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 (Wieczkowski 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 benefits 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 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 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 resins (Inside Dentistry, 2009). The volumetric shrinkage is 5.6 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 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: Occlusal view after cementation of the porcelain inlay. Final light-curing of the porcelain was done from the occlusal and axial facial surfaces for 20 seconds with a slow-light curing unit (Ivoclar). 

Fig. 2: After etching with phosphoric acid for 30 seconds, the enamel and dentine surfaces were dried and light-cured for 20 seconds with a slow light curing unit. 

Fig. 3: Enamel and dentine surfaces were prepared for bonding using XPrime (Ivoclar) that was utilized to seal the marginal gaps of the porcelain inlay. 

Fig. 4: Completed restoration after finishing and polishing with an opaqué shade 30 mm thick Carbide finishing bur (Kerr) and sequential finishing with OpitDiscs (Kerr) to ensure removal of any unsupported enamel. 

Fig. 5: The cavity outline after removal of the die stone using a high-speed handpiece with a fusible carbide finishing bur (Kerr) and sequential finishing with OpitDiscs (Kerr). Note the adequate adaptation of the matrix band to the gingival enamel margin. 

Fig. 6: Enamel and dentine surfaces were etched for 15 seconds with 38% orthophosphoric acid, rinsed with water and lightly air-dried. Two coats of fur Bond (Espe) were dispensed on top of the previous layer to approximately 1mm from the cavity-surface margin. The margins of the cavity were then etched and air-dried for 20 seconds with a slow light-curing unit (Ivoclar). 

Fig. 7: A circular matrix was selected: Hawe Contoured Tofflemire Bands (Triodent) that were utilized to seal the margins of the porcelain inlay. 

Fig. 8: Different sizes of the Blue Hedges (Triodent) that were utilized to seal the matrix band against the marginal gingival tissue margins, to gain a tight marginal seal and reducing the chance for contamination to ensure the establishment of an unapproximately bond strength. 

Fig. 9: Matrix assembly: Blue Hedges Contoured Tofflemire Band in a Tofflemire holder activated to 1 Rug and small Blue Hedges (white). Note the adequate adaptation of the matrix band to the gingival enamel margin. 

Fig. 10: Enamel and dentine surfaces were etched for 15 seconds with 37% orthophosphoric acid, rinsed with water and lightly air-dried. Two coats of fur Bond (Espe) were dispensed on top of the previous layer to approximately 1mm from the cavity-surface margin. The margins of the cavity were then etched and air-dried for 20 seconds with a slow light-curing unit (Ivoclar). 

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 dispensor tip. 

Fig. 12: The cavity inlay and restoration of the upper right first molar revealed a previously placed section partial amalgam restoration and interproximal decay on the mesial aspect of the tooth. 

Fig. 13: The cavity inlay and restoration of the upper right first molar revealed a previously placed section partial amalgam restoration and interproximal decay on the mesial aspect of the tooth. 

Fig. 14: The cavity inlay and restoration of the upper right first molar revealed a previously placed section partial amalgam restoration and interproximal decay on the mesial aspect of the tooth. 

Fig. 15: Another 4mm increment of SDR was dispensed on top of the previous layer to approximately 1mm from the cavity-surface margin. The margins of the cavity were then etched and air-dried for 20 seconds with a slow light-curing unit (Ivoclar). 

Fig. 16: Successive increments of composite were applied in an oblique layering technique, adapted with a point composite instrument and light-activated for 40 seconds. The inclination of the remaining cuspal step were used as indication to reconstitute the occlusal morphology. 

Fig. 17: Completed restoration after finishing and polishing with an opaqué shade 30 mm thick carbide finishing bur (Estadent) and sequential finishing with OpitDiscs (Kerr). 

Fig. 18: Aqueous view of the buccal cusp demonstratng no signs of enamel cracking that could have been caused by polymerization shrinkage of the bulk fill, flashable SDR base material. 

Fig. 19: Immediate post-operative occlusal view demonstrating no signs of enamel cracking that could have been caused by polymerization shrinkage of the bulk fill, flashable SDR base material. 

Fig. 20: The cavity preparation was pre-etched for bonding using XP Bond (Espe) 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 light-curing agent for cementation of the prefabricated restoration. 

Fig. 21: After etching with phosphoric acid for 30 seconds, the enamel and dentine surfaces were dried and light-cured for 20 seconds with a slow light-curing unit. 

Fig. 22: Cavity outline after removal of the die stone inlay restoration and decay on the mesial marginal ridge. Caries bur (Kavo) was utilized to identify some carious affected tooth structure. 

Fig. 23: Occlusal view after the cavity restoration was completed and the preparation was etched for approximately 15 seconds with a 38% orthophosphoric acid. The cavity was then light-cured for 20 seconds with a slow light-curing unit. 

Fig. 24: After etching with phosphoric acid and application of XP Bond (Espe), (Fig. 25) according to the manufacturer’s instructions, the SDR, flashable base mate- rial (Fig. 13) was applied in the treated tooth structure. The objective was to block out undercuts on the axial wall preparations and to level the pulpal floor plane. After light-curing, the ideal cavity preparation was achieved by using a medium grit diamond bur. 

Fig. 25: After making an impression with an A-silicon putty and aclosed light body (Espe) the tooth was temporized with Integrity (Dentsply). A porcelain inlay fabricated in the laboratory from pressed Emax (Sirona) was utilized with Viver 3 (Ivoclar) that was utilized to seal the marginal gaps of the porcelain inlay. 

Fig. 26: Occlusal view after cementation of the rubber dam and the temporary inlay retention. A single flow ligation was utilized around the upper first molar to a guarantee optimal isolation. The cavity preparation was chased with OpitDiscs (Kerr) to ensure removal of any remnants of the temporary cements. Plumber’s tape was utilized 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 (Espe) mixed with the Self-Cure Activator (Dentsply) according to the manufacturer’s instructions. 

Fig. 28: Final cavity preparation after removal of the rubber dam and the temporary inlay retention. The final restor- ation reflects optimal restoration of aesthetics, occlusal anatomy, marginal ridges and interproximal integrity. 

Fig. 29: Immediate post-operative occlusal view after removal of the rubber dam. The final restora- tive reflects optimal restoration of aesthetics, occlusal anatomy, marginal ridges and interproximal integrity.

References
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