

## Grandio – Viscoelastic properties

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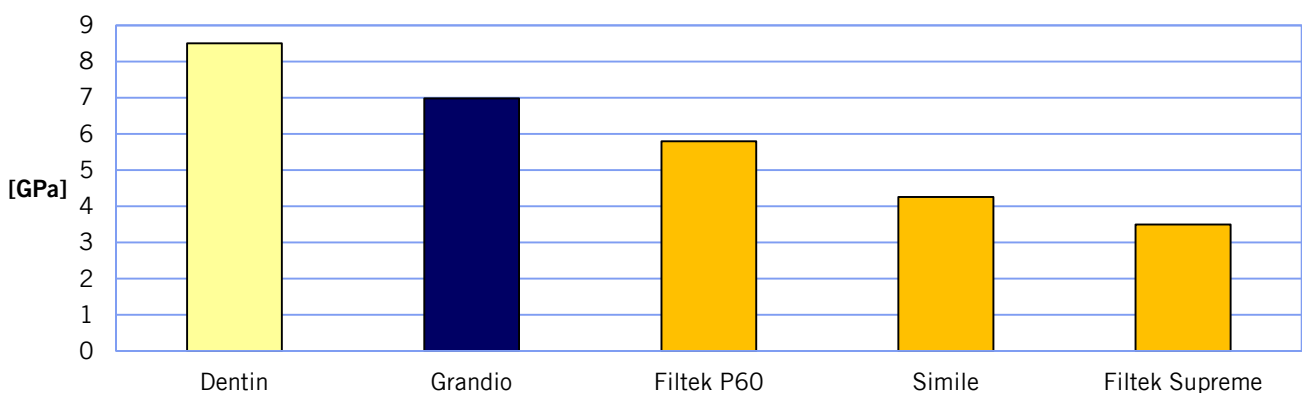


**When the mechanical properties of composite materials are examined, Grandio, the hybrid composite from VOCO, is the material that corresponds best to the properties of dentine from the products tested under clinical conditions. <sup>[1]</sup>**

Composite materials were mainly used for anterior restorations in the past, but today these materials are increasingly also finding use as a restorative for cavities in premolars and molars. The chewing forces that occur, however, are quite powerful. Restoratives are thus subject to high standards in reference to elasticity, compression stability and the resistance to bending and shear forces. Ideally, the restorative should not differ from the tooth substance in its properties, so that all occurring forces are evenly distributed over the tooth.

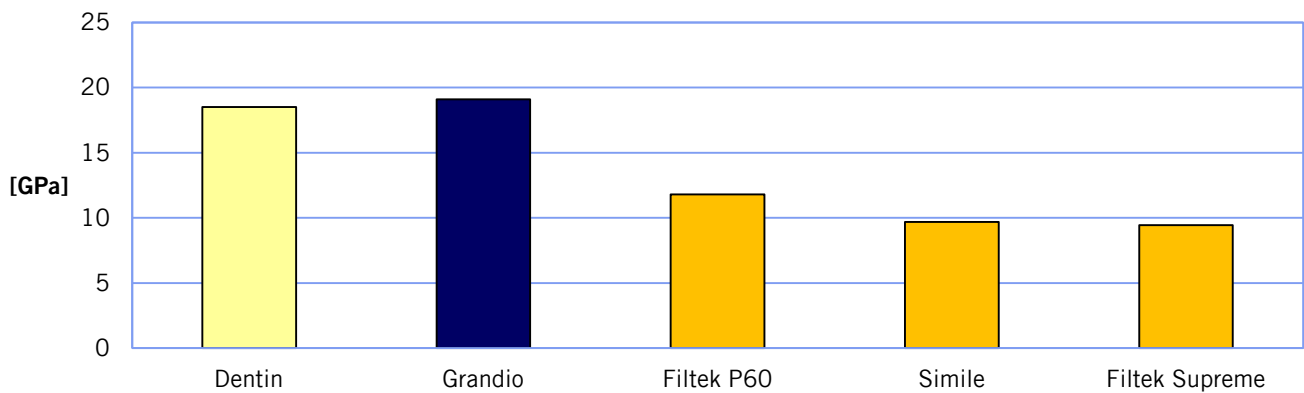
### Viscoelastic properties under wet conditions at 37 °C

Different parameters for materials were assigned for the description of the mechanical behaviour, including Shear modulus, Elasticity modulus and Poisson's ratio. These standardised tests, however, were conducted under dry conditions at room temperature shortly after curing of the composite; thus, under conditions that are not present in the mouth. The effect of these modified conditions on the different parameters was studied at the University of Athens by Papadogiannis et. al.<sup>[1]</sup> In this study, composite samples were stored in distilled water for one month and subsequently examined in wet conditions at 37 °C. The results of these tests are displayed in the following three figures:

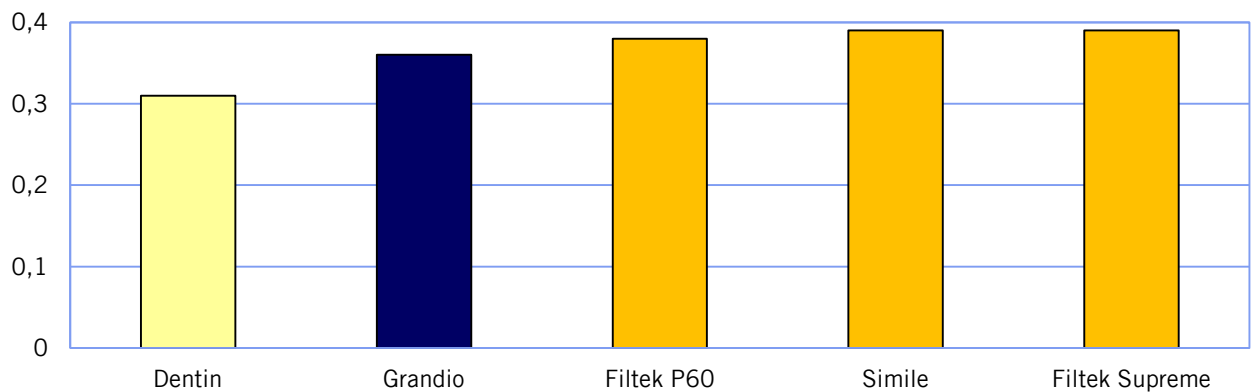


**Figure 1:** Shear modulus under wet conditions at 37 °C (after storage in distilled water for 1 month)

The absolute values of these measurements do not permit a statement regarding the suitability of the materials. The comparison with the values of dentine is crucial here; only a sufficient homogeneity of tooth and restorative ensures an ideal distribution of force during loading. The literature values are 7-10 GPa for Shear modulus, <sup>[2]</sup> 18.5 for the E modulus, <sup>[3]</sup> and 0.31 for the Poisson ratio. <sup>[4]</sup> When the literature values are compared with the assigned parameters in this study, it is apparent that Grandio provides the closest match to dentine from all the materials tested.



**Figure 2:** Modulus of elasticity under wet conditions at 37 °C (after storage in distilled water for 1 month)



**Figure 3** Poisson's ratio in wet conditions at 37 °C (after storage in distilled water for 1 month)

**Conclusion: Grandio, the nano-hybrid composite from VOCO, is the only product that closely corresponds to the physical parameters of dentine under loading within the scope of the study presented here. This is crucial during the conduction of occurring chewing load and an important criterion for the durability of the restoration.**

[1] D.Y. Papadogiannis, R.S. Lakes, Y. Papadogiannis, G. Palaghias, Dental Materials 2008, 257-266.

[2] J.H. Kinney, S.J. Marshall, G.W. Marshall, Crit. Rev. Oral Biol. Med. 2003, 14, 13-29.

[3] G. Willems, P. Lambrechts, M. Braem, G. Vanherle, Quintessence Int. 1993, 24, 641-658.

[4] J.W. Farah, R.G. Craig, K.A. Meroneh, J. Oral Rehabil. 1989, 68, 462-467.