

What is smart dentin replacement?

Dr Frank Pfefferkorn investigates a revolutionary way to save you time

Do you remember how a crumbling mixture could turn an easy and safe amalgam filling into a challenge? Have you found the stickiness of the material troublesome when placing tooth-coloured fillings with a composite material? Do you loathe constructing a filling using the layering technique? If so you probably wish for a more simple yet reliable and safe procedure during your hectic daily routine. How such a process works, and how it was developed, is described below.

Vital

Besides the correct application of the bonding agent, and for this please follow the manufacturer's instructions for use carefully, the following step is of vital importance.

What is the advantage of a filling material that shows excellent mechanical properties under ideal circumstances in the laboratory but is difficult to apply in a cavity? Here, the intimate adaptation to the adhesive layer, as well as the smooth application of small increments without surface defects, is the most important factor for a high quality filling. The use of flowable composites has found widespread use particularly where a simple and safe initial adaptation is required. However, there is no proof that this, in general, is accompanied by a reduction of polymerisation stress¹. Researchers at Dentsply have now developed modified monomers¹ which, in combination with conventional methacrylate-based monomers, lead to significantly reduced polymerisation stress independent of the filler load. With this, the idea was created to develop a flowable material that allows an efficient and safe cavity filling technique. As a flowable consistency is not ideal for either the occlusal reconstruction or the required wear resistance, the occlusal capping with a universal composite was considered from the beginning. In other words, dentine can be cleverly replaced with SDR – Smart Dentin Replacement.

What makes SDR different?

SDR is based on the chemistry of conventional universal composites and a certain adhesive or a combination of a material for occlusal coverage is not necessary. The difference lies in a modulator that is incorporated into a urethane-based dimethacrylate. With this, a conventional network structure is built from conventional monomers and the SDR monomer (Figure 1).

What has been tested?

Measurements conducted at the University of Munich recorded the contraction force during polymerisation in 0.2 sec. intervals demonstrating how SDR differs from other materials (Figure 2). This difference remains during further polymerisation and leads to significantly reduced polymerisation stress (Figure 3).

Besides low polymerisation stress it is important to have a high depth of cure. This is achieved with one universal shade with sufficient translucency. Samples prepared with different layer thickness have been tested after a curing time of 20 seconds. Successful curing is achieved when the hardness of the lower side of a sample reaches a minimum of 80% of the upper side.

Figure 4 shows SDR compared to other flowable materials applied in increments of up to 5mm. It is clear that SDR has a much higher depth of cure than other flowable materials.

The combination of very low polymerisation stress, along with a high depth of cure, allows layering in 4mm increments. This simplified procedure with SDR, in comparison to conventional flowable composites, is shown in Figure 5. Representative for many other studies regarding the compatibility (of SDR) with adhesives and composites for the capping layer is the result of a chewing simulation shown below. Incrementally layered fillings (adhesive and

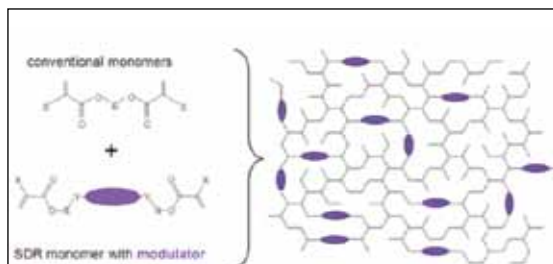


Figure 1: The SDR monomer with modulator builds a network with conventional monomers. The difference is not that the modulator becomes a part of the polymerised network but that it influences its development and how quickly the network is built. With this, polymerisation stress is reduced from the very beginning.

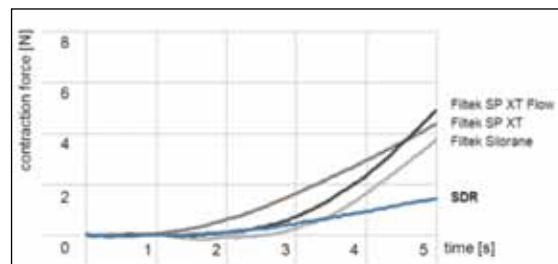


Figure 2: Contraction force in the first five seconds after polymerisation. Ilie N (2009) This difference remains during further polymerization and leads to significantly reduced polymerisation stress (Figure 3).

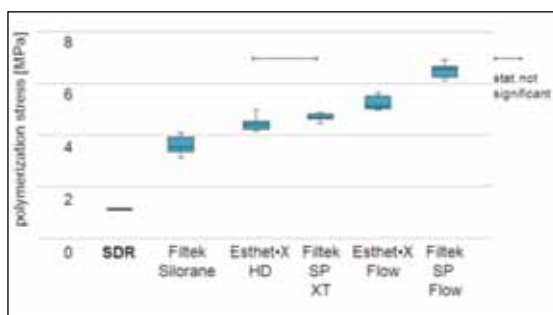


Figure 3: Polymerisation stress after five minutes. Ilie N. (2009)

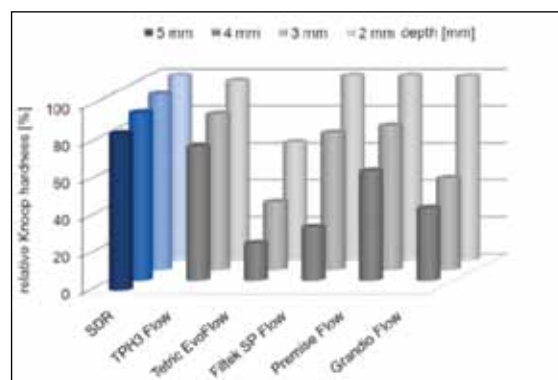


Figure 4: Relative Knoop Hardness of different flowable composites as a measure for depth of cure

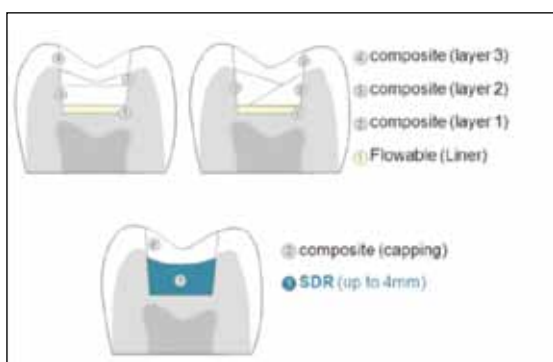


Figure 5: Conventional layering technique with composites vs simplified filling technique with SDR

| Adhesive | Smart Dentin Replacement | composite | system result |
|--------------------|--------------------------|-------------------|---------------|
| XP Bond | SDR | Ceram-X mono* | ✓ |
| Xeno V | SDR | Ceram-X mono* | ✓ |
| Syntac | SDR | Tetric EvoCeram | ✓ |
| Adper Prompt L-Pop | SDR | Filtek Supreme XT | ✓ |
| iBond SE | SDR | Venus Diamond | ✓ |

Table 1: Adhesive systems tested with chewing simulation

composite of the same manufacturer) were compared with simplified filled cavities using the same bonding agent and composite and additionally SDR, before and after chewing simulation regarding their marginal quality. All cases showed that using SDR in 4mm layers and capping with a universal composite, provides the same level of marginal quality compared to a restoration using incremental layering (Table 1).

Summary

SDR allows the use of a simplified filling technique applied in increments of up to 4mm and capped with a universal composite at the occlusal surface. This is achieved with a reduction in the polymerisation stress and a high depth of cure. To achieve this, a modulator has been built into the conventional monomer – this also allows SDR to be used with other conventional adhesives and composites. A chewing simulation demonstrated that, with this simplified filling technique; the same marginal quality of

a restoration can be achieved compared to a restoration created using an incremental layering technique.

With this a new, simplified and safe procedure becomes available for use in your daily practice.



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SDR is the revolutionary way to save you time, making posterior direct restorations less cumbersome for the clinician. To learn more, visit www.dentsply.co.uk.