SCIENTIFIC REPORT

GrandioSO – Creep and permanent set

VOCO GmbH, Knowledge Communication Department

Anton-Flettner-Str. 1-3
27472 Cuxhaven, Germany

Tel.: +49 (0)4721-719-1111
Fax: +49 (0)4721-719-109

info@voco.de
www.voco.com

The parameters creep and permanent set describe volume and shape changes due to (repeated) pressure loads. The extent of these dimensional changes in various restorative materials was examined by Prof. Watts et al. at the University of Manchester.[1]

The values creep and permanent set describe the deformation behaviour of materials under pressure. When a force acts on a body, that body is initially compressed. The extent of this compression is already partially described by the modulus of elasticity. After the initial fast compression, a further, slow compression takes place over the course of the following seconds or hours. This compression is accompanied by creep processes within the composite. In some areas, the spatial structure is reorganised in order to compensate for local load peaks. As soon as the overlying force is removed, a reverse process takes place. Within a very short time, expansion occurs, which already leads to a recovery of 80-90 %. Subsequently, a further, slower relaxation takes place. However, even after this relaxation period, the original volume is not reached again. This discrepancy is known as the permanent set. The value thus describes the inelastic deformation and is therefore of great importance especially for posterior restorations. If a material is no match for daily masticatory loads, deformations on the occlusal surface may occur over time. This naturally has an influence on the occlusion, which means that deformations can lead to greater problems. Minimal creep represents long-term shape stability. Pressure loading on dental materials normally does not take place over longer periods of time; loads during mastication are short-term. However, even these brief loads lead to dimensional changes; a common example of this is the formation of ruts in roads.

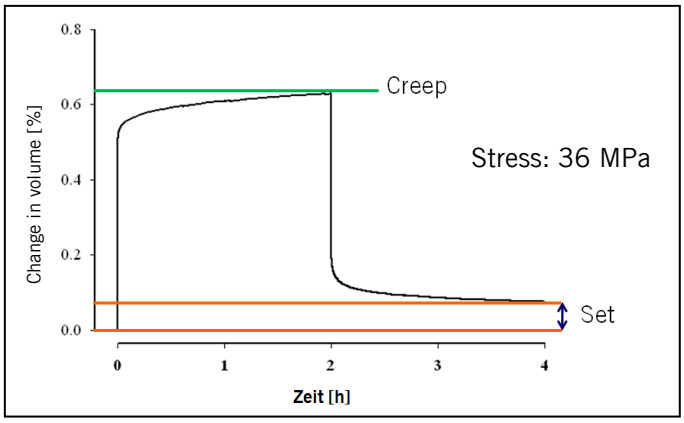

Figure 1: Measurement of creep and permanent set

Experimental set-up

Cylindrical test specimens (6 mm length, 4 mm diameter) were made and stored at 37 °C for 1 month before measurement, in a dry (group 1) or damp (group 2) environment. The cylinders were then loaded with a force of 36 MPa in a special creep-measuring device for 6 h, after which the test specimen was not loaded for 6 h. The elastic deformation before the resting phase is indicated by the creep and the permanent deformation after the resting phase is indicated by the permanent set.[1]

Results of the measurements

Figures 2 and 3 show the results of the measurements.

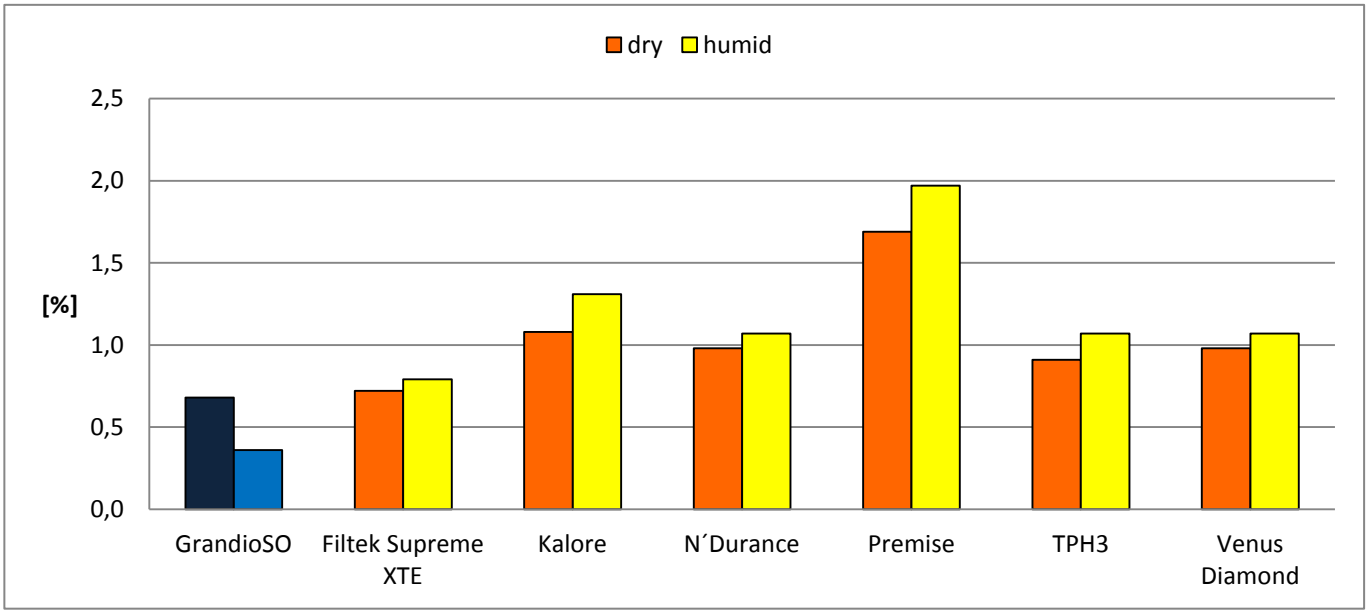

Figure 2: Creep of various restorative materials [%]

The first noticeable thing about the results is that GrandioSO is the only material in this study to show better results under the realistic conditions in the moist oral cavity than in dry storage conditions. With a volume change of below 0.5 %, GrandioSO therefore represents by far the most stable in volume of the materials.

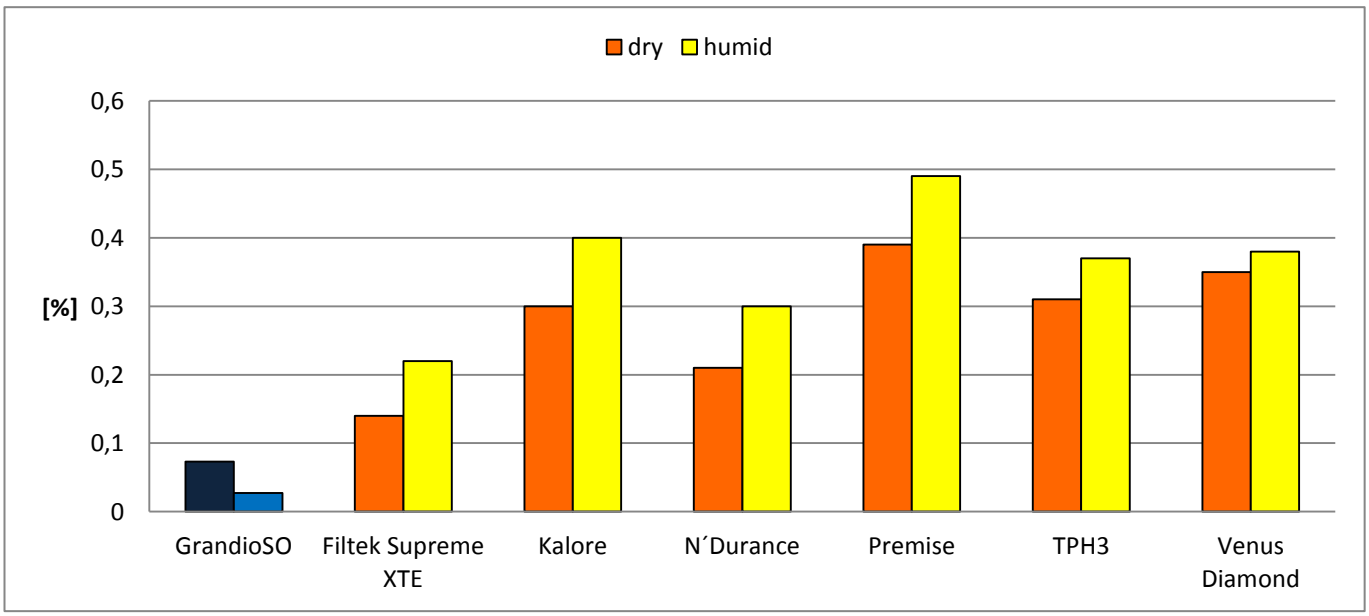

Figure 3: Permanent set of various restorative materials [%]

As previously observed in the direct volume change, GrandioSO also shows the best values in permanent surface deformation. GrandioSO retains its shape even after permanent or frequently repeated stress.

Conclusion: In comparison to other restorative materials, GrandioSO is distinguished by its extremely low creep and high shape stability. These properties are fundamental requirements for long-term intact occlusal surfaces and restoration margins.

[1] Watts et al., University of Manchester, report to VOCO **2011**, data on file.