are above 4 MPa. The material is available in only one universal shade and can be used with any dentine bonding system.

Figs 1-19 outlines two clinical case reports that illustrate the benefits and clinical application of this new innovative flowable base material for direct posterior composite resin restorations. Base materials are mainly indicated to reduce the volume of filling material (Lutz, et al., 1986).
or to create adequate geometry to the cavity preparation for inlay / onlay preparation techniques (Dietrich & Spreafico, 1997). The shape of the cavity preparation will depend on the extent of the decay or the geometry of the restoration to be replaced. The removal of decay often creates unwanted undercuts which are not compatible with the principles of cavity preparation design for inlays/onlays. In order to preserve sound enamel/dentine as much as possible, the internal tapered design should be obtained by the application of a base material (Dietrich & Spreafico, 1997). Sherrer et al., 1994 demonstrated that the resistance to fracture for full ceramic crowns is significantly influenced by the elasticity of the core material and luting cement. Because of the favorable properties of the SDR material the author is of the opinion that it might be the ideal material to block out undercuts in order to preserve additional enamel for adhesive techniques and to improve cuspal strength during ceramic inlay cavity preparations. Figures 20–29 depicts a clinical case report to illustrate the clinical application of the SDR flowable base material to allow ideal cavity preparation design for indirect posterior inlay/onlay restorations.

Conclusions

Providing the clinician with a flowable base material for posterior direct and indirect restorations that can be placed and cured in bulk must be one of the most exciting technological advancements in dentistry towards technique simplification for what is generally regarded as a highly technique sensitive procedure.

The fact that SDR exhibits excellent adaption to the preparation walls due to its flowable nature, reducing the potential for void formation on the margins that could lead to post-operative sensitivity or aesthetic failure of the restoration. Another unique characteristic of the SDR material is the self-leveling feature which eliminates the need to manuipulate or sculpt the material before curing. This also creates an ideal surface for the addition of any regular viscosity composite resin to complete direct restorations, providing the desired strength, aesthetics and wear resistance for occlusal surfaces.

The reduced polymerization stress of the SDR base material on normal and compromised cusps after conventional cavity preparation might provide the clinician with an improved and simplified operative technique to provide patients with more durable posterior restorations.

Fig 6: SDR: Smart Dentine Replacement (Denpisty) compule tip, which incorporates a fine, needle-like tip for precise dispensing of the material with the attached macros despairing tip.

Fig 7: To cut the cavity margins and interproximal surface, a bur (KERR) was inserted in a handpiece to the burhao technique (Bichado, 1994) to avoid damage to the enamel. Initial caries and recurrent caries were not removed up to approximately 3mm from the enamel margin.

Fig 8: Different sizes of the Blunt Hedges (Dentsply) that were utilized to seal the matrix band against the mesial gingival cavity margins to gain a tight marginal seal and reducing the chance for contamination to ensure the establishment of an unconditioned bond strength.

Fig 9: Matrix assemblage: Blunt Contoured Sufference Band in a sufference holder activated V Ring and small Blunt Hedges (white). Note the adequate adaptation of the matrix band to the gingival marginal margin.

Fig 10: Enamel and dentine surfaces were etched for 1min with 40per cent Hydrofluoric acid, rinsed with water and lightly air-dried. Two coats of XP Bond (Dentsply) were applied in an oblique layering technique to the enamel and dentine surfaces, agitated with a microbrush for 15 seconds and lightly air-dried and light-cured for 20 seconds with a Soft Light-curing unit (Ultradent).

Fig 11: The cavity margins were initially cleaned using a point and composite instrument and light cured for 40 seconds. The inclusion of the remaining caries-associated step were used as indication to reestablish the wall morphology.

Fig 12: After the bonding protocol, the SDR material was dispensed using slow, steady pressure from the deepest portion of the cavity and adjacent cavity preparations. After a 20 seconds increment was dispensed the material was left undisturbed for 5 minutes to self-level before it was light-cured for 40 seconds from the occlusal aspect.

Fig 13: Completed restoration after finishing and polishing with an oval-shaped 50 flattened carbide finishing bur (Endenta) and sequential finishing with Poliffinish (Kerr). The opaque shade of Calibra Resin cement (Dentsply) was used as a luting cement for cementation of the prefabricated composite resin inlay.

Fig 14: The remaining part of the cavity prep was filled with Triox N Crown (V-Brands), a regular viscosity composite resin, and the proximal integrity was ensured using a V-Ring (Triodent) was utilized to create separation between the canine and premolar in order to ensure a tight interproximal contact point.

Fig 15: Anchored inlay: the retaining cements were cured after polishing with a diamond polishing paste (3I Trillium) illustrating the optimal aesthetics, improved interproximal contour and the shape of the composite restoration. Note the optimal integration of the composite resin and SDR with the surrounding tooth structure.

Fig 16: Pre-operative view of the upper right mandibular molar. Clinical and radiographic examination of the upper right first molar revealed a previously placed sectioned amalgam restoration and interproximal decay on the mesial aspect of the tooth.

Fig 17: Completed restoration after finishing and polishing with an oval shaped 35 flattened carbide finishing bur (Endenta) and sequential finishing with Polifinish (Kerr).

Fig 18: Cavity outline after removal of the existing amalgam restoration and decay on the mesial marginal ridge. Caries bur (Kerr) was utilized to identify some caries affected tooth structure.

Fig 19: Immediate post-operative occlusal view after polishing with a diamond polishing paste (3I Trillium) illustrating the optimal aesthetics, improved interproximal contour and the shape of the composite restoration. Note the optimal integration of the composite resin and SDR with the surrounding tooth structure.

Fig 20: At the cementation appointment, the SDR flowable base material (Dentsply) was applied and left to dry for 1min before the SDR base material (Dentsply) the tooth was temporized with Aquasil soft-putty and Aquasil light body (Dentsply) for 20secs, rinsed with water and air-dried. Silane Coupling Agent (Dentsply) was applied and left to dry for 3min before the temporary porcelain surface was coated with a thin layer of Prime & Bond XT mixed with Soft Cures Activator (Dentsply).

Fig 21: After removing the posterior ceramic inlay restoration, the composite resin and SDR with the surface slopes were used as indication to reestablish the wall morphology.

Fig 22: Cavity outline after removal of the defective amalgam restoration and decay on the mesial marginal ridge. Cavities were sealed using the self-conditioned base material.

Fig 23: Cavity preparation was prepared for bonding using XP Bond (Dentsply). Accord to the manufacturer’s instructions, the SDR flowable base material (Fig. 11) was applied and left to dry for 1min before the SDR base material (Dentsply) the tooth was temporized with Aquasil soft-putty and Aquasil light body (Dentsply) for 20secs, rinsed with water and air-dried. Silane Coupling Agent (Dentsply) was applied and left to dry for 3min before the temporary porcelain surface was coated with a thin layer of Prime & Bond XT mixed with Soft Cures Activator (Dentsply).

Fig 24: After etching with phosphoric acid and application of XP Bond (Dentsply) (Fig. 10) according to the manufacturer’s instructions, the SDR flowable base material (Fig. 11) was applied in the treated tooth structure. The objective was to block out undersurface on the axial wall preparations and to level the pulpal floor plane. After light-curing, the ideal cavity preparation was achieved by using a universal grid diamond bur.

Fig 25: After making an impression with “Aqua soft” putty and “Aqua light body” (Dentsply) the tooth was temporized with Integrity (Dentsply). A porcelain inlay fabricated in the laboratory from pressed Enamel (Dentek), fired (3I Trillium) was etched with 9per cent Hydrofluoric acid (3I Trillium) for 30min, rinsed with water and air-dried. Silane Coupling agent (Dentsply) was applied and left to dry for 3min before the temporary porcelain surface was coated with a thin layer of Prime & Bond XT mixed with Soft Cures Activator (Dentsply).

Fig 26: Occlusal view after cementation of the upper right second premolar with rubber dam and the temporary inlay removed. A single flute light-curing unit was utilized around the upper first molar to guarantee optimal isolation. The cavity preparation was angled with an explorer (Kerr) to ensure removal of any remnants of the temporary cement. Plasmon’s ligp was isolated around the upper first premolar to act as an isolation medium during cementation.

Fig 27: The cavity preparation was prepared for bonding using XP Bond (Dentsply) mixed with the Self Cure-Activator (Dentsply) according to the manufacturer’s instructions. The translucent shade of Calibra Resin cement (Dentsply) was used as a luting cement for cementation of the prefabricated composite resin inlay.