Ultimate bond strength for highest aesthetics
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RelyX™ Ultimate Clicker™ Adhesive Resin Cement

RelyX™ Ultimate Clicker™ Cement is an innovative dual cure, adhesive resin cement from 3M ESPE. The cement was developed with the specific needs of highly aesthetic – especially glass ceramic – cementation in mind. RelyX Ultimate cement ensures uncompromising results and guarantees ultimate bond strength and high, long-lasting aesthetics because of high marginal integrity, tooth-like fluorescence and colour stability.

The cement was designed for optimal performance when combined with Single Bond Universal Adhesive from 3M™ ESPE™. RelyX Ultimate cement has an integrated dual-cure activator for Single Bond Universal adhesive which eliminates the need for a separate activator and the corresponding additional steps.

Single Bond Universal adhesive is a one-component dental adhesive, designed to cover all techniques and all indications. It can be used in a self-etch mode, selective-enamel-etch mode or in a total-etch (or “etch and rinse”) mode for both direct and indirect dental restorative procedures. In addition to serving as the adhesive on tooth substance Single Bond Universal adhesive also functions as a metal and zirconia primer as well as a silane.

Benefits of RelyX™ Ultimate Clicker™:

- Dual-cure cement with ultimate bond strength
- Ease of use: only two components, lower number of procedural steps
- Outstanding aesthetics: high marginal integrity, wear resistance and natural fluorescence
- Suitable for total-etch or self-etch procedures
- Less waste and controlled dosage of material due to Clicker™ delivery

RelyX Ultimate cement is delivered in the Clicker™ Dispenser containing 4.5 g base paste/catalyst paste, which is sufficient for approximately 16 applications. For colour coordination there are four different shades: Translucent, B 0.5 (Bleach), A1 and A3 Opaque. Corresponding RelyX™ Try-in Pastes are available as well. Shelf life in aluminium pouch is 18 months. Neither the cement nor the adhesive require refrigeration.

RelyX Ultimate cement covers the whole spectrum of indirect indications with the final cementation of:

- All-ceramic, composite or metal inlays, onlays, crowns and bridges;
- 2–3-unit Maryland bridges and 3-unit inlay/onlay bridges*
- All-ceramic or composite veneers
- All-ceramic, composite, or metal restorations to implant abutments
- Posts and screws
- … and is especially designed for highly aesthetic glass ceramic restorations

* Excluded for patients with bruxism or periodontitis.
Composition

2.1 Cement

RelyX™ Ultimate Adhesive Resin Cement is formulated to meet the highest demands for glass ceramic cementation as well as to allow easy handling. The qualitative composition is shown in the following table. While RelyX Ultimate cement was designed for optimal performance when combined with Single Bond Universal Adhesive, it is also compatible with other 3M ESPE adhesives, e.g. Adper™ Scotchbond™ Multi-Purpose or Adper™ Single Bond.

<table>
<thead>
<tr>
<th>Base Paste</th>
<th>Catalyst Paste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methacrylate monomers</td>
<td>Methacrylate monomers</td>
</tr>
<tr>
<td>Radiopaque, silanated fillers</td>
<td>Radiopaque alkaline (basic) fillers</td>
</tr>
<tr>
<td>Initiator components</td>
<td>Initiator components</td>
</tr>
<tr>
<td>Stabilizers</td>
<td>Stabilizers</td>
</tr>
<tr>
<td>Rheological additives</td>
<td>Rheological additives</td>
</tr>
<tr>
<td>Stabilizers</td>
<td>Fluorescence dye</td>
</tr>
<tr>
<td>Rheological additives</td>
<td>Dual-cure activator for</td>
</tr>
<tr>
<td></td>
<td>Single Bond Universal Adhesive</td>
</tr>
</tbody>
</table>

RelyX Ultimate cement offers all properties specially needed for cementing veneers: high mechanical strength, radiopacity, high wear resistance, high adhesive strength and low film thickness. For dentists that prefer a light cure only material, 3M ESPE recommends RelyX™ Veneer.

In addition, RelyX™ Try-in Pastes are available in the shades of RelyX Ultimate cement. These pastes are used during shade selection for the final cementation. RelyX try-in pastes contain polyethylene glycol (PEG), zirconia and silica fillers and pigments. All try-in pastes are water-soluble and can be cleaned up easily both from tooth and restoration.

2.2 Adhesive

The Single Bond Universal chemistry utilizes phosphorylated monomers in a water/ethanol based solution that provides acidity and allows the adhesive to bond to dentine and enamel without the use of a separate phosphoric acid etching step. With its pH of 2.7 it can be considered as a mild self-etch adhesive.

Single Bond Universal adhesive uses three trusted and well known adhesion promoters in one formulation (VMS technology) and thus also bonds to restoration substrates.

- **Vitrebond™** Copolymer provides consistent bond performance to dentine under varying moisture levels.
- **MDP** provides self-etching properties and bonds to zirconia, alumina, metals and metal alloys.
- **Silane** to chemically bond to glass ceramic surfaces without using a separate ceramic primer.

In combination with RelyX Ultimate cement the integrated activator in the cement cures the Single Bond Universal adhesive. This eliminates the need for light curing or additional activator liquids. However, light curing the adhesive remains optional. This dual-cure mechanism allows reliable cementation of:

- Posts
- Opaque zirconia restorations
- Full metal casts
- Porcelain-fused-to-metal restorations
2.3 Summary of physical and mechanical properties

The physical and mechanical properties of RelyX™ Ultimate Adhesive Resin Cement were adjusted based on 3M ESPE’s long standing experience with dental cements.

<table>
<thead>
<tr>
<th>Properties</th>
<th>RelyX™ Ultimate (Ic) Adhesive Resin Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexural strength [MPa]</td>
<td>98</td>
</tr>
<tr>
<td>Compressive strength [MPa]</td>
<td>262</td>
</tr>
<tr>
<td>Modulus of elasticity [GPa]</td>
<td>7.7</td>
</tr>
<tr>
<td>Surface hardness (HV 0.2)</td>
<td>40</td>
</tr>
<tr>
<td>Film thickness [µm]</td>
<td>12</td>
</tr>
<tr>
<td>Water sorption [µg/mm³]</td>
<td>21</td>
</tr>
<tr>
<td>Solubility [µg/mm³]</td>
<td>0</td>
</tr>
<tr>
<td>Expansion after 1 month [%]</td>
<td>0.5</td>
</tr>
</tbody>
</table>
In vitro results

3.1 Bonding performance

3M™ ESPE™ offers its new adhesive resin cement in different deliveries to suit different market requirements. RelyX™ Ultimate and RelyX Ultimate Clicker™ Cement employ the same formulation. The equivalent in-vitro performance has been proven. (Sources: 3M ESPE internal data; R. Perry Tufts University, MA, USA)

3.1.1 Bond to enamel and dentine

Internal and third party adhesion test data show excellent results to dentine and enamel — both in the self-etch (Fig. 1) and total-etch (Fig. 2) mode. This is especially true for dentine, when the smear layer is still present and the adhesive is used in the self-etch mode. All tests were performed both 24 hours after bonding as well as after additional artificial aging for 5,000 thermocycles between 5 and 55 °C.

In independent research, RelyX Ultimate cement shows the highest bond strength to enamel (Fig. 3) as well as highest retention strength for Lava™ Zirconia Crowns (Fig. 4) compared to other resin cements that use a self-etching primer system.

Tufts University investigated shear bond strength to enamel 24 h after cementation. The group of Dr. John Burgess cemented Lava zirconia crowns to teeth with non-retentive preparations and compared the pull-off forces of various resin cements after artificial aging with mechanical loading (100,000 × 20 N) and thermocycling (10,000 × 5 – 55° C).

![Shear bond strength of self-etch systems](image1.png)

**Fig. 1:** Shear bond strength to dentine and enamel after artificial aging (5,000 thermocycles). RelyX™ Ultimate Adhesive Resin Cement was used with Single Bond Universal Adhesive, the other cements with their respective adhesives. Source: 3M ESPE internal data

![Shear bond strength of total-etch / selective-etch systems](image2.png)

**Fig. 2:** Shear bond strength to dentine and enamel after artificial aging (5,000 thermocycles). RelyX™ Ultimate Adhesive Resin Cement was used with Single Bond Universal Adhesive, the other cements with their respective adhesives. Source: 3M ESPE internal data

![Shear bond strength to enamel](image3.png)

**Fig. 3:** Shear bond strength to enamel after 24 h storage, cement was light cured. Source: C. Decoteau, M. Ogledzki, G. Kugel, and R.D. Perry; Tufts University, Boston, USA, IADR/AADR 2011, #375

![Lava™ Zirconia Crown pull-off strength of resin cements after artificial aging](image4.png)

**Fig. 4:** RelyX™ Ultimate Cement was used with Single Bond Universal Adhesive (no extra light curing), the other materials with their respective primers. Zirconia was sandblasted (< 50µm) before priming, all cements light cured. Source: G. Cai, D. Cakir, P. Beck, L. Ramp, and J. Burgess, University of Alabama Birmingham, Al., USA, AADR 2012 #1010
Research at the University of Trieste, Italy, also confirmed excellent adhesion for RelyX™ Ultimate Cement when compared to traditional adhesive resin systems that use etching, priming and bonding. The researchers used RelyX Ultimate cement without a tooth etching step, Single Bond Universal Adhesive was just applied to the dentine. Due to its versatility, both tested restoration materials, feldspathic glass ceramic and Resin Nano Ceramics (RNC, like Lava™ Ultimate), were pretreated with Single Bond Universal adhesive as silane, the feldspathic ceramic after HF etching and the RNC after just sandblasting.

**Microtensile bond strength to dentine and restoration materials**

<table>
<thead>
<tr>
<th>Restoration material</th>
<th>Cement</th>
<th>Pre-treatment tooth</th>
<th>Pre-treatment restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RelyX™ Ultimate Cement</td>
<td>Single Bond Universal Adhesive</td>
<td>Single Bond Universal Adhesive</td>
</tr>
<tr>
<td></td>
<td>Variolink® II</td>
<td>Phosphoric acid etching, Heliobond and Syntac</td>
<td>Monobond Plus</td>
</tr>
<tr>
<td></td>
<td>RelyX™ Ultimate Cement</td>
<td>Single Bond Universal Adhesive</td>
<td>Single Bond Universal Adhesive</td>
</tr>
<tr>
<td></td>
<td>Variolink® II</td>
<td>Phosphoric acid etching, Heliobond and Syntac</td>
<td>Monobond Plus</td>
</tr>
</tbody>
</table>

**Shear bond strength of RelyX™ Ultimate Cement to etchable ceramics – before and after artificial aging**

**3.1.2 Bond to restoration**

High bond strength and aesthetics predestine RelyX Ultimate cement for the cementation of Resin Nano Ceramic and glass ceramic restorations. The bond strength data to different types of glass ceramics shown in Fig. 6 and Fig. 7 underlines the performance of RelyX Ultimate cement. To simplify the cementation procedure, Single Bond Universal adhesive was used as silane replacement for all types of etchable ceramics tested.

**Fig. 6:** Vita Mark II and e.max CAD were etched with HF according to manufacturers’ instructions before silanization with Single Bond Universal Adhesive, all cements light cured. Artificial aging: 5,000 thermocycles (5 – 55 °C). Source: M. Rosentritt, University of Regensburg, Germany

**Fig. 7:** All-ceramic materials were etched with HF according to manufacturers’ instructions before silanization with Single Bond Universal Adhesive, all cements light cured. Artificial aging: 5,000 thermocycles (5 – 55 °C). Source: 3M ESPE internal data
The University of Regensburg showed extremely high bond strength to oxide ceramic restoration material for RelyX™ Ultimate Cement, both before and after artificial aging (Fig. 8). Figure 9 shows the bonding performance of different cements in the self and light-cure mode. For testing, all zirconia materials were sandblasted and then pretreated with Single Bond Universal Adhesive or as recommended by the respective manufacturer.

![Graph](image1)

**Fig. 8:** RelyX™ Ultimate Cement was used with Single Bond Universal Adhesive (left uncured). Cercon Zirconia was sandblasted (50 µm, 2.5 bar) before priming, cement light cured. Artificial aging: 5,000 thermocycles (5–55 °C). Source: M. Rosentritt, University of Regensburg, Germany

![Graph](image2)

**Fig. 9:** RelyX™ Ultimate Cement was used with Single Bond Universal Adhesive as primer (left uncured), the other materials were used with their respective primers if indicated by manufacturer. Cements were light cured or dark cured. Lava® Zirconia was sandblasted (50 µm, 2.5 bar) before priming. Source: 3M ESPE internal data

* Dark-cure procedure is not clearly described in the manufacturer’s instructions for use for Variolink II.

**Manufacturer does not specify zirconia pretreatment.**

Figure 11 shows the shear bond strength of different cements to titanium and nonprecious alloy. All cements were tested in the dark-cure mode. The high bond strength of RelyX Ultimate cement was also confirmed by the University of Regensburg (Fig. 10).
3.2 Optimised properties for high and long-lasting aesthetics

A clinically successful cement must offer top performance in more than just bond strength; longevity, aesthetics and marginal integrity are also key.

3.2.1 Marginal integrity

Behr et al. (University of Regensburg, Germany) investigated the marginal integrity of Empress 2 MOD inlay restorations luted with RelyX™ Ultimate Adhesive Resin Cement. The reference group was Multilink Automix. After chewing simulation and thermocycling the marginal integrity was investigated by dye penetration and topological SEM analysis. The control group Multilink Automix showed statistically higher dye penetration than RelyX Ultimate cement independently of the luting protocol. RelyX Ultimate cement works excellent under all luting conditions – in the self-etch and total-etch mode, both when light-cured and when dark-cured. According to the SEM examination, perfect margins in dentine as well as in enamel were in the range of 95% to 100%.

3.2.2 Shades and fluorescence

RelyX Ultimate cement takes advantage of a modern initiator technology, which is free of aromatic amine initiator components that lead to discolouration. It enables dual-curing, while at the same time guaranteeing long term colour stability of the cement. As a result of its colour stability, the cement is suited for use with highly aesthetic restorations such as ceramic or composite crowns, inlays, and veneers. RelyX Ultimate cement is available in 4 shades. For brilliant natural colour imitation, a fluorescence dye is added to the cement.

### Available shades of RelyX™ Ultimate Cement

<table>
<thead>
<tr>
<th>TR</th>
<th>B 0.5</th>
<th>A1</th>
<th>A30</th>
</tr>
</thead>
</table>

Photos of RelyX™ Ultimate samples (1.5 mm thickness). Source: 3M ESPE internal data

### Fluorescence of cements in comparison

<table>
<thead>
<tr>
<th>10 % UV</th>
<th>90 % UV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human tooth</td>
<td></td>
</tr>
<tr>
<td>RelyX™ Ultimate Cement</td>
<td></td>
</tr>
<tr>
<td>Panavia™ F 2.0</td>
<td></td>
</tr>
<tr>
<td>NX3</td>
<td></td>
</tr>
<tr>
<td>Clearfil™ Esthetic Cement</td>
<td></td>
</tr>
</tbody>
</table>

Fluorescence of RelyX™ Ultimate Clicker™ Cement. Source: Courtesy of Dr. Paolo Montero

Source: 3M ESPE internal data
3.2.3 Colour stability

To maintain high aesthetics, the resin cement must be resistant against staining. Food and beverages can be a major source of staining. Compared to other leading products, RelyX™ Ultimate Cement shows the lowest discolouration after incubation in coffee solution. The pictures show cement samples after storage in standardised coffee solution for 3 days at 36 °C.

3.2.4 Wear resistance

An aesthetic restoration requires marginal integrity. RelyX Ultimate cement is optimised for a high wear resistance. This will help maintain a good marginal sealing over the life time of the restoration and prevents marginal discolouration due to marginal grooves and gaps.

When compared to other resin cements and flowable filling composites, RelyX Ultimate cement shows very low three-body wear. It only abrades 0.5 times more than the reference hybrid filling composite Filtek™ Z250 (3M ESPE) and less than the other adhesive resin cements tested.

![ACTA three-body wear test. Material abrasion calculated relative to Filtek™ Z250 (3M ESPE).](source: C. Kleverlaan, ACTA University, Netherlands)
4 Simple procedure

RelyX™ Ultimate Clicker™ Adhesive Resin Cement adapts to your needs. It is applicable for total-etch, selective-enamel-etch and self-etch procedure. Single Bond Universal Adhesive can be left uncured, as the dual-cure activator is integrated in the cement. Light-curing is optional. Additionally, Single Bond Universal adhesive functions as a pretreatment agent for all kinds of restoration surfaces.

4.1 Single Bond Universal Adhesive – adhesive and restoration primer

Single Bond Universal adhesive functions not only as a self-etch or total-etch adhesive, but also as a primer for metal and zirconia restorations as well as a silane for glass ceramics. This eliminates one of the major drawbacks of older adhesive cement systems which is the need for a high number of accessory primers and activators. The required functionality has simply been integrated into either the cement or the adhesive. With its special initiator system, the cement initiates curing in the adhesive layer, so no separate dual-cure activator is needed.

The chemistry of Single Bond Universal adhesive including Vitrebond™ Copolymer, MDP, HEMA and water allows using the adhesive both with additional phosphoric acid etching in a total-etch approach but also as self-etch adhesive, depending on the clinical situation and personal preference. It will deliver consistent performance even to etched dentine whether it is kept moist as recommended or dry. This is a major advantage compared to typical 5th generation or 2-step etch-and-rinse systems that require the dentine surface to be moist or otherwise result in reduced bond strength and potential sensitivity if the dentine surface is dried prior to the application of the adhesive.

The same Single Bond Universal adhesive can be used as a universal restoration primer, containing MDP for adhesion to oxide ceramics and metals and silane to chemically and bond to Lava™ Ultimate glass ceramic surfaces, simplifying procedure and inventory.
4.2 Procedure versatility – self-etch, selective-enamel-etch or total-etch

Self-etching simplifies the technique and provides protection to the dentine surface to reduce the potential for post-operative sensitivity. Total-etching on the other hand usually provides higher bond strength to cut and especially uncut enamel but is traditionally more technique sensitive on dentine.

When combining a selective-enamel-etching step with a self-etch adhesive, the clinician can maximise the enamel bond strength and takes advantage of the low post-operative sensitivity feature that the self-etch adhesive provides and still achieves a strong bond to dentine.

<table>
<thead>
<tr>
<th>3M™ ESPE™ recommends self-etch procedure when:</th>
<th>3M™ ESPE™ recommends selective or total-etch when:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk of tooth sensitivity or proximity to pulp exists</td>
<td>Situation calls for bonding to enamel (rather than to dentine)</td>
</tr>
<tr>
<td>Situation calls for bonding to dentine (rather than to enamel)</td>
<td>Preparation is non-retentive</td>
</tr>
<tr>
<td>Risk of moisture contamination exists</td>
<td>No risk of post-op sensitivity exists (e.g. non-vital tooth)</td>
</tr>
<tr>
<td>Cementation needs to happen quickly</td>
<td>Situation is easy to keep dry</td>
</tr>
</tbody>
</table>

self-etch

total-etch
### 4.3 Restoration pre-treatment

**Single Bond Universal Adhesive as universal restoration primer – this greatly simplifies your daily routine:**

<table>
<thead>
<tr>
<th>Restoration material</th>
<th>Pre-treatment recommendation for clean surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass ceramic</td>
<td></td>
</tr>
</tbody>
</table>
| etchable feldspathic, leucite reinforced and lithium disilicate | **Step 1:** Etching with hydrofluoric (HF) acid  
**Step 2:** Single Bond Universal Adhesive |
| Resin Nano Ceramic                    |                                               |
| Zirconia and Alumina                  |                                               |
| (oxide ceramics, non-etchable, high strength) | **Step 1:** Sandblasting (&lt; 50 μm)  
**Step 2:** Single Bond Universal Adhesive |
| Composite, Metal, PFM                 |                                               |
| Fiber reinforced composite post       | Single Bond Universal Adhesive               |

### 4.4 Indications

RelyX™ Ultimate Cement covers the whole spectrum of indirect indications. Ideally suited for glass ceramics and Resin Nano Ceramics, RelyX Ultimate cement perfectly completes the 3M ESPE cement portfolio.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal / Metal based</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlays / Onlays</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>Crowns / Bridges</td>
<td>–</td>
<td>+</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Endodontic Posts</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>–</td>
</tr>
<tr>
<td>Maryland Bridges</td>
<td>++</td>
<td>+</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Glass Ceramics (incl. Li. Disilicate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlays / Onlays</td>
<td>++</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Crowns / Bridges</td>
<td>++</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Veneers</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>++</td>
</tr>
<tr>
<td>Ceramic Posts (e.g. Lava™ Zirconia)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlays / Onlays</td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>–</td>
</tr>
<tr>
<td>Crowns / Bridges</td>
<td>++</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Veneers</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>++</td>
</tr>
<tr>
<td>Resin Nanocomposites (e.g. Lava™ Ultimate CAD/CAM Restorative)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlays / Onlays</td>
<td>++</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Crowns / Bridges</td>
<td>++</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Veneers</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>++</td>
</tr>
<tr>
<td>Resin Composites</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inlays / Onlays</td>
<td>++</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Crowns / Bridges</td>
<td>++</td>
<td>++</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Veneers</td>
<td>+</td>
<td>++</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

**Not indicated**: Either better performance for this indication or easier handling at equal performance.
5 Clinical results and recommendations

5.1 Clinical results

RelyX™ Ultimate Clicker™ Adhesive Resin Cement was evaluated in a clinical trial by 200 dentists. 89% of the testers were satisfied or even very satisfied with the product (Fig. 14). The convenient Clicker™ Dispenser is well accepted by dentists (Fig. 15). Particularly the ease of dosing and less waste is highly appreciated. For cementation with RelyX Ultimate Clicker cement the easy procedure, strong adhesion and the broad range of indications were named as the dentists’ most preferred features. Due to the high level of satisfaction, most testers would recommend RelyX Ultimate Clicker to their colleagues (Fig.16).

Fig. 14: General satisfaction with RelyX™ Ultimate Clicker™. Source: Field evaluation conducted by AFG Research

Fig. 15: General satisfaction with Clicker™ Dispenser. Source: Field evaluation conducted by AFG Research

Fig. 16: Likelihood to recommend RelyX™ Ultimate Clicker™. Source: Field evaluation conducted by AFG Research.
5.2 Recommended procedures to achieve excellent margins with resin cements

For best aesthetic results remove excess cement immediately with a sponge pellet and then cover the exposed margins with glycerin gel. Coverage of the cement with glycerin gel as air block ensures the complete polymerization of the cement surface. Oxygen can inhibit curing at the surface. A cement that is not fully polymerized could absorb water which might result in increased opacity or staining. Additionally, the mechanical properties will be compromised which could result in washouts and poor marginal integrity.

**Recommended**

- **With gel**: Completely cured material due to oxygen inhibition.
- **Without gel**: Not completely cured material due to oxygen inhibition.

For faster results we recommend initial curing before excess removal: either light-cure briefly (tack-cure, approx. 1 sec.) or allow dark curing for about 1 min. in the mouth. To achieve long-term high marginal aesthetics with this technique, well fitting restorations are mandatory. Small gaps enable a clean break of the cement at the margin. Big gaps can result in irregular breaks which can create white lines. The optical effect of white lines occurs due to unequal light scattering. Over time plaque build-up on the rough surfaces could cause additional discolouration.

**Recommended**

- **Ideal fit – small gaps**: Smooth surface.
- **Poor fit – wide gaps**: Rough surface due to irregular breaks.

Therefore, careful removal of excess cement followed by thorough final polishing helps to avoid discolourations. Cement or adhesive accidentally spread onto uncut enamel can also lead to different light scattering and become perceptible as white or discoloured lines.
**5.3 Clinical case**

_Cementation of glass ceramic veneers and crown_

Dr. R. Mędzin, Poland

1. Pre-operative situation.

2. Final veneer and crown preparations.

3. Highly aesthetic glass ceramic veneers and crown on model.


5. After try-in, hydrofluoric acid was used to etch the glass ceramic, afterwards Single Bond Universal Adhesive (3M™ ESPE™) was applied as a silane.

6. Prepared teeth were rinsed and dried after try-in and prior cementation.

7. The enamel was etched with phosphoric acid for 15 seconds.

8. Enamel surfaces after etching.

9. Applying Single Bond Universal Adhesive (3M ESPE) to tooth structure (20 sec.).


12. The veneers and the crown were cemented in succession. Seating of the veneer on left first incisor is shown.


14. Application of Single Bond Universal Adhesive to tooth structure and core build-up (20 sec./surface).

15. Seating of the glass ceramic crown on left second incisor.

16. Light curing of RelyX™ Ultimate Cement using Elipar™ S10 Curing Light from 3M ESPE (20 sec./surface).

17. All restorations in situ.

18. Final situation.