

## Admira Fusion – Cusp deformation / marginal integrity

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With Admira Fusion, VOCO has introduced the first ceramic restorative material with a pure ORMOCER® resin base, thereby setting a new standard in the dental industry yet again. Following many years of research and development, Admira Fusion now unites two outstanding, innovative systems in one material: Nanohybrid and ORMOCER® technology. VOCO first employed ORMOCER® technology back in 1999, in Admira. However, in the new Admira Fusion, the resin matrix has been further developed, allowing conventional methacrylate monomers to be dispensed with entirely.

In this new, pure ORMOCER® resin, the inorganic backbone is exclusively composed of silicon oxide structures, as are the fillers, meaning that Admira Fusion is based on pure silicate technology. It is compatible with all adhesive systems. In addition to the low polymerisation shrinkage of just 1.25% by volume and the very low shrinkage stress, the biocompatibility of Admira Fusion is another outstanding characteristic.

Innovative products such as Admira Fusion, which represents a new generation of restorative material, need to bear comparison with the established products and prove their reliability as a restorative material with long-term marginal integrity. For this reason, the team led by Dr. Fleming at the University of Dublin tested the strength of different restorative materials in terms of cusp deformation and cervical marginal integrity.<sup>[1]</sup>

### Examination of cusp deformation / marginal integrity

Human maxillary premolars free from caries, hypoplasia defects and fractures were used for the in vitro study. The buccal-palatal width of the teeth was between 8.4 and 8.8 mm. For the study, identical MOD cavities were prepared in accordance with defined criteria and then treated with three different, packable restorative materials (n = 8) using the conventional incremental technique. Eight increments were placed for each restoration and cured for 20 seconds layer by layer. The universal adhesive Futurabond U (VOCO) was used as the adhesive in all cases in the self-etch mode. The three restorative materials studied are listed in Table 1.

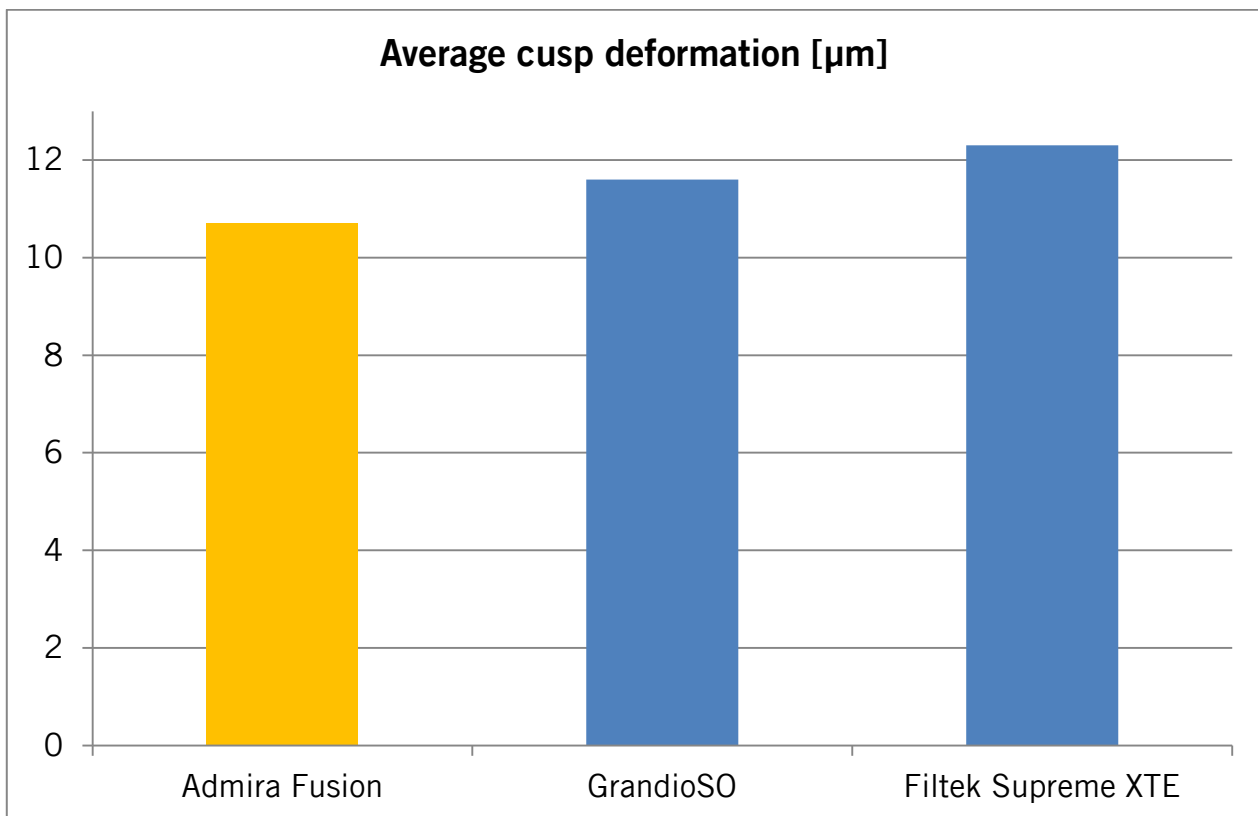
**Table 1:** Overview of the studied restorative materials

Restorative material	Description	Resin technology used	Filler content (% by weight)
<b>Admira Fusion</b> (VOCO)	Universal nanohybrid ORMOCER® restorative material	ORMOCER®	84
<b>GrandioSO</b> (VOCO)	Universal nanohybrid composite	Conventional methacrylates	89
<b>Filtek Supreme XTE</b> (3M ESPE)	Universal nano-composite	Conventional methacrylates	78.5

The buccal and palatal cusp deformations were measured during the light-curing of each individual increment and for up to three minutes afterwards. To determine the cervical marginal integrity, the restored teeth were subjected to artificial ageing by means of thermocycling (500 cycles, 4 °C – 65 °C) and then immersed in a magenta fuchsine solution for 24 hours in order to allow the dye to penetrate any marginal gaps. The teeth were then split from mesial to distal and the cervical marginal integrity assessed under a microscope using a scale from 0 to 4. The type and depth of penetration of the concentrated fuchsine solution were used as the index, with 0 corresponding to no dye penetration and thus a restoration with optimal marginal integrity. The highest value on the scale, 4, corresponded to dye penetration into the pulp chamber. A precise explanation of this scale with additional illustration can be found in Table 2.

## Results

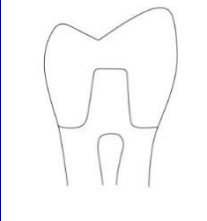
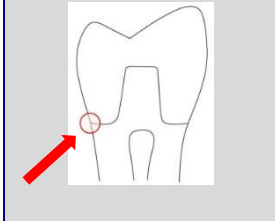
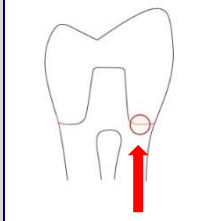
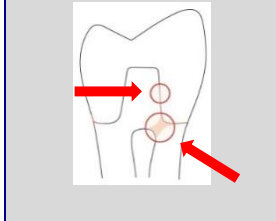
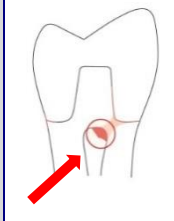
Figure 1 shows the measured cusp deformations induced by the three materials studied: Admira Fusion, GrandioSO and Filtek Supreme XTE. It is evident that the innovative Nanohybrid ORMOCER® restorative material Admira Fusion can not only hold its own against the established restorative composites GrandioSO and Filtek Supreme XTE, but also managed to impress across the board in this part of the study. Admira Fusion displays a cusp deformation of 10.7 µm. The cusp movement of Filtek Supreme XTE, in contrast, is 15% larger at 12.3 µm.



**Figure 1:** Average cusp deformation in µm

Following the measurement of cusp deformation of the cured materials, the cervical marginal integrity was classified on the above scale of 0 to 4. The lower the number, the higher the marginal integrity of the placed restoration. The results can be found in Table 2.

**Table 2:** Average cervical marginal integrity of studied restorative materials

Studied restorative material		- Admira Fusion - - GrandioSO -		- Filtek Supreme XTE -	
Type of dye penetration observed	No dye penetration	Superficial penetration (not beyond the enamel-dentine junction)	Penetration along the gingival floor	Penetration to the axial wall, as far as the pulp	Penetration into the pulp chamber
Schematic illustration of dye penetration					
Classification based on points	0	1	2	3	4

Admira Fusion and GrandioSO displayed only superficial penetration (evaluated as 1) on average, whilst Filtek Supreme XTE showed an average penetration as far as the pulp (evaluated as 3). Thus, Admira Fusion and GrandioSO stand out in this study too, and both materials from VOCO display better marginal integrity than the material from 3M ESPE. These results are consistent with the preceding cusp deformation results.

**Conclusion:** With Admira Fusion, the world's first purely ceramic-based restorative material, VOCO avoids the addition of conventional methacrylate monomers completely. In this test, this innovative technology not only had to bear comparison with established restorative materials but actually surpassed them. The dentist can therefore rest assured that Admira Fusion allows permanently stable restorations, not least because of its extremely low shrinkage of just 1.25%. The combined Nanohybrid ORMOCER® technology and the resulting excellent biocompatibility mean that VOCO has once again succeeded in setting a new benchmark in the dental industry.

[1] Tomaszewska IM, Kearns JO, Ilie N, Fleming GJP, *Journal of Dentistry*, 43, 309-316, 2015.