SCIENTIFIC REPORT

Application capsules from VOCO

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.de

Mixing errors are a common occurrence with multi-component systems and have a detrimental effect on the physical properties and consequently on the clinical success of the material. For this reason, VOCO provides application accessories to facilitate application and help to avoid mixing errors. These application systems also offer a whole host of additional advantages.

A study conducted at the University of Birmingham as early as 1999 showed that mixing errors are part and parcel of daily work with hand-mixed systems.[1] 40 trained dental assistants with a minimum of 4 years of professional experience participated in the study. The task involved mixing a zinc phosphate cement three times with a specified quantity of liquid. There was a considerable difference in the mixing ratio of the components among the participants (Figure 1).

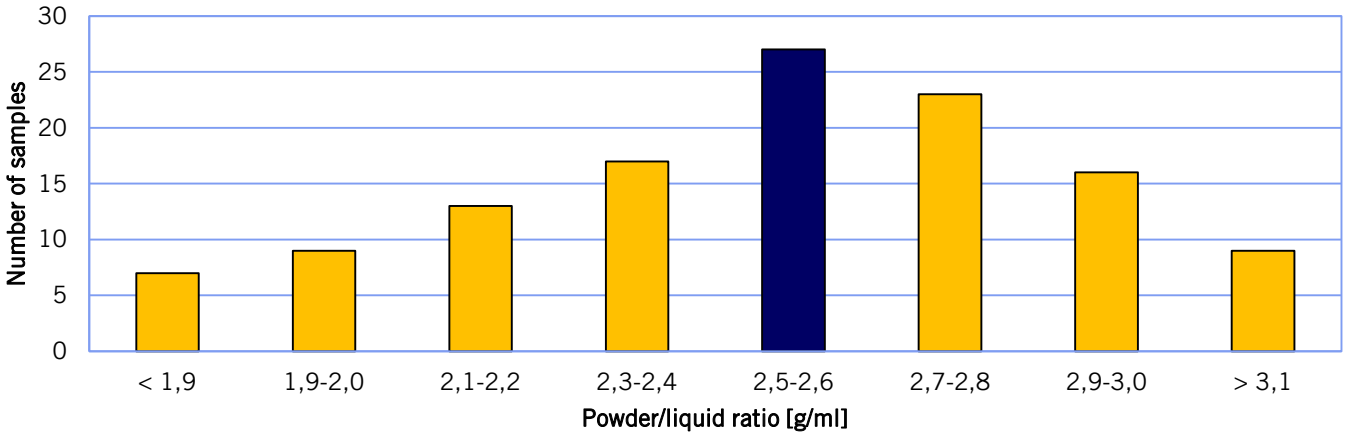

Figure 1: User-related variation in mixing ratio in hand-mixed cements

The mix ratio specified by the manufacturer for the cement employed in the study is 2.6 g/ml. It is interesting to observe the effects of a different mixing ratio on the physical properties of the material. This study investigated the compressive strength. Over 70 % of the cement samples produced did not achieve the compressive strength specified by the manufacturer of 70 MPa, with 25 % of the test specimens even displaying a value below 40 MPa. These figures are testament to the necessity of a correct mixing ratio, which can be decisive for the clinical success of a treatment.

The more common mixing error is the use of too much liquid, with the use of too high a proportion of powder occurring more rarely. Errors due to a reduced powder proportion / increased liquid proportion have a very negative effect, as the physical properties are highly correlated to the filler content of a material. In the case of glass ionomer cements, a reduction in the powder proportion is closely connected to considerably reduced compressive and flexural strengths and lower abrasion resistance. An increase in the powder proportion may result in slightly better values in terms of the stability, but viscosity becomes a problem in this case. It may no longer be possible to apply the material properly and, in addition, increased viscosity leads to the formation of thicker layers, which can prove problematic in the case of luting cements in particular.

VOCO has developed and patented application capsules to facilitate application and to prevent the problems described above. This was done by coordinating the capsules and the viscosities of the materials.

The capsules offer a host of different advantages compared with hand-mixed cements:

- The components are protected against light and moisture
- You can always be certain that the mixing ratio is correct
- Automatic mixing creates optimal homogeneity
- Direct application from the capsule facilitates the application
- Simplified handling results in fewer mixing errors and ultimately to clinical success

The individual points are illustrated in more detail below. The components are weighed into the application capsule with approx. 2 % accuracy. This minimal deviation can scarcely be called a deviation compared with the findings of the study by the University of Birmingham described before. The dry storage of the powder in the application capsule also makes it possible to avoid another potential error. The powders of glass ionomer cements are hygroscopic, which means that they take up water from the ambient air. The more often the powder comes into contact with humidity – in other words with every removal – the more water is absorbed. It is not possible for the user to influence this effect as it is not possible to readily determine the degree to which the powder absorbs water. In addition, automated mixing of the components in capsule-mixing devices such as the VOCO Mix 10 at a mixing frequency of 4,000 to 4,500 oscillations per minute ensures homogeneous distribution of the constituents and the result is thus optimal material properties. It is practically impossible to attain such homogeneity in manual mixing. Another advantage of mixing in the capsule can be found in another form of homogeneity. In manual mixing it is also possible for small bubbles of air to be incorporated, which represent sites of predilection for the formation of micro-cracks in the subsequent restoration. The probability of air bubbles in the hand-mix version is higher in highly viscous cements in particular.[2] The fill level of the application capsule is measured at just over half a gram, meaning that even large MOD fillings can be placed with just one capsule. This can mean an excess of material when filling smaller cavities, but this excess also occurs in the hand-mix versions, as more material is generally mixed than is actually needed in the majority of those cases too. In the case of the application capsule, there is no need to clean the mixing tools.

When using capsules it is merely important to ensure that they are completely activated and used promptly after mixing.

Conclusion: The application capsules from VOCO offer the dentist two key benefits: Optimal physical properties of the cement and a user-friendly application, which ultimately results in higher clinical success.

[1] G. J. P. Fleming, P. M. Marquis, A. C. C. Shortall, *Dent. Mater.* **1999**, *15*, 87-97.
[2] R. Nomoto, M. Komoriyama, J. F. Mc Cabe, S. Hirano, *Dent. Mater.* **2003**, *20*, 972-98.