FactFile

Surefil one™

Self-Adhesive Composite Hybrid

In the history of material development there were multiple approaches to make a resin composite self-adhesive without the need for separate etching and bonding. The most prominent approach was modifying the reactive diluents with acidic moieties to facilitate interaction with the tooth structure. Alternatively, the structural monomers can be modified with acidic groups to achieve sufficient adhesion. To its extreme this approach is realized in the polyacids used in glass ionomers. However, polyacids cannot contribute to the radically polymerized network due to lack of polymerizable groups.

In order to overcome this, Dentsply Sirona introduces **Surefil one™**, a self-adhesive composite hybrid. It enables dentists to fill cavities in one bulk without the need for etching, bonding and layering. Its modified polyacid merges the self-adhesive properties of classical polyacids known from glass ionomers with the crosslinking ability of structural monomers known from resin composites (Figure 1).

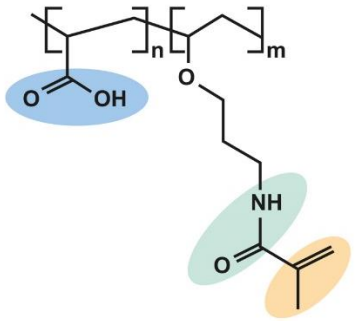

Fig. 1 Modified polyacid showing the polymerizable groups and showing the hydrolytically stable amide connection of the polymerizable groups with the rest of the molecule, and showing the groups interacting with tooth substrate.

The vast number of interfaces to the calcium ions of the tooth structure ensures a durable bond and good marginal integrity to enamel and dentin. This has been confirmed in internal and external studies (Figure 2).

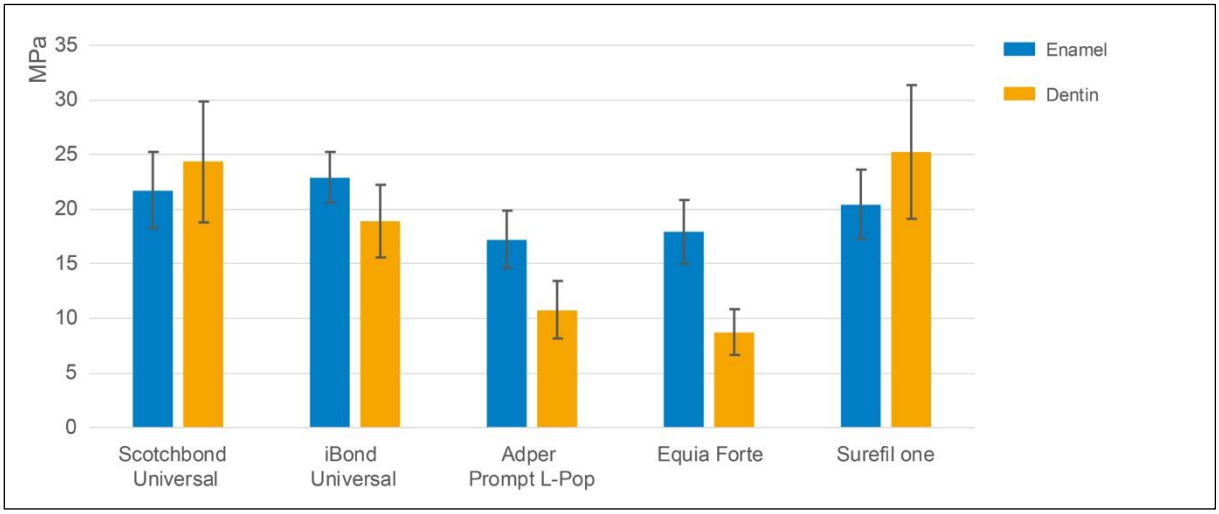

Fig. 2 Shear bond strength of the self-adhesive composite hybrid Surefil one™ to enamel and dentin in comparison to other adhesive/restorative materials. All adhesives were combined with the same universal composite (R&D Dentsply Sirona, 2019).

Dentsply Sirona

Research

In order to generate a composite-like three-dimensional network that significantly improves the mechanical strength of **Surefil one™** the formulation contains crosslinkers based on amide chemistry making the formulation hydrolytically stable. The crosslinkers polymerize with all components of the formulation - glass fillers, resins and polyacids (Figure 3).

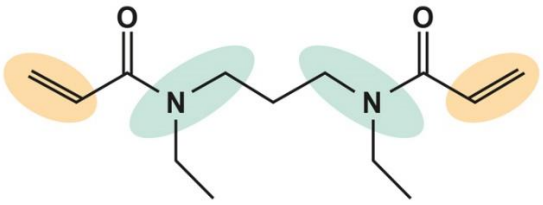

Fig. 3 Crosslinker used in Surefil one™ showing the polymerizable groups and showing the hydrolytically stable amide connection of the polymerizable groups with the rest of the molecule.

By using a dual-cure activator **Surefil one™** allows unlimited bulkfil. Light curing of the surface layer allows a fast and easy polish. Survival of MOD restorations with cervical margins in enamel and dentin was evaluated after thermocycling and chewing simulation. The results show that all **Surefil one™** restorations survived chewing simulation without chipping or bulk facture resulting in 100% survival (Figure 4).

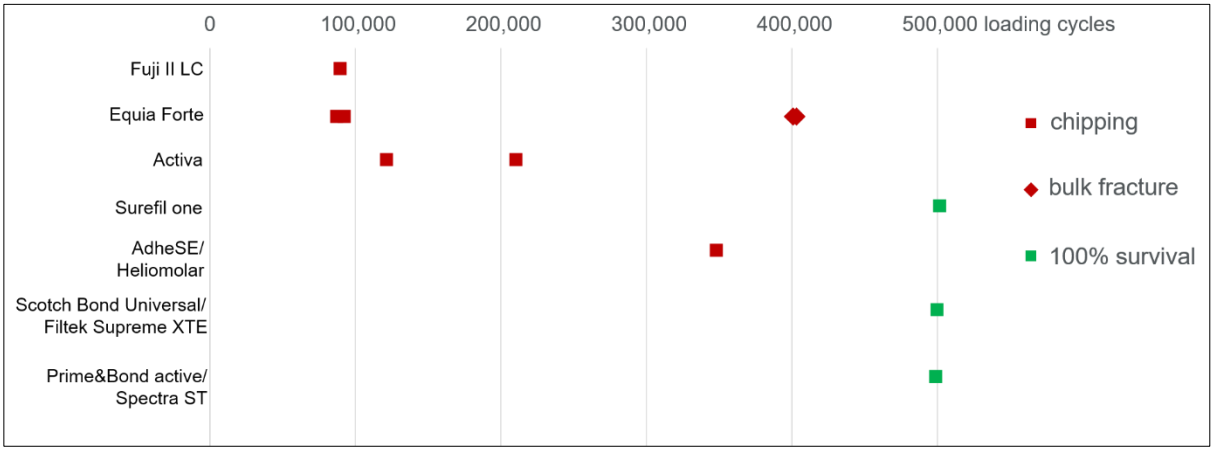

Fig. 4 Fractures and survival of the self-adhesive composite hybrid Surefil one™ in comparison to other adhesive/restorative materials after thermo-mechanical loading (Frankenberger R, 2018).

Using polyacids in formulations requires the use of water in the formula due to insolubility in traditional composite resins. Adding a well-defined amount of water to a formulation has major consequences on the nature of the chemistry. Every component needs to be compatible with water and stable in an aqueous environment. Therefore, the classical reactive diluents need to be substituted by water soluble, hydrolytically stable molecules. To ensure proper mixing of the ideal ratio of powder and liquid **Surefil one™** is delivered in capsules. **Surefil one™** comes in five different shades (A1 to A3.5). Currently, a clinical study in the United States is ongoing. The results of this study will be expected in April 2019.