Smart Dentin Replacement -The Smart Choice: A Case Report

Abstract

'Bulk-filling' is highly desired in routine restorative practice, but concerns about shrinkage stress have caused certain reluctance in its application.A real breakthrough came a few years ago, when SDR was introduced. It is a single component, fluoride containing, visible light cured, radiopaque, low-viscosity resin composite restorative material specially designedfor the bulk-filling technique. This was the first material that allows reliableadaptation to the cavity wall of bulk increments up to 4 mm in thickness .Itis the first posterior composite for dentin replacement combining the handling properties of a flowable composite with minimal shrinkage stress. The'Smart Dentin Replacement' layer is applied as a base inClass I and II cavities following the use of a conventionaldentin/enamel adhesive. It is chemically compatible withall methacrylate-based universal/posterior compositesused to replace the occlusal enamel layer and completethe adhesive filling. SDR offers interesting advantages ineveryday practice, because it allows dentists to providetheir patients with high-quality aesthetic posteriorrestorations in a cost-effective way.This case reportemphasis the innovative technique that outlines the management of a carious toothwith the new-generation flowable composite resinmaterial as a dentin substitute.

Key words

SmartDentin replacement, flowable composite resins, adhesives ,polymerization shrinkage.

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Introduction

'Flowables' are low-viscosity composites obtained from formulationswith a filler loading that is 2025% lower than that of conventional composites [1]. They possess a good wettingability, which favours their adaptation to the cavity walls, andare therefore expected to decrease the risk for air entrapmentand void inclusion [2,3].Because, flowable composites are richer in resin than traditional composites, their elastic modulus is also lower, which gives them greater bond-strength values than those of conventiona lmaterials.

However, the first-generation flowable composites were not suitable for full-depth posterior fillings because of their inferior mechanical properties and increased volumetric shrinkage compared to conventional paste-like composites, primarily due to the lower filler content [14].Basically, they could only be applied as liner or sealer, or tore store very small cavities [1,5].

As dental industry constantly searches for materials with improved properties, the latest generations of flowable composites have higher filler content and are claimed to have increased mechanical properties; they thus are now also recommended for larger posterior restorations[6]. To further simplify the filling procedure and to save precious chair time, the latest trend in composite technologyis the development of flowable restorative composites that can be placed in bulk up to 4 mm thickness [79].

Posterior bulk-filling was introduced with the flowable composite'SDR Posterior Bulk Fill Flowable Base' (Dentsply, Konstanz, Germany; in US: Sure Fil SDR Flow); it still requires a conventional paste-like composite to be placed/cured on top of the 4-mm thick composite base. Due to an enhanced translucency and by incorporating a photoactive group in the methacrylateres in polymerization kinetics are claimed to be better controlled, enabling the composite base to be injected and cured in bulk up to a depth of 4 mm.

In the few studies that investigated this flowable composite base, polymerization stress was indeed reported to be considerably lower than that of a conventional flow able composite, being comparable to that of marketed low-shrinking composites [1012], and marginal integrity appeared as good as that obtained with a conventionally layered composite [8,10].(Fig.no. 1)

The benefits of SDR (Fig No. 6) include a quick, simple and cost effective application technique, a very low polymerization stress value of only 1.5 MPa (average value of flowable composites: 3-4 MPa), a maximum increment thickness of 4mm, and compatibility with all methacrylate-basedadhesive systems.

Case Report

An 27-year old female patient reported to the Department of Conservative Dentistry and Endodontics with the chief complaint of food lodgement in right lower back teeth region since 2 months.

The medical history of the patient was non-contributory.

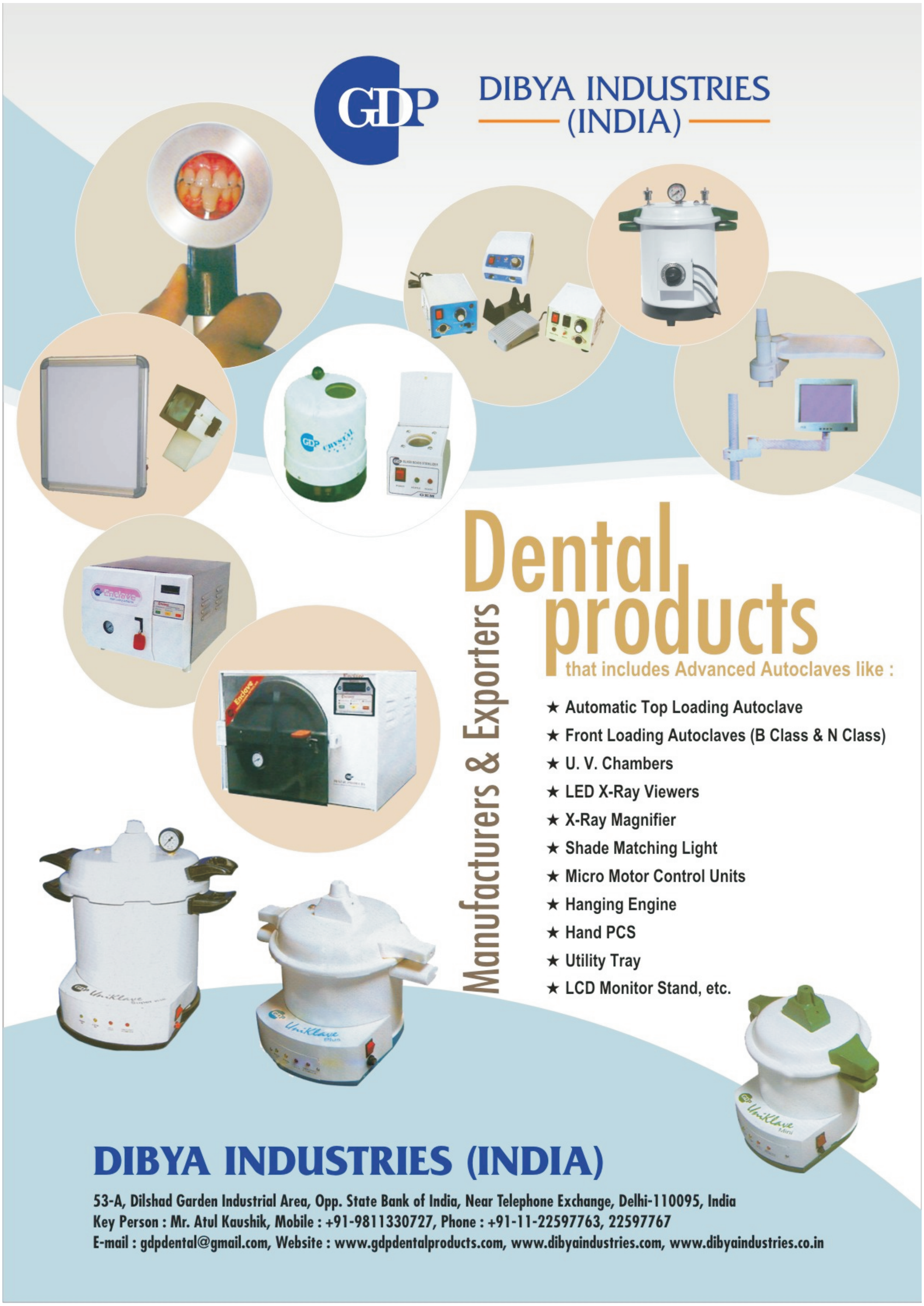
On clinical examination, a carious lesion was present on occlusal surface in 47 .The tooth was asymptomatic and no pain could be elicited. The tooth responded positively to the thermal and electric pulp testing. The involved tooth showed no signs of mobility.(Fig.no.2)

Her radiographic examination revealed the presence of a carious lesion approaching but not involving the pulp with no signs of apical involvement.(Fig.no.3)

The patient's informed consent and necessary ethical clearance were obtained.

Clinical Procedure

1. After removal of the carious lesion and cavity preparation in 47, the treatment site was isolated with cotton rolls.
2. After etching for 15 seconds ,the cavity was thoroughly rinsed to prevent any gel from remaining on the tooth substrate. This step is particularly essential for vital teeth, as it helps to avoid postoperative sensitivity.
3. After the rinsing step, excess water was gently removed from the cavity with air. It was important not to desiccate the dentin, in order to prevent the exposed collagen network from collapsing; this would have led to poorer adhesive infiltration.
4. The adhesive was applied and was left undisturbed for 20 seconds; then the solvent was carefully evaporated with a soft blow of air. The adhesive layer was then light-cured for 10 seconds .Afterwards, the cavity surface had a glistening exterior and was ready for composite application.
5. SDR was dispensed directly from the Compula Tip (Fig no. 4) into the cavity at a light, steady pressure, starting at the deepest point of the cavity and filling it up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to an increment thickness.The slender design of the metal cannula of the Compula Tip ensures good visibility and allows the user to reliably and quickly fill up the cavity even if there are undercuts. SDR self-levelled easily to a homogeneous surface and was placed approximately up to the level of the dentin-enamel junction. The SDR layer was light-cured for 20 seconds at a light intensity of at least 550mW/cm^2.

6. To reconstruct the occlusal enamel, a layer of Tetric-N-Ceram composite was applied on top of SDR ,sculpted and cured which greatly facilitates anatomical contouring.(Fig.no.5).The occlusion and the articulation were checked carefully. Occlusal Pits of adjacent tooth were sealed with pit and fissure sealants(HELIOSEAL)
7. Patient was recalled after 3 months and 12 months clinical follow up and radiographic evaluation.(Fig No.7,8)

Discussion

Following the trend of 'low-shrinking' composite technology, the demand for bulk-filling has more recently been approached with the introduction of flowable composites that can be placed and cured in one layer of up to a thickness of 4 mm [9]. Although flowable composites generally shrink more than conventional paste-like composites [1,4], their resulting shrinkage stress remains comparatively low [5].This should mainly be attributed to the highly stress-relieving internal monomer flow prior to reaching the gel-point, the moment at which stress starts to build up [13,14]. The first flowable bulk-fill concept was introduced with 'SDR' (Dentsply); it consists of a two-stage procedure, involving the placement and curing of an up to 4-mm thick flowable composite base that subsequently is covered by a conventional composite placed/cured on top.

Bulk-filling is possible thanks to the abovementioned stress-relieving flow-ability, potentially enhanced by a so-termed 'polymerization modulator', “to be chemically embedded in the polymerizable resin backbone of the 'SDR' resin monomer” [11].

In 2004,Eichmiller F.C., Lu H. et al., measured the polymerisation stress of a prototype of SDRand several conventional flowable and universal/posteriorcomposites using a National Institute ofStandards and Technology (NIST) Tensometer. Thedata obtained show the stress developed by SDR to besignificantly lower than that of all other materials tested.

Intests using a Stress-Strain-Analyzer by IIie N in 2007, SDR also showedthe lowest stress build-up consistently with the othertwo independent trials. The ATR-NIR method was used toevaluate SDR's degree of conversion at various incrementthicknesses.

The study showed that theconversion of SDR to be excellent, even at a thickness of5 or 6mm. These results prove that SDR will be optimallypolymerised when bulk-placed in increments of up to 4mm, as recommended.

Marginalintegrity tests after thermomechanicalfatigue [15] alsoshowed that SDR™ will be a very goodbase material in the filling technique.

A recent study, comparing SDR with two traditionalflowable methacrylate-based composites found that SDRhad the lowest level of shrinkage stress, the longestpre-gel time, and the lowest shrinkage rate.[16]

Koltiskoet al.[17] found the polymerization stress of SDR to belower than that of other flowable composites, whereasno differences were found in flexural modulus and volumetric shrinkage (3.5% volume) of the composite stested.

According to, Burgess et al.,[9] the chemistry ofSDR is designed to slow the polymerization rate, therebyreducing polymerization shrinkage stress without affectingpolymerization shrinkage levels.

Jin et al.[18] found that the new SDR resin system in unfilled, as well as in variousdifferently filled formulations, exhibited less curing stressthan conventional resin.

Conclusion

SDR is characterised by a remarkably low polymerisation stress, in combination with a low polymerisation shrinkage and a high depth of cure. Thanks to the 'stress decreasing resin' technology, it is the first flowable composite that can be used as a bulk-fill base material in increments of up to 4mm in Class I and II cavities. SDR's self-leveling consistency ensures optimal adaptation to the cavity walls. Its compatibility with methacrylatebased adhesives and composites and its availability in one universal shade in Compula Tips help to optimise the workflow in clinical practice.Thus, SDR is a composite providing a quick and cost-effectivetechnique to create aesthetic, high-quality, long-lasting posterior restorations

Reference:

References are available on request at editor@healtalkht.com

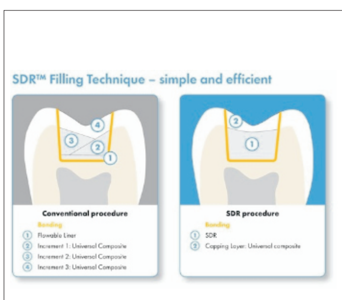


Fig. 1

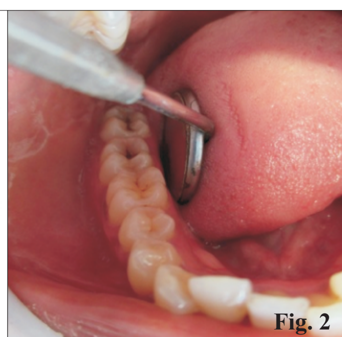
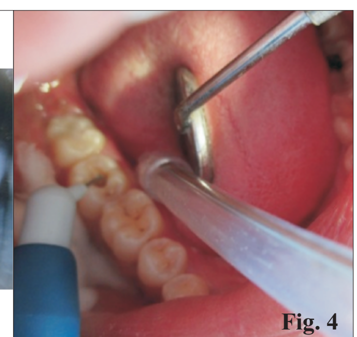


Fig. 2


Fig. 3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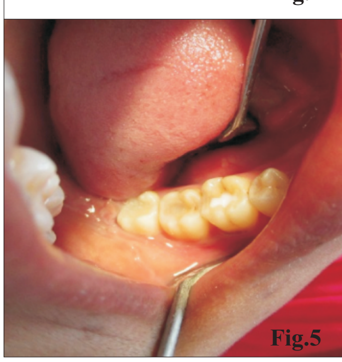
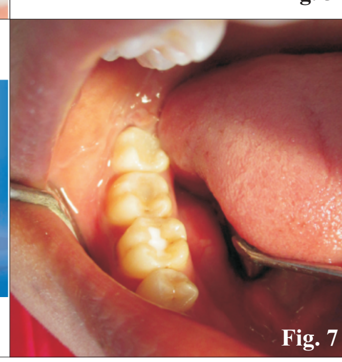


Fig.5

Fig. 6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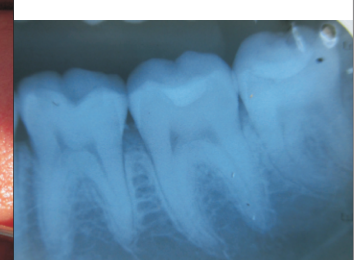
Fig.8