

Ivoclean



Scientific Documentation



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1. Adhesive cementation of restorations

Adhesive cementation has been clinically proven to be a suitable procedure for the permanent seating of indirect restorations. The use of an adhesive luting composite is inevitable in conjunction with conservative preparation methods and in the esthetic restoration of teeth, where demands are more exacting. With Mulilink Automix and Variolink II, Ivoclar Vivadent AG is offering two time-tested luting composites which can be used in these cases. Additionally, the Ivoclar Vivadent range of cementation materials includes Variolink Veneer, a purely light-curing composite. This material is particularly indicated for the cementation of very translucent restorations, e.g. veneers, which are easy to access with the curing light. Moreover, SpeedCEM, a self-adhesive resin cement, is available which can be used for the cementation of restorations made of high-strength restorative materials in conjunction with retentive preparation.

Adhesive cementation procedures are preferably used for the incorporation of highly esthetic all-ceramic and composite resin restorations.

However, this type of cementation procedure is more complex than conventional procedures and requires operators to follow a strict protocol. After the temporary restoration has been removed, the cavity or the prepared tooth needs to be cleaned. Subsequently, the restoration can be tried in e.g. using a try-in paste. After try-in, the bonding surfaces of the restorations require cleaning again prior to pre-treating or conditioning them with suitable agents as indicated in the instruction for use of the respective material.



Fig 1: Try-in of an all-ceramic bridge

Glass-ceramics, for example, are etched with hydrofluoric acid gel to create an etching pattern and thus achieve a retentive surface. The next step involves the application of a suitable silane (e.g. Monobond Plus). The surfaces of restorations made of zirconium oxide and other oxide ceramics should be cautiously blasted with corundum particles (e.g. IPS e.max ZirCAD at 1 bar pressure). In this way the restoration is cleaned and micro-retentions are created on the surface. Then a primer, e.g. Monobond Plus, is applied. The phosphoric acid-containing reactive ingredient is capable of producing a strong bond to metal.

The next step involves the incorporation of the restoration according to the instructions for use of the luting composite - a procedure that is usually pretty straightforward. Very frequently, however, the restorations are pre-treated in the laboratory. Not all dental practices have the equipment required to carry out etching and sandblasting procedures. In such cases, the pre-treated restorations are tried in in the mouth of the patient, which leaves them contaminated with try-in paste, blood and saliva. Normally water or phosphoric acid gel is used to remove any contamination and clean the restoration.

2. Cleaning of restorations after intra-oral try-in

The effect of different cleaning procedures on the resin bond strength to lithium disilicate glass-ceramics has been investigated [1]. The study revealed that surfaces contaminated with saliva are best cleaned with either 37% phosphoric acid (e.g. Total Etch gel) or 5% hydrofluoric acid. The most effective way of cleaning surfaces contaminated with silicone, which may occur when e.g. checking the accuracy of fit of restorations, is by means of hydrofluoric acid.

The influence of saliva contamination on bonding to zirconium oxide restorations has been investigated by Kern et al [2]. Densely sintered yttrium-stabilized zirconium oxide discs were polished and then blasted with 50 μm Al_2O_3 at 2.5 bar for 15 s. The specimens were immersed in saliva for 1 minute and subsequently cleaned using different methods:

- rinsing under tap water for 15 s and then blow-drying;
- immersing in 70% isopropanol for 2 minutes and then rinsing with water;
- etching twice with phosphoric acid gel for 30 s;
- blasting with 50 μm Al_2O_3 at 2.5 bar for 15 s.

The test set-up involved the cementation of a composite onto the differently treated surfaces using Panavia F 2.0 (Kuraray). Before testing their tensile bond strength, the specimens were either stored for 3 days at a temperature of 37 °C or stored for 150 days and subjected to 37,500 cycles of thermocycling at 5 °C / 55 °C. The most significant difference was noted after 150 days of thermocycling (see Fig. 1).

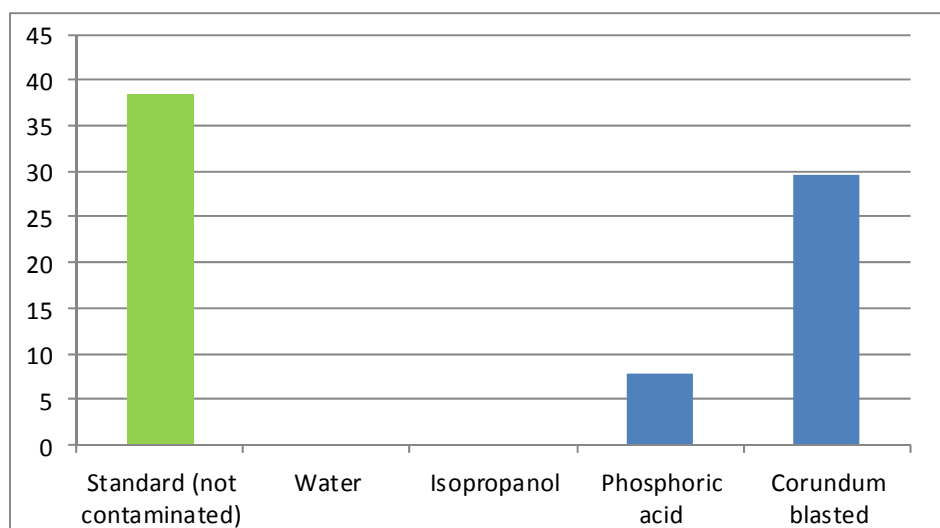


Fig. 2: Tensile bond strength values of saliva-contaminated zirconium oxide specimens cleaned with different methods, after immersion in water for 150 days and thermocycling (Kern et al., Kiel 2008, [2])

Blasting the restoration with corundum particles was shown to be the only cleaning method that allowed reliable adhesion to be achieved after saliva contamination.

4. Ivoclean

So what is the mode of action of Ivoclean?

Chemical reactions are equilibrium reactions. This means that the direction in which they occur is dependent on various parameters. These include the concentration of the reaction partner, for example. If there is a large amount of one reactant, the formation of a bond to this reactant is much more probable than to any other reactant that is less frequent. This chemical peculiarity has been utilized in Ivoclean. Ivoclean consists of an alkaline suspension of zirconium oxide particles. Due to the size and concentration of the particles in the medium, phosphate contaminants are much more likely to bond to them than to the surface of the ceramic restoration. Ivoclean absorbs the phosphate contaminants like a sponge and thus leaves behind a clean zirconium oxide surface. After having rinsed the restoration with water, it has to be conditioned again with the primer (e.g. Monobond Plus). Subsequently, the restoration can be adhesively cemented according to the instructions for use.

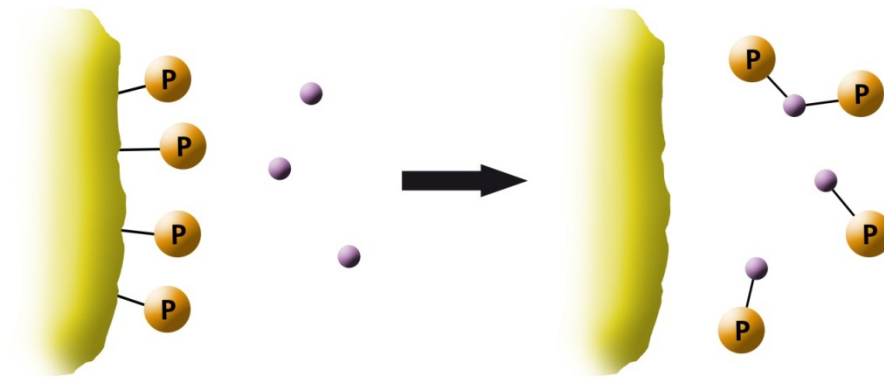


Fig. 4: Schematic representation of the cleaning action of Ivoclean on zirconium oxide surfaces

5. Technical data

Ivoclean

Extra-oral cleaning paste for indirect restorations

Standard composition (in wt%)

Zirconium oxide	10 - 15
Water	65 - 80
Polyethylene glycol	8 - 10
Sodium hydroxide	≤ 1
Pigments, additives	4 - 5

Physical properties

pH	13 - 13.5	
Dry mass at 120 °C	17 - 19	wt%

6. Cleaning effect of Ivoclean on zirconium oxide

To evaluate the cleaning effect on zirconium oxide, IPS e.max ZirCAD discs were prepared for tensile strength testing. A detailed description of the test can be found in reference [4]. The discs were immersed in fresh human saliva for 60 s. Then they were cleaned with either water, phosphoric acid gel (Total Etch) or Ivoclean as well as dried and then conditioned again with Monobond Plus. Subsequently, a MultiCore Flow cylinder was cemented onto the ceramic specimen using Multilink Automix (see schematic representation in Fig. 5). The Multilink Automix layer was light-cured for 10 s with a bluephase LED curing light using the HIGH mode. Prior to the tensile test, the specimens were stored in Water at 37°C for 24 hours.

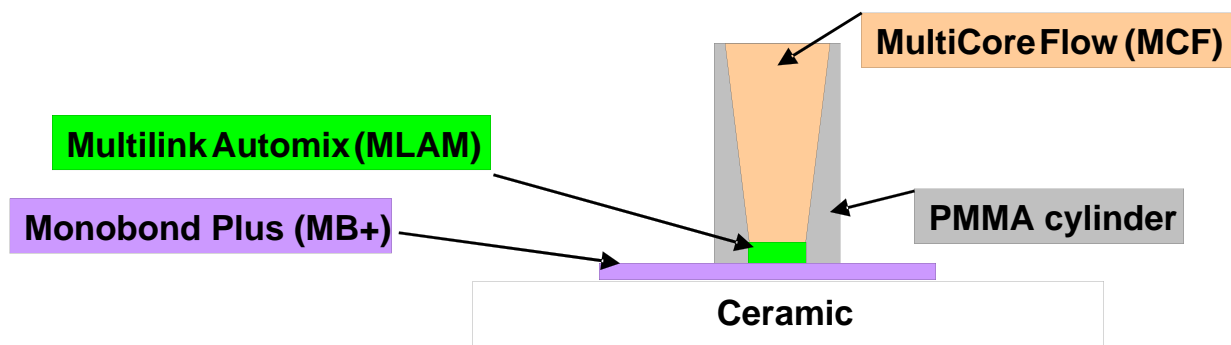


Fig. 5: Schematic representation of the tensile strength test set-up

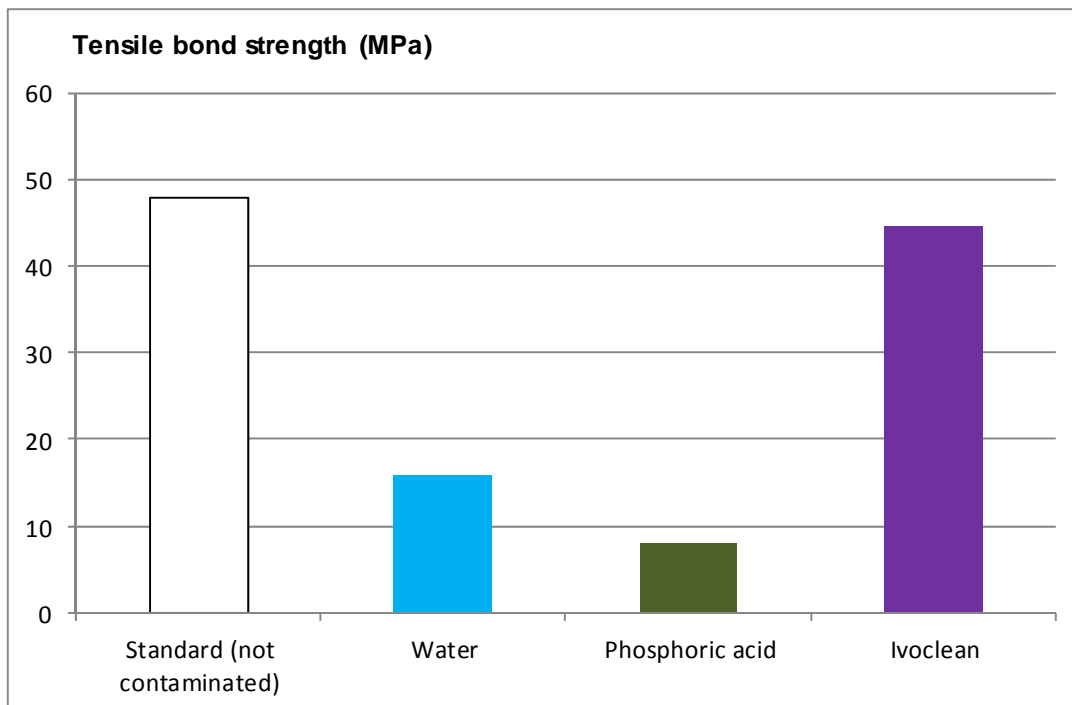


Fig. 6: Tensile bond strength on zirconium oxide after contamination with saliva and cleaning with different cleaning procedures

The results of the tensile bond strength test clearly show that cleaning with water alone is not very effective and cleaning with phosphoric acid even produces a further reduction in the adhesive strength. Please refer to the chemical explanation provided in Section 4. After cleaning with Ivoclean, the same adhesive strength values were achieved as prior to the contamination with saliva.

7. Cleaning effect of Ivoclean on lithium disilicate

The cleaning effect of Ivoclean on lithium disilicate glass-ceramic was investigated using the same test set-up as that described in Section 6. The test specimens made of IPS e.max CAD were immersed in human saliva. Subsequently, they were cleaned with water, phosphoric acid gel or Ivoclean.

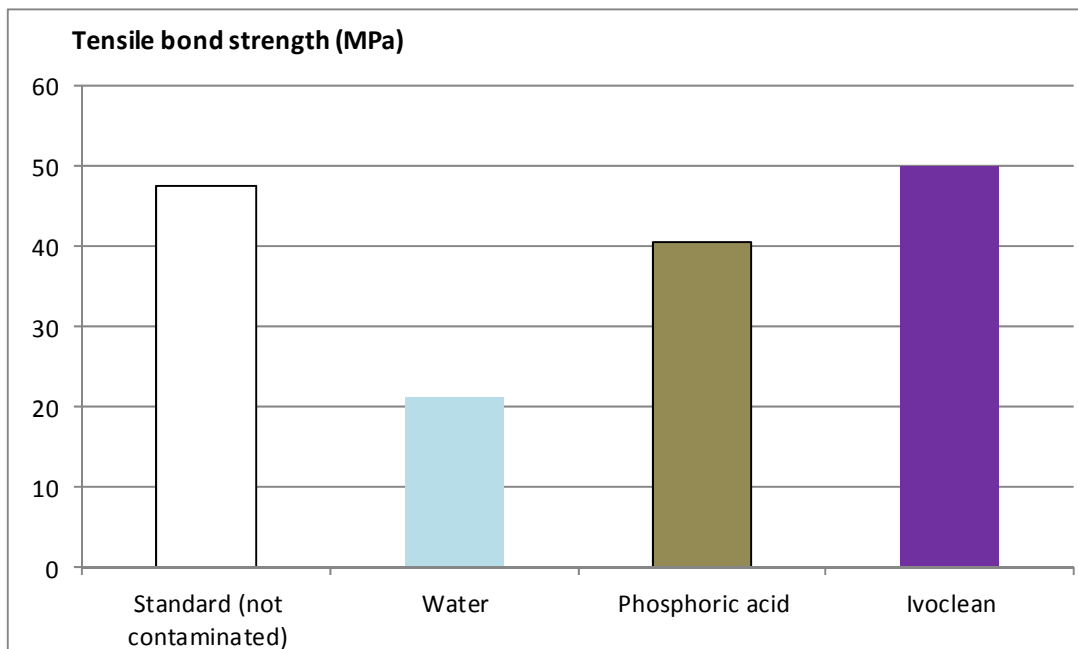


Fig. 7: Tensile bond strength on lithium disilicate glass-ceramic after contamination with saliva and cleaning with different cleaning procedures

This test proves that lithium disilicate glass-ceramic restorations can also be effectively cleaned with Ivoclean after intraoral try-in and the same adhesive strength values as prior to the contamination are achieved.

8. Safety notes

Ivoclean is a suspension of zirconium oxide particles in water. The product is strongly alkaline and thus corrosive. Due to safety reasons, Ivoclean must not be applied intra-orally. Users should wear gloves and eye protection. In case of contact with the skin or eyes, immediately rinse with copious amounts of water. Consult an ophthalmologist if eye irritation persists.

9. Literature

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Ivoclar Vivadent AG
Research and Development
Scientific Services
Bendererstrasse 2
FL-9494 Schaan
Liechtenstein

Contents: Dr Thomas Völkel
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