

Application capsules from VOCO

VOCO GmbH, Department of Knowledge Communication

Anton-Flettner-Str. 1-3
Postfach 767
D-27472 Cuxhaven

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

info@voco.de
www.voco.de



Mixing errors frequently occur with multi-component systems. These errors can adversely affect the physical properties and thus the clinical success of the material. For this reason, VOCO endeavours to eliminate such mixing errors by providing application assistance. The advantages of application systems, however, are not limited to just the avoidance of mixing errors.

A study at the University of Birmingham showed that mixing errors in hand-mix systems are a daily occurrence.^[1] 40 dental nurses with a minimum of 4 years work experience participated in this study. The task was to mix zinc phosphate cement with a specified amount of liquid three times. The mixing ratio of the components varied considerably between the participants (Figure 1).

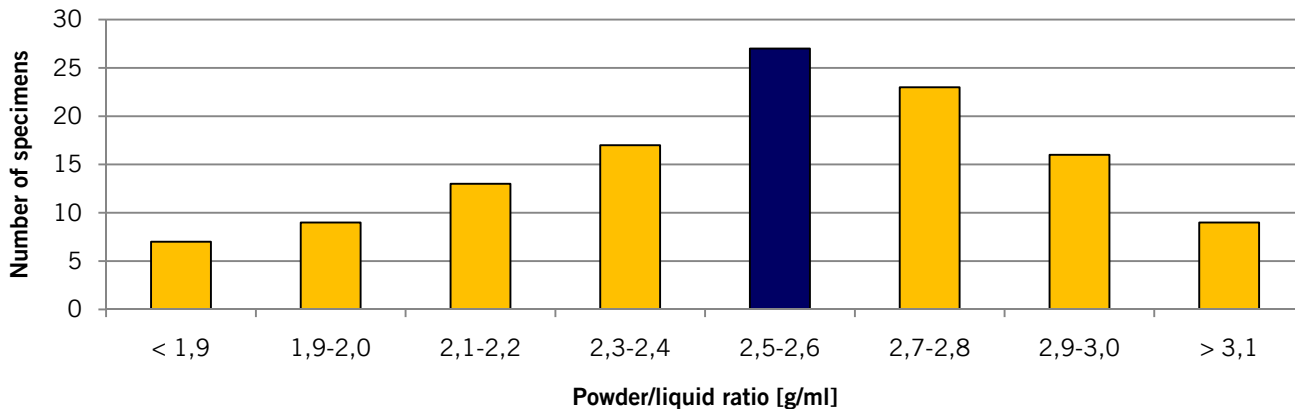


Figure 1: Mixing ratio variations in hand-mix cements caused by the user

The mixing ratio specified by the manufacturer for the cement used in this study is 2.6 g/ml. The interesting part now is the observation of the effects of deviating from the mixing ratio on the material's physical properties. The compressive strength was examined in this study. Over 70% of the fabricated cement specimens failed to reach the compressive strength of 70 MPa specified by the manufacturer, with 25% of the test specimens even having a value below 40 MPa. These numbers document the necessity of a correct mixing ratio, which can be decisive for the clinical success of a treatment.

A frequent mixing error is using too much liquid. Using a higher amount of the mineral portion than necessary rarely occurs. Errors caused by a reduction in the mineral portion have quite a negative effect, since the physical properties are strongly correlated to the filler content of a material. In the case of the cement, a decrease in the mineral portion is closely linked to a significant reduction in compressive and transverse strength as well as lowered abrasion resistance. An increased portion of the mineral does lead to slightly better stability values, but it leads to problems with viscosity in this case. On the one hand, the material can possibly no longer be processed; and on the other hand, increased viscosity leads to the formation of thicker layers,

which can be particularly problematic with luting cements. This trend was also exhibited with resin-reinforced, glass ionomer cements (RMGICs) in another study.^[2] The effects of the mixing errors were not as pronounced as in the study presented above, but only the correct mixture here likewise led to optimal values.

To facilitate the application and of course to avoid the above-described problems, VOCO developed and patented application capsules. The capsules were coordinated for the viscosity of the materials. High viscosity and medium viscosity glass ionomer cements are each available in their own application capsule.

These capsules offer several advantages in comparison to the hand-mix varieties:

- Securing the correct mixing ratio of the components
- Components are protected from light and moisture
- Mechanical mixing causes optimal homogeneity
- Mixing in the capsule reduces the risk of the incorporation of air bubbles
- Capsules enable mixing to a consistency that is suitable for direct application

These individual items are discussed in more detail below. The initial weight of the components in the application capsules proceeds with ca. 2% accuracy. This minimal deviation would not even be called a deviation, in comparison to the above-mentioned study at the University of Birmingham. A further potential mixing error can be prevented by the consistent dry storage of the mineral components in the application capsules. The mineral powders of cements are hygroscopic; that means, that they expand themselves with water from the ambient air. The more often the powder comes in contact with humidity (with each withdrawal), the more water is absorbed. This reason for a mixing error cannot be controlled by the user, since the degree of water absorption of the mineral cannot be easily regulated. The mechanical mixing of the components in the capsule mixing machine, such as the VOCO Mix 10 with a mixing frequency of 4000-4500 oscillations per minute, provides homogeneous distribution of the ingredients and leads to optimal material properties. Such homogeneity can seldomly be achieved with manual mixing. An additional advantage of mixing inside the capsule lies in another form of homogeneity. Small air bubbles can occasionally be incorporated into the material during manual mixing. These can represent preferred areas for the development of micro-fractures in the subsequent restoration. Particularly with high viscosity cements, the probability of air bubbles in hand-mix versions is higher.^[3] With almost a half gram, the contents of the application capsule have been measured so that even large MOD restorations can be completed with only one capsule. Although this means that there is a surplus of material remaining after filling smaller cavities, this excess likewise occurs when hand-mix versions are used, since more material is also usually mixed than actually needed. Mixing utensils do not have to be cleaned when application capsules are used.

A special advantage of VOCO glass ionomer cements applied from a capsule lies in the viscosity of the materials in the setting process. Figure 2 illustrates the viscosity of the cements depending on the time. VOCO cements have a packable consistency immediately after the capsule has been mixed, which allows it to be directly applied and modelled. Due to its somewhat slower setting, the practitioner has more working time available (represented by the coloured bars on the time axis) and thus a sufficient amount of time to model and contour the restoration.

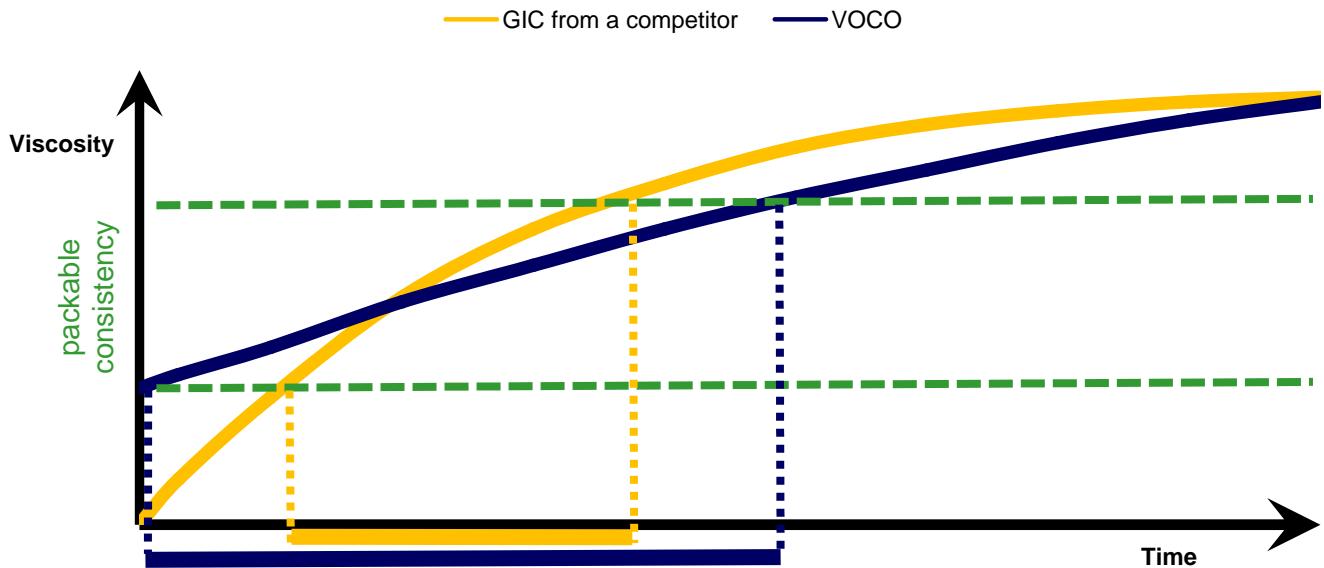


Figure 2: Viscosity of GICs during setting

Conclusion: The application capsules made by VOCO offer the dentist two considerable advantages: optimal physical properties of the cement as well as user-friendly application. This makes the capsule application superior to all other hand-mix systems.

- [1] G. J. P. Fleming, P. M. Marquis, A. C. C. Shortall, *Dent. Mater.* **1999**, *15*, 87-97.
- [2] M. Behr, M. Rosentritt, H. Loher, G. Handel, *Acta Odontol. Scand.* **2006**, *64*, 214-220.
- [3] R. Nomoto, M. Komoriyama, J. F. Mc Cabe, S. Hirano, *Dent. Mater.* **2004**, *20*, 972-978.