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 polymerization stress. Polymerization 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 (Wierzowski 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, 1998). According to Davidson 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 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), polymerization 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 resin (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., 1988).

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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 1: Final cavity preparation after caries removal and the etched enamel margins of the prepared surfaces were prepared with the Sun-nytix Prep Cream Tips (Kerr) to ensure removal of any unsupported enamel.

Fig 2: Pre-operative view of the upper right maxillary second molar. Clinical and radiographic examination of the upper right first molar revealed a previously placed occlusal amalgam restoration and interproximal decay on the mesial aspect of the tooth.

Fig 3: The cavity was extended to include the cervical enamel margins. The prepared enamel margins were etched with the BurTech etch technique (Buchala, 1994): mesial and distal marginal ridges were built up with a regular viscosity composite resin, one at a time and light-cured.

Fig 4: Enamel and dentine surfaces were etched for 30 seconds with 10 per cent hydrofluoric acid, rinsed with water and lightly air-dried. Two coats of XP Bond (Dentsply) were applied to the enamel and dentine surfaces, agitated with a microbrush for 15 seconds and air-dried and light-cured for 20 seconds with a Photo Light-curing unit (Ivoclar). The etched enamel and dentine surfaces were primed with XP Bond (Dentsply) and light-cured for 5 seconds to self-level before it was light-cured for 40 seconds from the external aspect.

Fig 5: The deflection amelogen restoration and decay on the mesial marginal ridge. Cavity walls were recontoured to act as an isolation medium during cavity preparation. The small wedge was utilized to identify some carious affected tooth structure.

Fig 6: The cavity outline after removal of the deflection amalgam restoration and decay revealed the permanent filling material was dispensed on top of the previous layer using an oblique layering technique. This magnified view revealed a fracture in the amalgam restoration (arrow) and extensive creep of the restoration margins.

Fig 7: After the bonding protocol, the SDR material was dispensed using slow, steady pressure from the deepest portions of the prepared cavity floor and cervical wall. Two coats of XP Bond (Dentsply) were applied and left to dry for 1 minute before the SDR was light-cured for 20 seconds.

Fig 8: Different sizes of the Bovie Hedges (Dentsply) that were utilized to seat the matrix band against the mesial gingival cavity margins to gain a tight marginal seal, reducing the chances for contamination to ensure the establishment of an unobstructed marginal seal.

Fig 9: Matrix assembly: Bovie Concave Stainless Steel Band in a Stainless Steel holder activated x-ray and small Bovie Hedges (white). Note the intermediate adaptation of the matrix band to the gingival enamel margins.

Fig 10: Enamel and dentine surfaces were etched for 15 seconds with 10 per cent hydrofluoric acid, rinsed with water and lightly air-dried. Two coats of XP Bond (Dentsply) were applied to the enamel and dentine surfaces, agitated with a microbrush for 15 seconds and air-dried and light-cured for 20 seconds with a Photo Light-curing unit (Ivoclar). The etched enamel and dentine surfaces were primed with XP Bond (Dentsply) and light-cured for 5 seconds to self-level before it was light-cured for 40 seconds.

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

Fig 12: After the bonding protocol, the SDR material was dispensed using slow, steady pressure from the deepest portions of the external aspect of the cavity preparation. The small sedge was replaced with a larger Bovie Hedges (ipsil) (Fig. 12) to achieve improved adaptation of the matrix band against the gingival enamel margins.

Fig 13: Another 4mm increment of SDR was dispensed on top of the previous layer to approximately 5mm from the cervical enamel margins. The material was again left undisturbed to allow for self-filling before it was light-cured for 40 seconds.

Fig 14: The remaining part of the cavity prep was filled with Sure-Cure (Ivoclar) a regular viscosity composite resin, using the Self Cure Activator (Dentsply). The cavity was filled using a single floss ligature to achieve optimal marginal integrity. The working length of the cavity was confirmed using a thin layer of silicone rubber base material.