Clinical application of a new flowable base material for direct and indirect restorations

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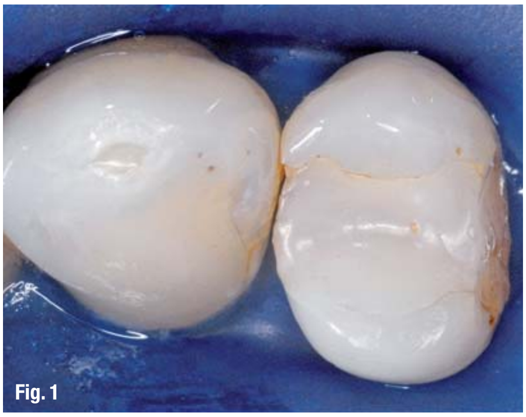


Fig. 1

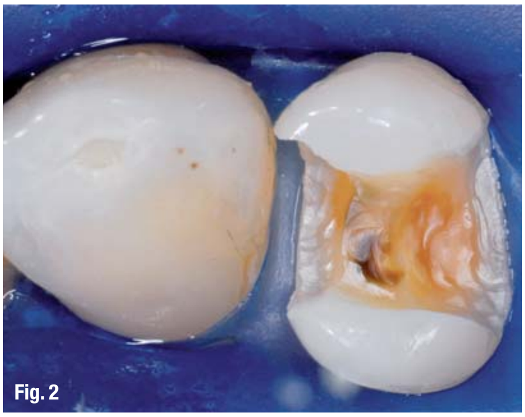


Fig. 2

_Recent developments in composite resin materials and bonding technology have made the routine use of these materials in posterior teeth possible.[1] Direct posterior composite resin restorations are now predictable and durable, and in many instances their superior aesthetic and tooth-supporting properties make them the ideal treatment option when restoring the posterior dentition.[2] The main shortcomings of composite resin materials are polymerisation shrinkage[3] and polymerisation stress. Polymerisation stress can result in contraction forces on the cusps that can result in cuspal deformation,[4] enamel cracks and ultimately decrease the fracture resistance of the cusps.[5]

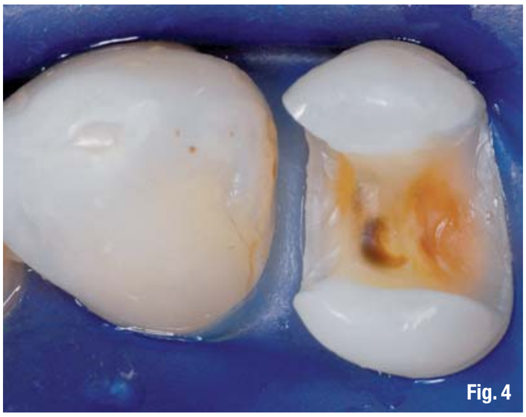

Fig. 3a


Fig. 3b

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.[6] According to Davidson and De Gee,[7] the parallel walls of a box-shaped cavity may restrict the flow of composite during polymerisation, causing stresses at the resin–dentine interface.[8]

The present generation of chemically or light-activated flowable composites undergoes free volumetric shrinkage of 4 to 9 % as compared with regular viscosity and packable composites at 2 to 5 %, with an average of 3.5 %. According to Jensen and Chan, polymerisation shrinkage stresses have the potential to initiate failure of the composite–tooth interface, which could cause deformation of the tooth, which in turn might result in post-operative sensitivity and which could even open pre-existing enamel microcracks.[9]

SDR Smart Dentin Replacement (DENTSPLY DeTrey) is marketed as a low stress flowable base material that can be placed in layers of up to 4 mm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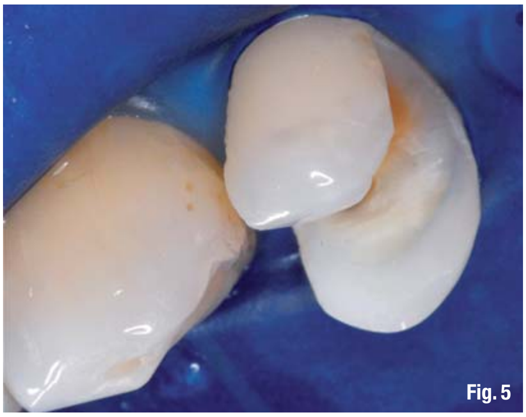


Fig. 5

in thickness and each bulk increment light-cured for only 20 seconds, on condition that at least 2 mm on the occlusal surface is left for regular viscosity composite resin. According to the manufacturer, a polymerisable modulator was chemically embedded into one of the monomers. The viscoelastic behaviour of this monomer and of the overall composition of the flowable composite allows the material to dissipate much more energy than induced during curing by polymerisation of the monomers. This leads to a reduction of remaining polymerisation stress by up to 60 % compared with conventional flowable composite resins.[10] The volumetric shrinkage is 3.6 % but more importantly, the stress generated during the polymerisation 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.

Figures 1 to 19 outline a clinical case report that illustrates the benefits and clinical application of this new innovative flowable base material for direct posterior composite resin restorations.

Base materials are mainly indicated for reducing the volume of filling material[11] or for creating adequate geometry for the cavity preparation for inlay/onlay preparation techniques.[12] 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 as much sound enamel/dentine as possible, the internal tapered design should be obtained by the application of a base material.[12]

Sherrer *et al.*[13] 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 favourable properties of the SDR material, 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 to 29 demonstrate 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.

_Case I: SDR as base material for posterior composite restoration

Fig. 1_Pre-op view of an isolated upper right maxillary sextant. Examination of the upper right first premolar revealed a defective composite restoration. Note the poor interproximal contact between the premolar and canine, as well as the inadequate contour on the distal aspect of the existing composite restoration.

Fig. 6

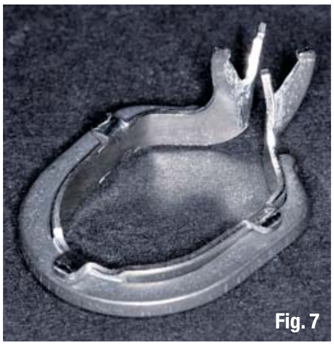


Fig. 7


Fig. 8

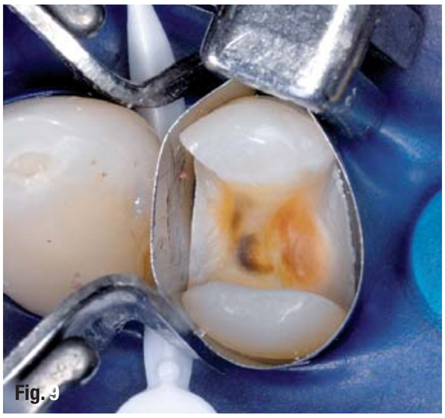


Fig. 9

Fig. 10

Fig. 11

Fig. 2_Initial cavity preparation after removal of the defective composite restoration.

Fig. 3_SONICflex air-driven scaler and SONICflex prep ceram tips (both KaVo) that were used to redefine the margins of the proximal boxes.

Fig. 4_Final cavity preparation after caries removal and preparation of the enamel margins of the proximal surfaces with the SONICflex prep ceram tips to ensure removal of any unsupported enamel.

Fig. 5_Angulated view of final cavity preparation. Note the extended depth of the distal gingival margin from the occlusal surface.

Fig. 6_Hawe Contoured Tofflemire-Bands (Kerr) were used in a Tofflemire holder to ensure correct contour of the definitive restoration. A circular matrix rather than a sectional matrix was selected because of the missing upper first molar.

Fig. 7_V-Ring (Triodent) was utilised to create separation between the canine and premolar in order to ensure a tight interproximal contact point.

Fig. 8_Wave-Wedges (Triodent) of various sizes were utilised to seal the matrix band against the mesial gingival cavity margin to gain a tight marginal seal, reducing the possibility of contamination to ensure the establishment of an uncompromised bond strength.

Fig. 9_Matrix assemblage: Hawe Contoured Tofflemire-Band in a Tofflemire holder, activated V-Ring and small Wave-Wedge (white). Note the inadequate adaptation of the matrix band to the mesial gingival margin on the buccal aspect of the cavity preparation. The small wedge was replaced with a larger Wave-Wedge (pink; Fig. 12) to achieve improved adaptation of the matrix band to the gingival enamel margin.

Fig. 10_Enamel and dentine surfaces were etched for 15 seconds with 36 % phosphoric acid, rinsed with water and lightly air-dried. Two coats of XP BOND (DENTSPLY) were applied to the etched enamel and dentine surfaces, agitated with a micro-brush for 15 seconds, lightly air-dried and light-cured for 20 seconds with a VALO light-curing unit (ULTRADENT).

Fig. 11_The SDR Compula Tip has a fine tip for precise dispensing of the material with the attached macro-dispensing tip.

Fig. 12_After the bonding protocol, the SDR material was dispensed using slow, steady pressure from the deepest portions of the mesial and


Fig. 12


Fig. 13

distal proximal box preparations. After a 4 mm increment had been dispensed, the material was left undisturbed for a few seconds to self-level before it was light-cured for 40 seconds from the occlusal aspect.

Fig. 13_Another 4 mm increment of SDR was dispensed on top of the previous layer up to approximately 3 mm from the cavo-surface margin. The material was again left undisturbed to allow for self-levelling before it was light-cured for 40 seconds.

Fig. 14_The remaining part of the cavity preparation was filled with Tetric N-Ceram (Ivoclar Vivadent), a regular viscosity composite resin.

Fig. 15_The Class II cavity was transformed into a Class I cavity according to the Bichacho technique:[14] mesial and distal marginal ridges were built up with a regular viscosity composite resin, one at a time and light-cured.

Fig. 16_Successive increments of composite were applied in an oblique layering technique, sculpted with a pointed composite instrument and light-cured for 40 seconds. The inclination of the remaining cavo-surface slopes was used as indication to reconstitute the occlusal morphology.

Fig. 14


Fig. 15

Fig. 17_Completed restoration after finishing and polishing with an egg-shaped, 30-fluted carbide finishing bur (Endenta) and sequential finishing with OptiDiscs (Kerr).

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

Fig. 19_Immediate post-op occlusal view after polishing with diamond polishing paste (ULTRADENT Diamond Polish), illustrating the optimal aesthetics, improved interproximal contour and the shape of the composite restoration. Note the optical integration of the composite resin and SDR with the surrounding tooth structure.

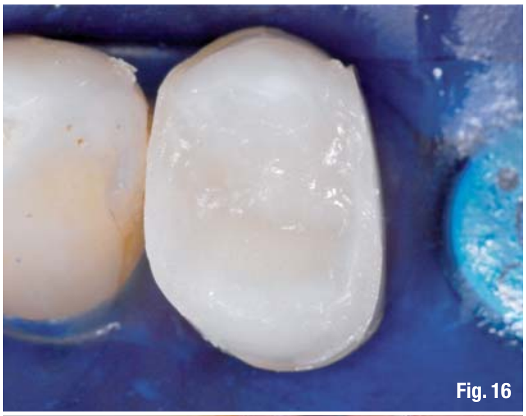
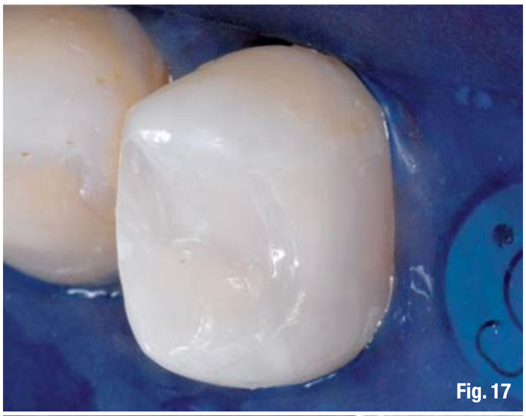


Fig. 16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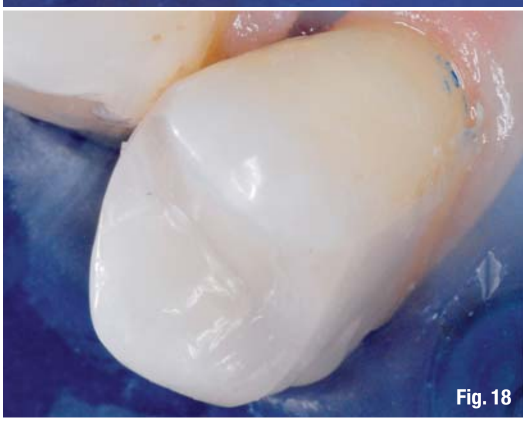
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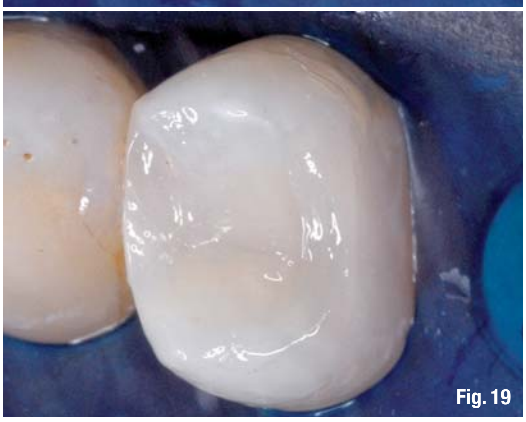
Fig. 19


Fig. 20

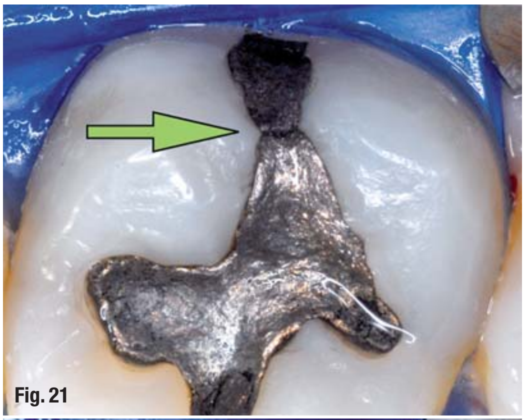
Fig. 21


Fig. 22


Fig. 23

_Case II: SDR as base material for posterior ceramic inlay restoration

Fig. 20_Pre-op view of the upper right maxillary sextant. Clinical and radiographic examination of the upper right first molar revealed a previously placed occluso-palatal amalgam restoration and interproximal decay on the mesial aspect of the tooth.

Fig. 21_Pre-op view of the isolated upper right maxillary molar. This magnified view revealed a fracture in the amalgam restoration (arrow) and extensive creep of the restoration margins.

Fig. 22_Cavity outline after removal of the defective amalgam restoration and decay on the mesial marginal ridge. A caries indicator (ULTRADENT) was utilised to identify the caries-affected tooth structure.

Fig. 23_Final cavity preparation after removal of caries left undercuts on axial wall preparations and an irregular pulpal floor plane.

Fig. 24_After etching with phosphoric acid and application of XP BOND (Fig. 10) according to the manufacturer's instructions, the SDR flowable base material (Fig. 11) was applied to 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 using a medium grit diamond bur.

Fig. 25_After making an impression with Aquasil Soft Putty and Aquasil Light Body the tooth was temporised with Integrity (all DENTSPLY). A porcelain inlay fabricated in the laboratory from IPS e-max Press (Ivoclar Vivadent) was etched with 9.5 % hydrofluoric acid (ULTRADENT Porcelain Etch) for 20 seconds, rinsed with water and air-dried. Silane coupling agent (Calibra, DENTSPLY) was applied and left to dry for one minute before the treated porcelain surface was coated with a thin layer of Prime & Bond NT mixed with Self-Cure Activator (both DENTSPLY).

Fig. 26_At the cementation appointment, the upper right sextant was isolated with a rubber dam and the temporary inlay removed. A single floss ligature was utilised around the upper first molar to guarantee optimal isolation. The cavity preparation line angles were cleaned with OptiClean (Kerr) to ensure removal of any remnants of the temporary


Fig. 24


Fig. 25


Fig. 26

Fig. 27


Fig. 28


Fig. 29

cement. Plumber's tape was folded around the upper first premolar to act as an isolation medium during cementation.

Fig. 27_The cavity preparation for bonding was done using XP BOND mixed with the Self-Cure Activator according to the manufacturer's instructions. The translucent shade of Calibra Esthetic Resin Cement (DENTSPLY) was used as a luting cement for cementation of the prefabricated inlay.

Fig. 28_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, using the VALO light-curing unit.

Fig. 29_Immediate post-op view after removal of the rubber dam. The final restoration reflects optimal restoration of aesthetics, occlusal anatomy, marginal ridges and interproximal integrity.

_Conclusion

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 are generally regarded as highly technique-sensitive procedures.

SDR exhibits excellent adaptation to the preparation walls owing to its flowable nature, reducing the possibility of void formation on the margins, which could lead to post-operative sensitivity or aesthetic failure of the restoration. Another unique characteristic of the SDR material is the self-levelling 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 polymerisation 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 offer patients more durable posterior restorations.

_Acknowledgement

I would like to acknowledge Mr Greg Flint for fabrication of the ceramic inlay._

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A video demonstrating the self-levelling properties of SDR is available on www.dentaltribune.com/articles/content/id/6974 or simply scan the QR code with your smartphone.

_about the author

cosmetic dentistry

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