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 resin 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 (Wierzekowski 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 gap at the interface between the dentine/enamel and the restoration (Walshaw & McComb, 1996). According to Davidon 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 em-bedded 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).

The 1st flowable bulk-fill base
or to create adequate geometry to the cavity preparation for inlay/onlay preparation techniques (Dietschi & 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 (Dietschi & 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 adhesion 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 procedures.

The fact that SDR exhibits excellent adaptation 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 manipulate 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 4: After removal of the rubber dam. The final restoration reflects optimal restoration of aesthetics, occlusal anatomy, marginal ridges and interproximal integrity.

Fig 5: Completed restoration after cementation and polishing with an oval-shaped 30-fluted carbide finishing bur (Svedenius) and sequential finishing with 3000 grit (Kerr). 

Fig 6: Enamel and dentine surfaces were etched for 15 seconds with 10% hydrofluoric acid, rinsed with water and lightly air-dried. Two coats of XP Bond (Kerr) were dispensed on top of the previous layer up to approximately 1mm from the cusp margins. The material was again left undisturbed to allow for self-filling before it was light-cured for 40 seconds.

Fig 7: The cavity was lined with a thin layer of Pre-Cure light-cured (Kerr) to ensure removal of any remnants that could have been caused by polymerisation shrinkage. A single pass light-curing unit (Kerr) was used to allow a thin light-cured layer to be cured before light-curing the bulk of the restoration.

Fig 8: Different sizes of the Hans Hugod (Cristal) that were utilized to seal the matrix band against the marginal gingival crevice margins to gain a tight marginal seal, reducing the chances for contamination to ensure the establishment of an uncommissioned bond strength.

Fig 9: Matrix assembly: Hans Conformable Stainless Band in a Stainless holder activated 1-Ring and small Hans Hugod (white). Note the intra-surgical adaptation of the matrix band to the gingival marginal seal on the buccal aspect of the cavity preparation. The small wedge was replaced with a larger Hans Hugod (pink). (Fig 12) It is the elongation of the matrix band against the gingival marginal margin.

Fig 10: Enamel and dentine surfaces were etched for 15 seconds with 10% hydrofluoric acid, rinsed with water and lightly air-dried. 

Fig 11: SDR: Smart Dentine Replacement (Dentsply) compule tip, which incorporates a fine, needle-like tip for precise dispensing of the material with the attached macro dispensing tip.

Fig 12: After the bonding protocol, the SDR material was dispersed using slow, steady pressure from the deepest portions of the marginal and cusp tip preparation. After a 4 mm increment was dispensed the material was left undisturbed for 5 seconds to self-level before it was light-cured for 40 seconds from the occlusal aspect.

Fig 13: After etching with phosphoric acid, rinsed with water and air-dried. Two coats of XP Bond (Dentsply) were applied in an oblique layering technique, followed by a composite resin increment and light-cured for 40 seconds. The placement of the remaining cavo-surface steps were used as indication to reposition the occlusal morphology.

Fig 14: The remaining part of the cavity prep was filled with Tri-N Ceram (3M), a regular viscosity composite resin, illustrating the optimal integration of the composite resin and SDR with the surrounding tooth structure.

Fig 15: Another 4mm increment of SDR was dispensed on top of the previous layer up to approximately 1mm from the cusp-surface margins. The material was again left undisturbed to allow for self-filling before it was light-cured for 40 seconds.

Fig 16: The cavity outline after removal of the adhesive amalgam restoration and decay on the mesial marginal ridge. Caries balls were isolated with a temporary inlay utilised to identify some carious affected tooth structure.

Fig 17: Completed restoration after finishing and polishing with an oval-shaped 30-fluted carbide finishing bur (Svedenius) and sequential finishing with 3000 grit (Kerr).

Fig 18: Axial view of the buccal cusp demonstrating no sign of enamel cracking that could have been caused by polymerisation shrinkage of the bulk fill, flowable SDR base material.

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

Fig 20: Occlusal view after cementation of the porcelain inlay. Final light-curing of the cement was done from the occlusal and palatal direction for 30 seconds respectively, aiming to a fully light-curing unit (3M).