

RelyX™ U200

Self-Adhesive Resin Cement



Technical Data Sheet

3M ESPE

Clinical case

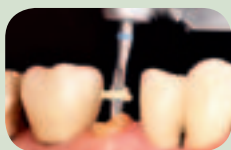
All ceramic crown on root treated second upper premolar

Dr. Gunnar Reich, Munich, Germany

1. Initial situation.



2. Preparation of root canal.



3. Try-in of RelyX™ Fiber Post.
After try-in, the root canal was cleaned by rinsing with water and dried with paper points.



4. Cutting the post using a diamond disk.



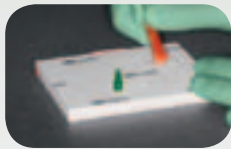
5. Dosing of the two pastes simultaneously in 1:1 ratio from the Clicker™.



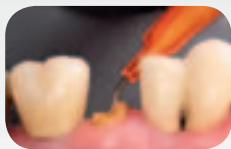
6. Mixing of catalyst and base paste.



7. Filling the needle tube with mixed cement.



8. Applying cement directly into root canal using a needle tube.



9. Seating the Fiber Post. While holding the post in place, the excess cement is carefully removed.



10. Light curing of the cement through the Fiber Post.



11. Final preparation of the built-up tooth.



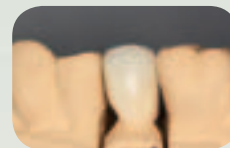
12. Temporary (Protemp™ 4) restoration *in situ*.



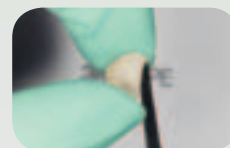
13. Cleaning of the prepared tooth prior final cementation of crown (using pumice paste).



14. All ceramic restoration on model.



15. Applying RelyX™ U200 into pretreated crown.



16. Excess removal immediately after crown seating.



17. Margins are covered with glycerine gel while self-curing.



18. Final restoration *in situ*.

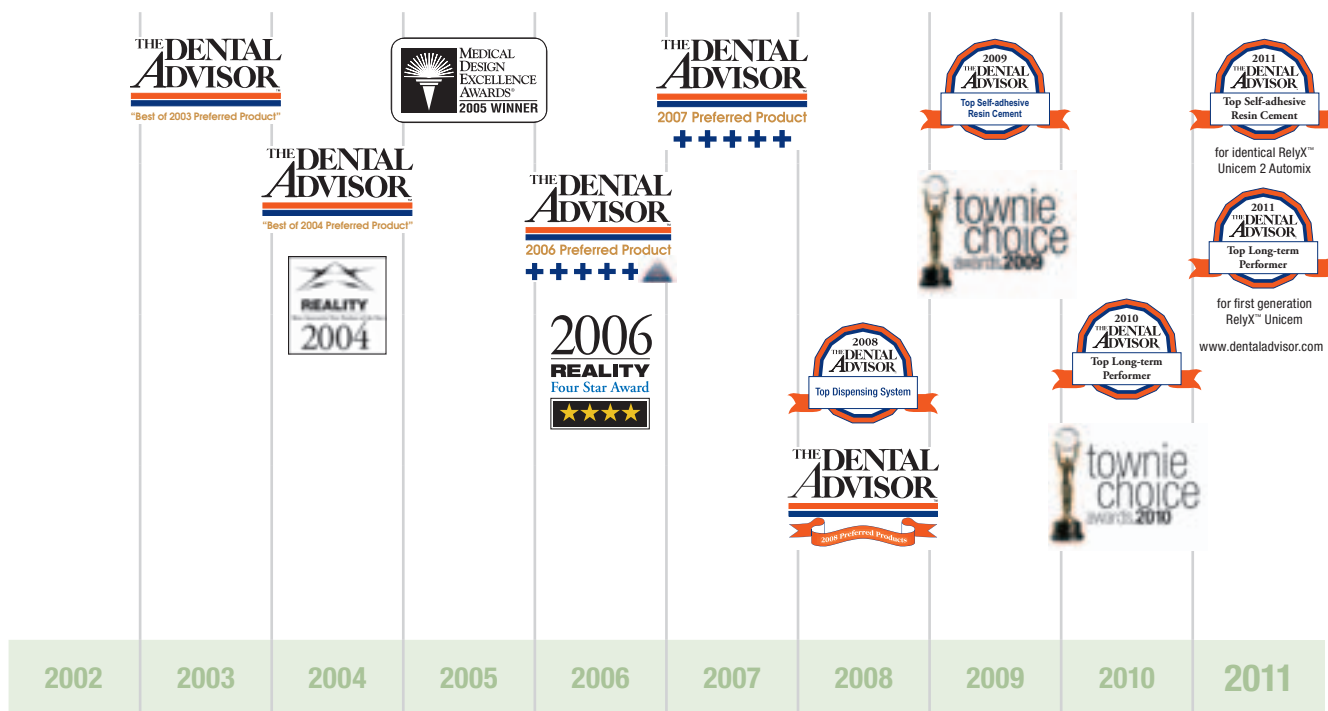


1 The success story goes on

In today's dentistry, resin cements are one of the most frequently used material class. Resin cements can be classified into two groups – adhesive and self-adhesive resin cements. Adhesive resin cements require various pretreatment steps (etching, priming, bonding) and the absolute exclusion of moisture (rubber dam). Therefore, adhesive cementation can be more technique sensitive than conventional cementation and the clinical success may be compromised by the technical challenges it imposes on the dentist. These drawbacks were resolved with the introduction of the first self-adhesive universal resin cement RelyX™ Unicem in 2002.

RelyX™ U200 represents the next generation of self-adhesive resin cement RelyX™ U100. RelyX™ Unicem and the paste/paste version RelyX U100 are the most clinically proven self-adhesive resin cement worldwide. They received the 2010 and 2011 Top Long-term Performer Award by THE DENTAL ADVISOR.

As with the 1st generation, there is no need for any pre-treatment of the tooth, such as etching, priming or bonding. The combination of proven technology with innovative features makes RelyX U200 cement a convenient and powerful, high performing product.



**RelyX™ Unicem
Aplicap™
Launch 2002**

**RelyX™ Unicem
Maxicap™
Launch 2003**


**RelyX™ U100
Launch 2006**

**RelyX™ U200
Clicker™
Launch 2011**

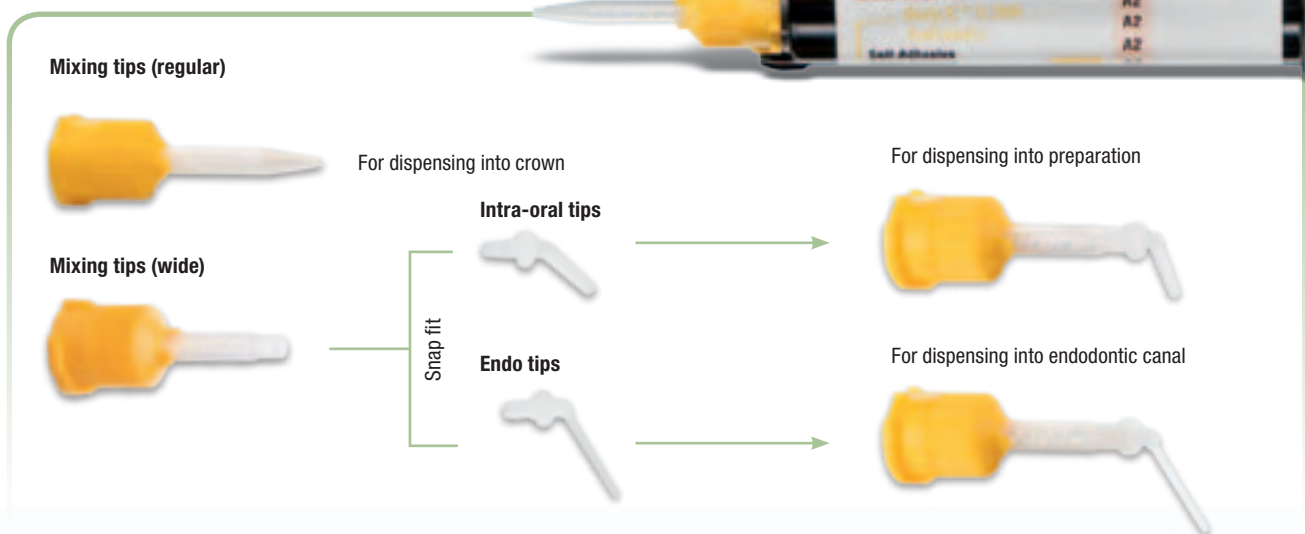
**RelyX™ U200
Automix
Launch 2011**



1.1 RelyX™ U200 – Product benefits at a glance:

Simplicity		Performance
Self-adhesive		Very high bond strength on all substrates
Dual-cure		Low post-operative sensitivities
Moisture-tolerant		Excellent mechanical properties
Very easy removal of excess		Excellent color stability
Very easy mixing and handling due to optimized rheology		Long-term stability
Easy to use Clicker™ delivery system <ul style="list-style-type: none"> • Flexible dosing • Simultaneous dosing of both pastes saves time • Very little material waste 	Easy to use automix syringe <ul style="list-style-type: none"> • Comfortable handling • Time saving • A great choice of tips allows always easy application of paste directly into the cavity or root canal. 	

RelyX™ U200 Automix Tip Options



1.2 Indications

RelyX™ U200 cement is indicated for the permanent cementation of

- All-ceramic, composite or metal inlays, onlays, crowns and bridges
- Posts and screws
- All-ceramic, composite or metal restorations to implant abutments
- 2- or 3-unit Maryland bridges and 3-unit inlay/onlay bridges*

*The high adhesive bond strength of RelyX™ U200 cement allows for reliable and comfortable cementation of Maryland and inlay/onlay bridges. For these indications an additional enamel etching step is required to increase the available surface area for bonding.

1.3 Chemical composition and setting reaction

RelyX™ U200 is based on the same proven chemistry as RelyX™ Unicem Aplicap™/Maxicap™ and RelyX™ U100. The RelyX™ Unicem adhesion monomer (a phosphoric acid methacrylate), the initiator system and the special filler technology providing the unique neutralization behaviour remained unchanged.

For RelyX U200 an additional monomer and a new rheology modifier were added to the mixture and the processing of our filler particles was optimized. All that leads to a formulation with increased mechanical properties and excellent overall adhesion performance.

Base paste	Catalyst paste
Methacrylate monomers containing phosphoric acid groups	Methacrylate monomers
Methacrylate monomers	Alkaline (basic) fillers
Silanated fillers	Silanated fillers
Initiator components	Initiator components
Stabilizers	Stabilizers
Rheological additives	Pigments
	Rheological additives

The setting of RelyX U200 cement is the same as for RelyX™ Unicem and RelyX U100. The reaction is started by light and/or by a chemical reaction of the initiator system (dual cure). The setting reaction is a radical polymerization during which the single monomer molecules are chemically cross-linked to form a three-dimensional polymer network. Simultaneously, neutralization reactions take place, which are important for the long-term stability of the set RelyX U200 cement.

1.4 Material properties

Strong performance needs to be balanced over many clinical relevant criteria to help the restoration to become a clinical success. Those criteria go well beyond bond strength to tooth or to restorative material alone and include longevity, esthetics and marginal quality.

The next generation RelyX U200 raises the high standard even higher: very easy usage combined with outstanding bond strength and very good mechanical properties.

Mechanical properties

Properties	RelyX™ U200 generation (lc)
Flexural strength [MPa]	99
Compressive strength [MPa]	291
Modulus of elasticity [GPa]	6.6
Surface hardness [MPa]	190
Film thickness [µm]	13
Water sorption [µg/mm ₃]	28
Solubility [µg/mm ₃]	0
Expansion after 1 month [%]	0.63



2 What's improved?

The combination of proven RelyX™ Unicem and RelyX™ U100 technology with new innovative features makes RelyX™ U200 cement a convenient and powerful, high performing product.

2.1 Bond strength

The bond strength of RelyX Unicem and RelyX U100 is clinically proven for years. The next generation is even better, ensuring an extremely durable bond of the restoration.

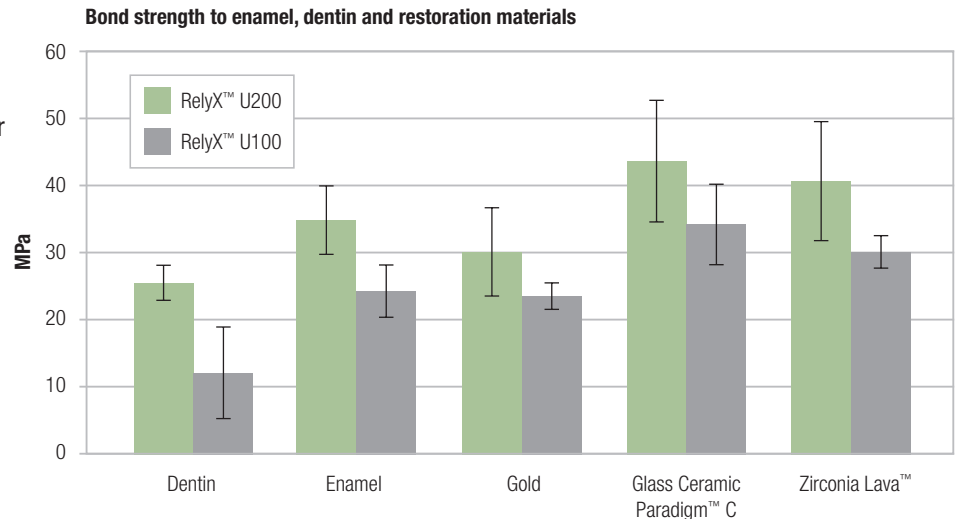


Fig. 1: Even better adhesion: shear bond strength of RelyX™ U200 to tooth and restoration materials compared to proven RelyX™ U100. Source: 3M ESPE internal data

2.2 Mixing properties

The mixing quality is very important for final material performance. To achieve best mixing results, either by hand-mixing or in a static mixing tip, the catalyst and base pastes need to combine easily. RelyX U200 catalyst and base pastes are well matched to each other in their flow properties (Fig. 2). The improved rheology leads to an easier mixing of the two pastes – helping you achieve a homogeneously mixed material which can perform reliably in the clinical application.

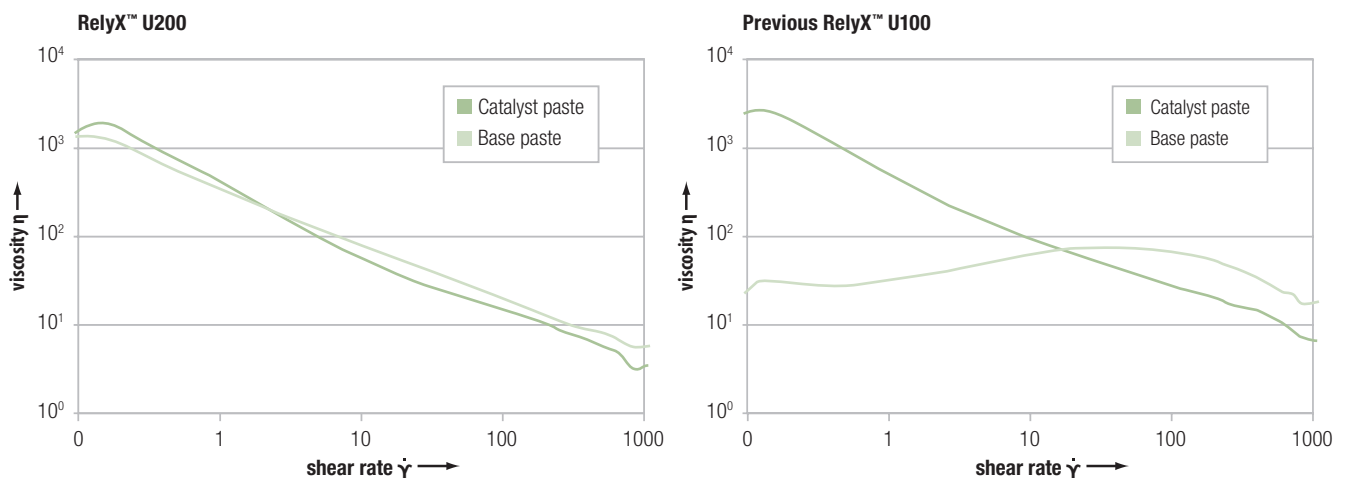


Fig. 2: On the right side RelyX™ U100: The catalyst and the base paste don't show similar behaviour in viscosity when sheared; On the left side: RelyX™ U200 catalyst and base paste show similar behaviour in viscosity when sheared. Source: 3M ESPE internal data

3 Advantages compared to other self-adhesive resin cements

3.1 Bond strength

RelyX™ U200 Automix and Clicker™ perform at a high level on all substrates (Fig. 3, 4, 5). The interface to tooth structure as well as to restoration materials is reliably bonded.

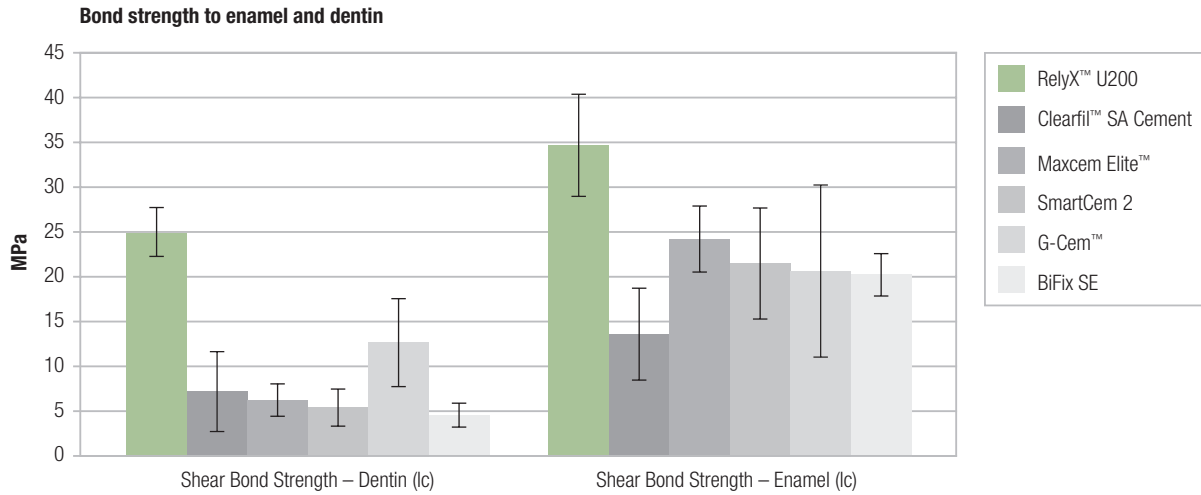


Fig. 3: Shear bond strength to enamel and dentin. Cements light cured. Source: 3M ESPE internal data and AADR/IADR 2011, #2929

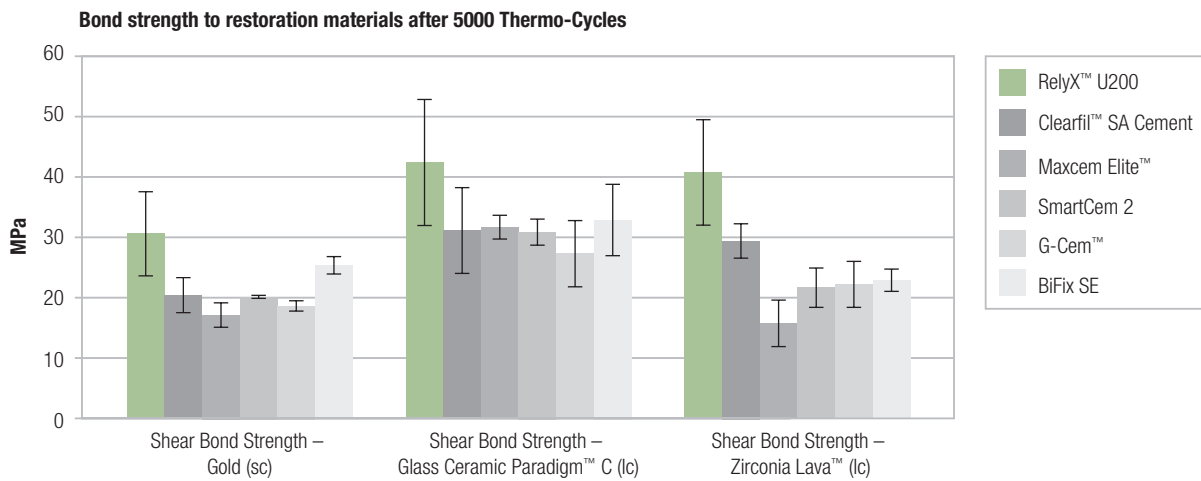


Fig. 4: Shear bond strength of self-adhesive resin cements to restoration materials after 5000 Thermo-Cycles. Source: 3M ESPE internal data

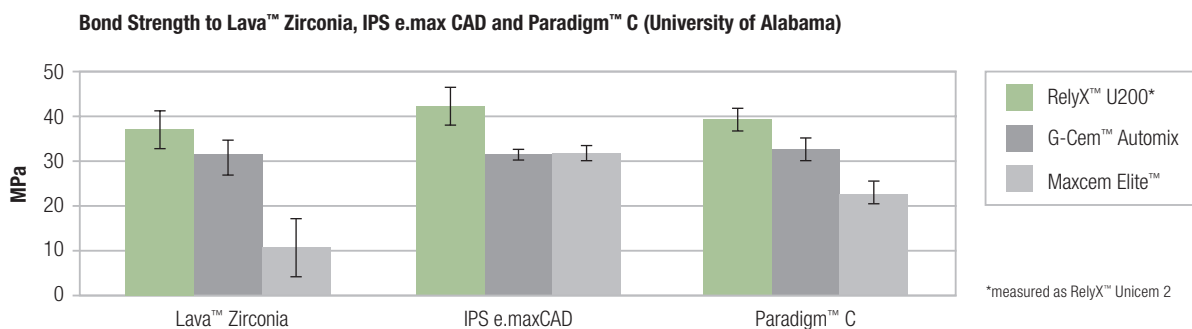


Fig. 5: The new generation of RelyX™ Unicem cements showed significantly higher bond strength to Lava™ zirconia, e.max, and Paradigm™ C than all other cements (p<0.05).

Source: S Singhal, J Burgess, D Cakir et al. Birmingham, AL, USA. IADR 2010 # 395

3.2 Long-term stability

The pH-value increases during the setting of RelyX™ U200. Immediately after mixing RelyX U200, the cement paste is very acidic. Within a few minutes the pH-value starts to increase and within 24 hours reaches a neutral level. After application to the tooth, the low pH-value of RelyX U200 cement is crucial for the self-adhesive mechanism, whereas the pH increase is an essential prerequisite for the long-term stability of the cement.

The unique chemical formulation of RelyX U200 raises its pH to a neutral level after application. This contributes to the material becoming hydrophobic, meaning it is better able to resist water uptake, staining and cracking.

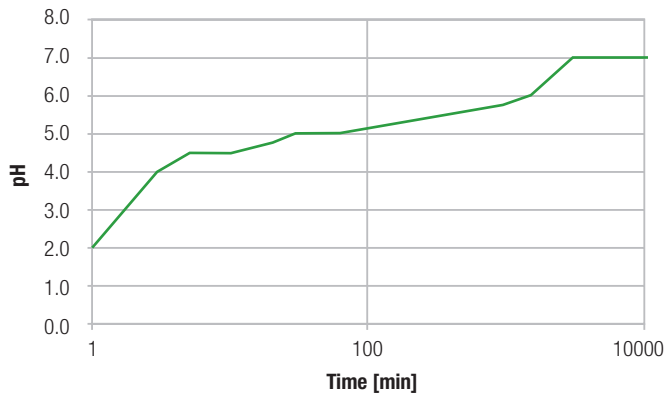


Fig. 6: pH-values were measured using a pH indicator paper at different times after mixing the cement. Source: AADR/IADR 2011, #2929



Fig. 7: Results of stress test on self-adhesive resin cements. All samples were self-cured and thermocycled 10,000 times. Source: 3M ESPE internal data



3.3 Esthetics

Compared to other leading products, RelyX U200 shows the lowest discoloration after incubation in a coffee solution. The pictures show cement samples after storage in standardized coffee solution for 3 days at 36 °C.



	before	after
RelyX™ U200		
Maxcem Elite™		
SmartCem® 2		
G-Cem™		

Fig. 8: Storage of cement specimen (1c) in standardized coffee solution for 3 days. Source: 3M ESPE internal data

4 Advantages compared to multi-step resin cements

Adhesive cementation poses a recurring technical challenge for dentists and dental assistants.

To securely bond a restoration to the tooth structure, a resin cement with an adhesive bonding system requires many more steps than RelyX™ U200 self adhesive resin cement.

Comparison of procedure steps for a cementation of high strength all-ceramic restorations (zirconia or alumina framework).

Cementing Steps	Typical total-etch resin cement system	Cementation with RelyX™ U200
1. Initial situation: Provisional restoration removed and prepared tooth cleaned.		
2. Apply rubber dam. Optional for RelyX™ U200.		 optional
3. Etch with a phosphoric acid etching gel.		not needed
4. Thoroughly rinse with water.		not needed
5. Dry with gentle air stream.		not needed
6. Apply primer with a disposable applicator and rub in thoroughly.		not needed
7. Dry with gentle air stream.		not needed
8. Apply adhesive with a disposable applicator and rub in thoroughly.		not needed
9. Lightly thin or air dry adhesive evenly with an air stream.		not needed

Cementing Steps	Typical total-etch resin cement system	Cementation with RelyX™ U200
10. Light cure adhesive if indicated.		not needed
11. Sandblast inner surface of the crown, clean and dry it.		
12. Condition inner surface with zirconia primer.		not needed
13. Dispense cement onto mixing pad.	 if hand-mix	 for Clicker™
14. Dispense second cement component onto mixing pad.	 if hand-mix	not needed
15. Mix cement.		
16. Apply cement to the prepared restoration or the prepared tooth.		
17. Place the restoration, light cure or self cure (tack cure if preferred), remove excess.		
18. Final situation: Adhesively cemented ceramic crown.		

4.1 Bond strength

Better or comparable results – in fewer steps: RelyX™ U200 shows excellent adhesion.

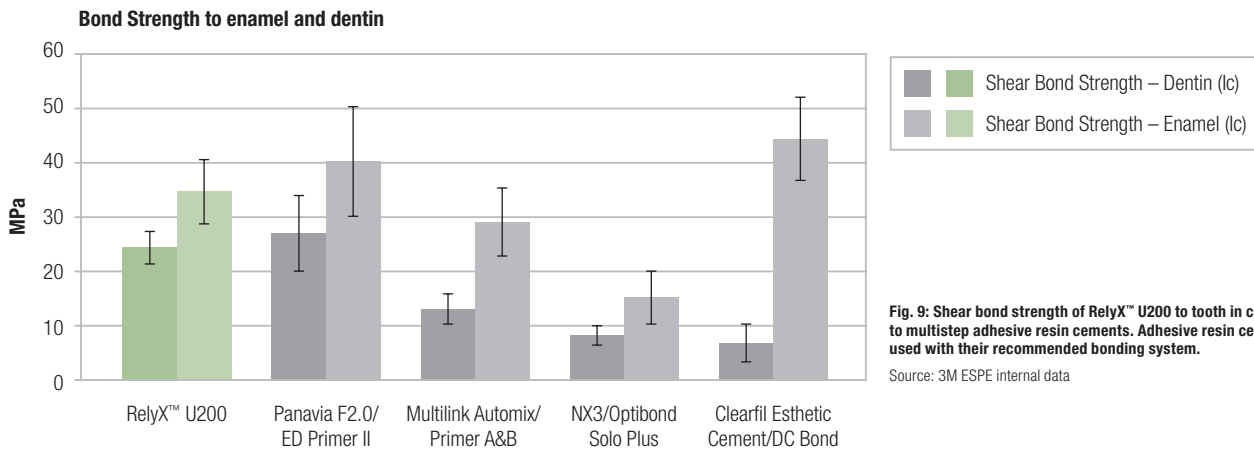


Fig. 9: Shear bond strength of RelyX™ U200 to tooth in comparison to multistep adhesive resin cements. Adhesive resin cements were used with their recommended bonding system.

Source: 3M ESPE internal data

RelyX U200 performs at a high level on all substrates – even compared to resin cements with an additional bonding/priming agent. Get better bonding results with RelyX U200 in a much faster and more robust procedure.

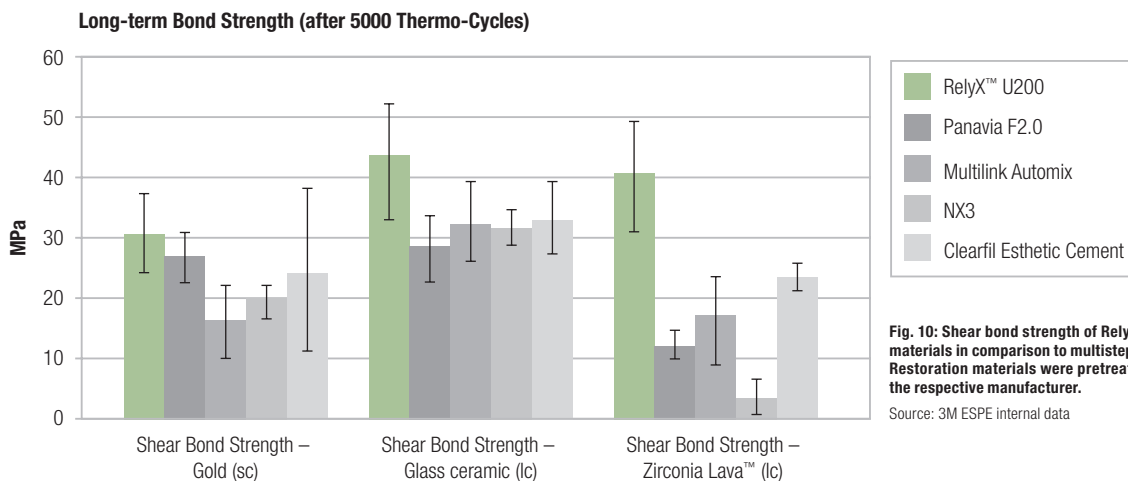


Fig. 10: Shear bond strength of RelyX™ U200 to restoration materials in comparison to multistep adhesive resin cements. Restoration materials were pretreated as recommended by the respective manufacturer.

Source: 3M ESPE internal data

4.2 Abrasion

Due to the optimized formulation the wear resistance of RelyX™ U200 is excellent. This will help maintain a good marginal sealing over the life time of restoration and to prevent marginal discoloration.

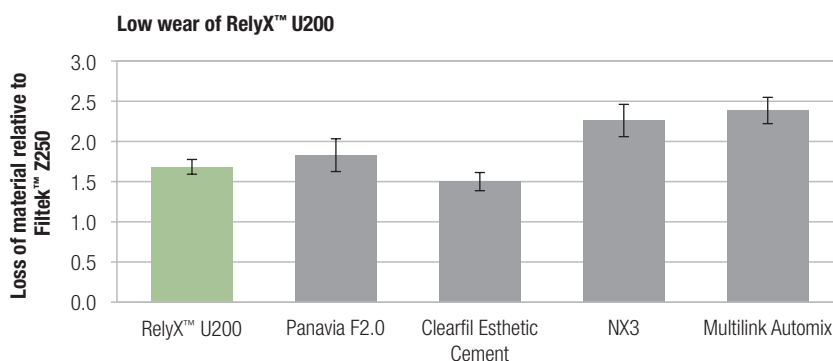


Fig. 11: ACTA-Abrasion test. Cements light cured.

Source: 3M ESPE internal data

5 Clinical performance

5.1 Results from field test

2.852 restorations were cemented in field evaluations with 112 dentists: the Clicker and the Automix syringe were highly accepted!

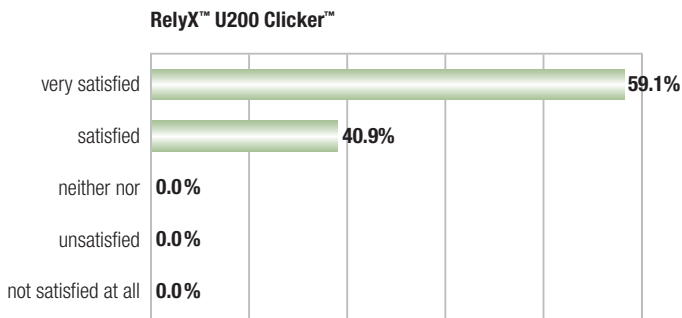


Fig. 12: Overall satisfaction with the new RelyX™ U200.
Field Test Jan 2011, n = 44

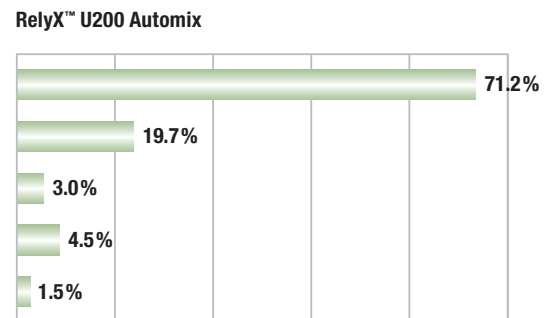


Fig. 13: Satisfaction level regarding delivery system.
Field Test Jan. 2010, n = 68

5.2 The rheology of the cement is optimized for the delivery system and also for the clinical handling

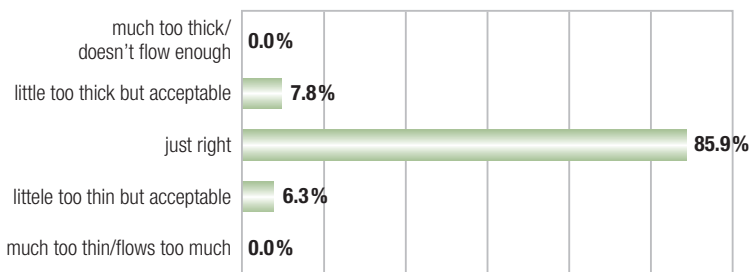


Fig. 14: Evaluation of the consistency of the cement when applying into or onto the restoration.
Source: Field Test Jan. 2010, n = 68

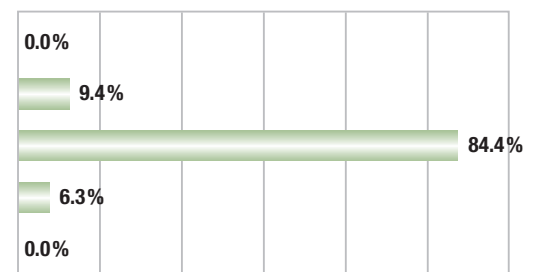


Fig. 15: Evaluation of the consistency of the cement when placing the restoration in the mouth.

5.3 Excess removal

Removal method is your choice (see Fig. 13). Either remove the cement in gel/wax like stage after initial curing or immediately with a sponge pellet and then cover the exposed margins with glycerol gel.

For easy removal in the wax like stage we recommend to either light cure briefly (approx. 1 sec.) or allow self-curing for about 1 min. in the mouth.



Fig. 16: Excess removal in the gel/wax-like state with scaler ...



... or immediately with a sponge.

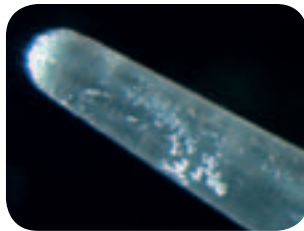
5.4 Cementing Fiber Post and RelyX™ U200 using Needle Tubes

For cementing root canal posts, e. g. with RelyX™ Fiber Post, with RelyX U200, we recommend using needle tubes. The needle tubes can be filled with the mixed cement and facilitate access to the root canal. With needle tubes, the cement can be directly applied into the canal to fill it from bottom to top. Compared to the traditional method of coating the post with cement before insertion, the risk of entrapping air bubbles and voids is lower. The results are strong and virtually void-free post cementations.

Cement applied directly into root canal.



Cement spread onto post before insertion.



In a study Fiber Posts were cemented in transparent resin models with standardized root canal cavities. The cement was applied directly into the canal using an AccuDose® Needle Tube (Centrix®) or classically spread onto the fiber post right before insertion.

The samples were analyzed using transmission light microscopy. The images clearly show less voids in the cement layer around the post when applying the cement directly into the root canal.



5.5 The perfect system: RelyX™ U200 Automix and RelyX™ Fiber Post

The endo tips facilitate easy access to the root canal, so you can apply cement in the canal from bottom to top. Compared to the traditional method of coating the post with cement before insertion, the risk of entrapping air bubbles and voids is much lower. This leads to outstandingly strong and virtually void-free post cementations.

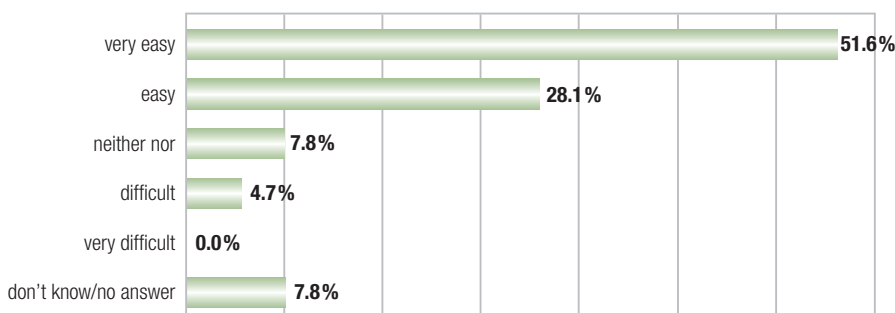


Fig. 17: Rating for usage of endo tips for post cementation. Source: Field Test Jan. 2010, n = 68

Clinical cases

Restoration of the anterior region with a 6-unit Lava™ Zirconia bridge

Dr. med. dent. Jakob Zafran, Zurich, Switzerland

1. Initial situation.



2. Prepared abutment teeth and recovering gingiva after covering of the pontic area with a connective tissue graft.



3. Esthetic and functional try-in of 6-unit Lava™ bridge before final glaze firing.



4. Filling of the bridge abutments with RelyX™ U200 Automix cement out of the automix syringe.



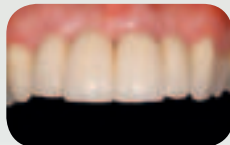
5. Restoration seated in the patient's mouth. Excess cement will be removed in the gel phase after initial curing.



6. Final light curing of RelyX™ U200 Automix cement.



7. 6-unit Lava™ Zirconia bridge *in situ* after light curing and removal of excess cement. Also note improved pink esthetics.



All Ceramic Restoration on Root Treated Second Upper Premolar

Dr. Barbara Cerny, Munich, Germany

1. Initial situation.



2. Preparation of the root canal using RelyX™ Fiber Post drills (3M ESPE).



3. Fit check of the RelyX™ Fiber Post (3M ESPE).



4. Extra-oral trimming of the RelyX™ Fiber Post.



5. Attaching mixing tip with endo tip on RelyX™ U200 Automix syringe (3M ESPE).



6. Application of RelyX™ U200 Automix cement directly into the root cavity.



7. Insertion of the RelyX™ Fiber Post.



8. Light curing using Elipar™ S10 Curing Light from 3M ESPE.



9. Preparation for Lava™ Crown (3M ESPE).



10. Lava™ Crown after final cementation.



3M ESPE

3M ESPE AG
ESPE Platz
82229 Seefeld · Germany
E-Mail: info3mespe@mmm.com
Internet: www.3MESPE.com

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