

# SCIENTIFIC REPORT

## Bifix SE – Adhesion

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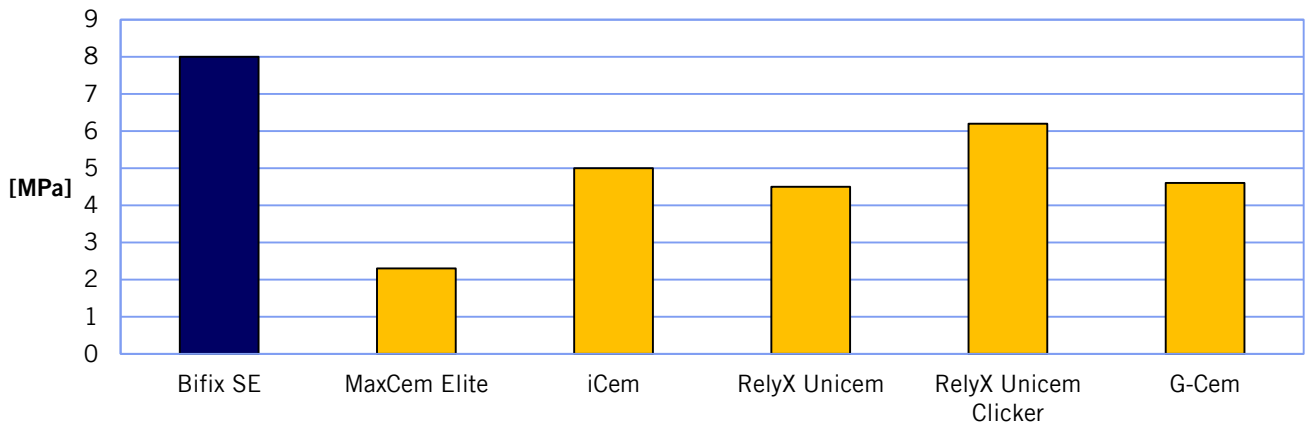
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**Bifix SE, the self-conditioning luting material from VOCO, is used for luting all types of indirect restorations. The adhesion values on diverse restorative materials and tooth substance have been examined in multiple internal and external studies.**

### Adhesion to tooth substance

The adhesion values on enamel, dentine and radicular dentine were examined for the evaluation of adhesion to natural tooth substance. The tests for enamel and dentine adhesion were carried out in shear tests on bovine teeth. With self-conditioning luting systems, the adhesion values for pure chemical curing were sometimes higher than those achieved with light-curing. The cause for this is found in the time requirement for the formation of self-organising layers in the adhesive. The light-curing causes immediate curing of the material and can abort the self-organisation of the components.



**Figure 1:** Shear bond strength [MPa] on bovine dentine after light-curing<sup>[1]</sup>

The shear bond strength values on dentine after light-curing are shown in Figure 1. Bifix SE shows significantly higher values than the other luting materials tested. An almost identical picture resulted from determining the adhesion values after pure chemical curing (Figure 2). A significantly more meaningful role should thus be assigned to these adhesion values, since light-curing is not possible in many cases (opaque materials) where indirect restorations are being luted.

The adhesion values on enamel (Figure 3) are generally slightly lower than the adhesion values on dentine, whereby the adhesion of Bifix SE is also superior to the competition on this backdrop. If increased adhesion is desired, separately etching the enamel can be carried out.

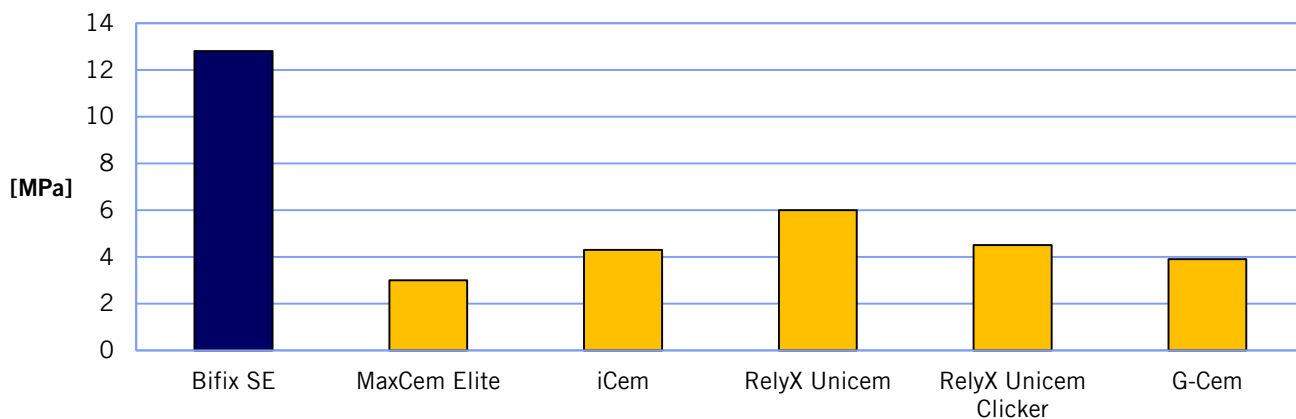


Figure 2: Shear bond strength [MPa] on bovine dentine after chemical curing<sup>[1]</sup>

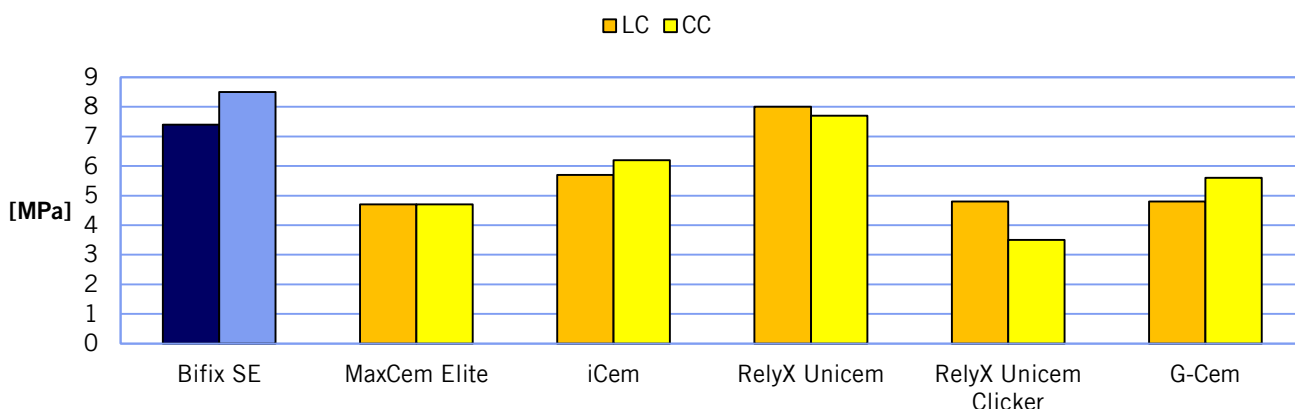


Figure 3: Shear bond strength [MPa] on bovine enamel;<sup>[1]</sup> LC = light-cured, CC = chemically cured

Adhesion to endodontic posts

The use of Bifix SE for luting endodontic posts is particularly interesting, since minimising the work steps is especially advantageous if accessibility to the root canal is problematic. At the University of Erlangen in Germany, the adhesion values were determined with extrusion tests by the Frankenberger workgroup.<sup>[2]</sup> The adhesion for the apical and coronal areas was separately measured in the testing. In the comparison of the curing methods, it was initially clear that additional light-curing of the dual-curing materials in the depth of the root canal does cause an effect. The adhesion values of the different systems do not vary significantly. The use of Bifix SE, the self-conditioning system, is also excellently suited for luting posts.

On the side of the tooth, the adhesion to the radicular dentine is particularly decisive for luting endodontic posts. This was examined by the work group for Dr. Gernhardt at the University of Halle. The result of this study is shown in Figure 5.

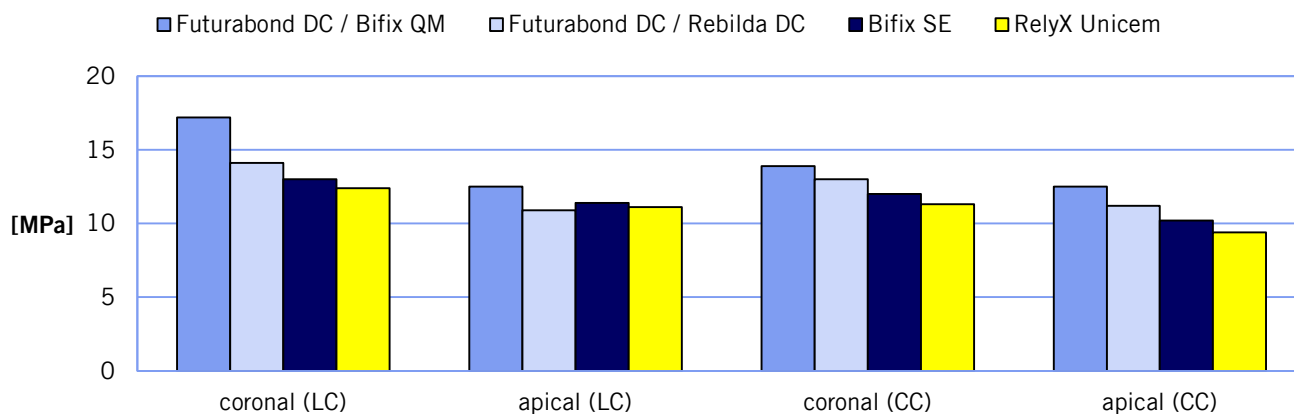
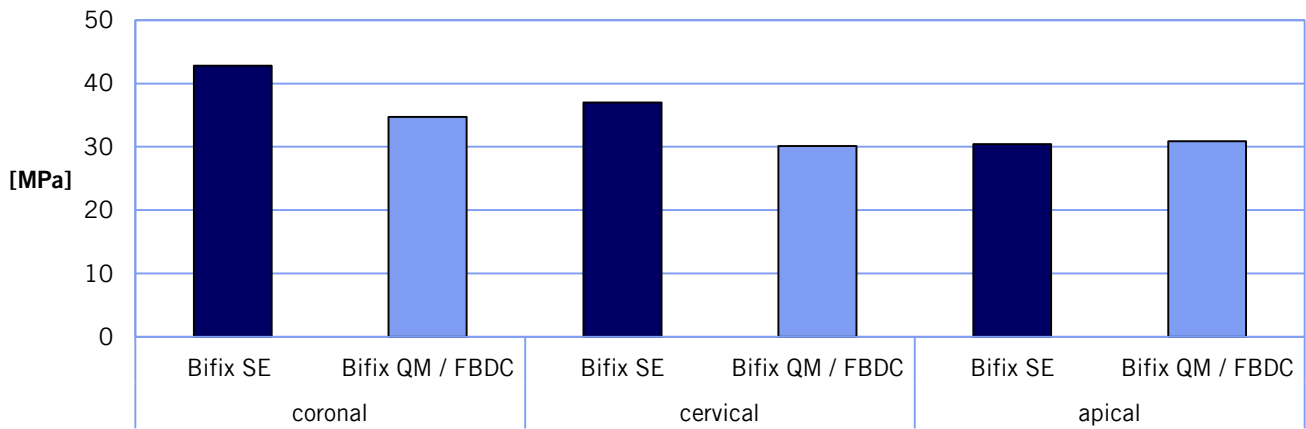


Figure 4: Extrusion bond strength [MPa] with post luting;<sup>[2]</sup> LC = light-cured, CC = chemically cured

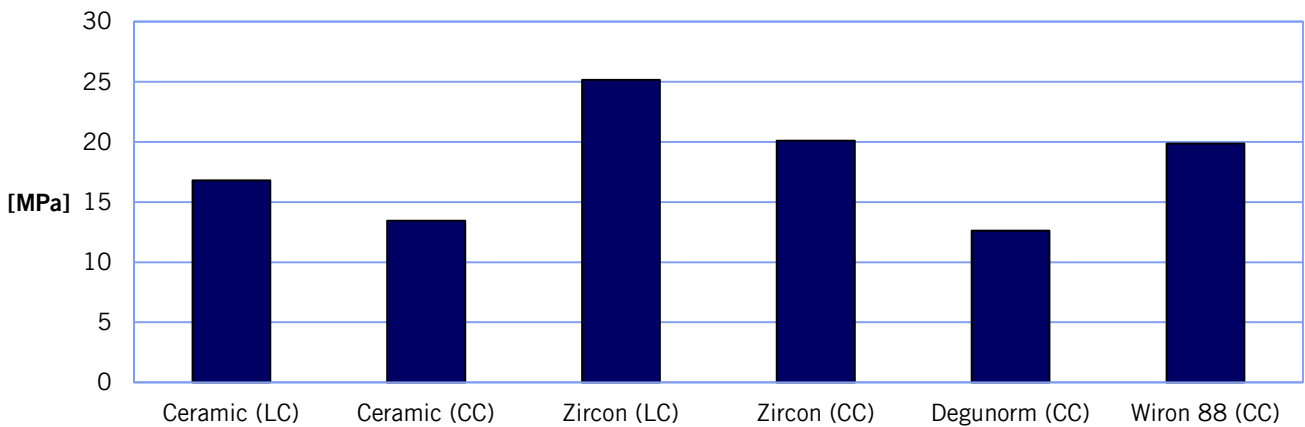


**Figure 5:** Micro tensile bond strength [MPa] on human radicular dentine; <sup>[3]</sup> FBDC = Futurabond DC

Excellent values were achieved in all areas in the examination of the adhesion in the root canal. The self-conditioning of the surface yielded values that are equivalent to those of traditional systems with separate application of bond and luting material.

**Adhesion to diverse restorative materials**

Bifix SE achieved not only excellent adhesion values from the side of the tooth, but the adhesion to materials used for indirect restorations is also very good. The adhesion values for ceramic, high-strength and acid-resistant ceramic zirconium oxide as well as two common metal alloys are shown in Figure 6.



**Figure 6:** Adhesion [MPa] to indirect restorations; <sup>[1]</sup> LC = light-cured, CC = chemically cured, light-curing is not possible with the metal alloys Degunorm and Wiron 88

**Conclusion: Bifix SE, the self-conditioning luting composite, combines all of necessary components (etchant, bond, composite and silanizer) for luting. Excellent to outstanding adhesion values are consistently achieved, although the application has been maximally simplified.**

[1] VOCO, Internal measurement, 2008, data on file.

[2] R. Frankenberger, M. Taschner, N. Krämer, Poster at 86<sup>th</sup> IADR Toronto 2008, Abstract 1749.

[3] C. Rettig, A. Rother, H.-G. Schaller, C. R. Gernhardt, Poster at 87<sup>th</sup> IADR Miami 2009, Abstract 1839.