GC FujiCEM™ Evolve

Radiopaque Reinforced Glass Ionomer Luting Cement

COMPREHENSIVE GUIDE

A step ahead

Smile for the World
Since 1921
100 years of Quality in Dental


GC FujiCEM™ Evolve
Single Pack
Universal
GC FujiCEM™ Evolve
Single Pack
GC FujiCEM Evolve
9.2g(5.0mL)

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1. Introduction to GC FujiCEM™ Evolve

GC has a long track record in high-quality glass-ionomer (GIC) and resin-modified glass ionomer luting cements (RMGIC). GIC/RMGIC have undergone continuous and considerable improvements and remain indispensable because of the proven clinical integrity and unique features and advantages such as ease of use, self-adhesiveness, moisture tolerance, good sealing ability, low post-operative sensitivity, and technique tolerance.

Advantages of Resin-modifed glass-ionomer cement

For everyday luting procedure | Simplified protocol of isolation | Strong retention | Virtually no post-operative sensitivity | Proven clinical performance

Porcelain-fused-to-metal crowns (PFMs) have been successfully used for many years and are considered as reliable, long-lasting restorations with satisfactory aesthetics. However, in recent years, aesthetic demands have increased and zirconia has been introduced as a high-strength alternative to metal-ceramic dental restorations. Nowadays, zirconia represents about 25% of the market. In Europe, approximately 8,400,000 crowns are made from zirconia on a yearly basis[1], making it the preferred crown material for many dentists.

FujiCEM Evolve has been designed to reply to this changing market by providing a strong and reliable solution for luting Zirconia based restorations. Resulting from 30 years of ongoing innovation, FujiCEM Evolve combines advantages of resin modified glass ionomer cements, but with strong extra benefits, such as

- Syringe delivery with push & click mixing tips
- Tack cure option for easier excess removal
- Strong bond to Zirconia based material
- Excellent radiopacity

With these improvements, dentists can keep up with the state-of-the-art while enjoying the benefits of GICs.

[1] KeyStone and GfK 2018

CERAMIC STRENGTH	PREPARATION	Resin-Modified Glass Ionomer	Self-Adhesive Resin	Adhesive Resin	Esthetic Resin (DC & LC)
LOW (feldspathic, leucite-reinforced)	Retentive			✓	✓
	Non-retentive			✓	✓
MEDIUM (lithium disilicate)	Retentive	✓	✓	✓	✓
	Non-retentive			✓	✓
MODERATE-HIGH (highly translucent zirconia)	Retentive	✓	✓	✓	✓
	Non-retentive			✓	✓
HIGH (zirconia)	Retentive	✓	✓	✓	✓
	Non-retentive			✓	✓

Figure 1: Dental Advisor cementation recommendation according to substrates and retention.
Source: Adapted excerpt from Dental Advisor, Special Issue, Cementation, Vol. 36-02, April 2019.

2. Product description

2.1 Based on the core technology of glass-ionomer from GC

FujiCEM Evolve is based on a classical resin-modified glass-ionomer technology, consisting of the following main components:

1) Glass-ionomer components: polyacrylic acid, fluoro alumino silicate glasses, water.
2) Resin components: mainly metacrylate elements and initiators. Monomers and water are generally insoluble. Resin-reinforced glass-ionomer usually contains HEMA as monomer. Containing a lot of OH (Hydroxy elements) in its chain, HEMA is soluble in water and allows an homogeneous mixture to be made.

A resin-modified glass-ionomer includes two processes in its setting reaction:

- An acid-based reaction between a polyalkenoic acid and fluoroaluminosilicate glass to form a polysalt matrix
- A radical polymerisation reaction to form the polymer network.

The cross-linking occurs in the gelation phase: H-bonds are formed and the polymer chains become physically entangled. After setting, glass-ionomer matrix and poly-HEMA chains are intertwined.

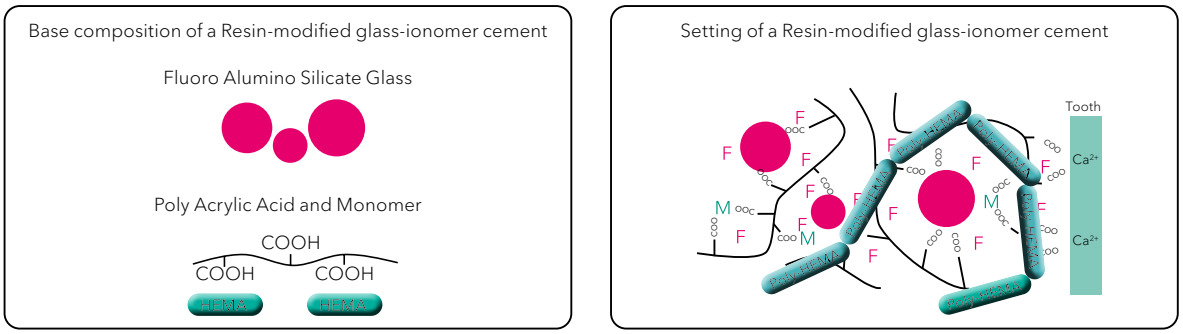


Figure 2: Schematic representation of the setting reaction of a glass-ionomer
Source: GCC R&D, Japan.

While the glass-ionomer part brings chemical adhesion and moisture tolerance, their mechanical properties will be directly linked to the resin matrix.

Since the introduction of FujiCEM in 2001, GC has brought several evolutions to the RMGIC technology.

- 2001: FujiCEM was the first RMGIC from GC to be dispensed in Paste/Paste cartridges.
- 2007: FujiCEM Automix made it possible to dispense & mix a RMGIC at the same time.
- 2012: FujiCEM 2 brought a second technological step to the RMGIC.
  Displaying the "Force and Fusion" technology, FujiCEM2 showed a considerably improved flexural strength. This was made possible by the addition of longer chain monomers (Strength) and optimisation of the filler surface treatment (Fusion).
- 2015: The addition of Slide-and-Lock feature improved further the ease of dispensing of the material.

2.2 Technological innovation

2.2.1 Improved adhesion to zirconia

Taking into account the increased use of zirconia-based restorations, the development of FujiCEM Evolve has focused on improving adhesion to zirconia, while keeping a very stable bond to the tooth tissue.

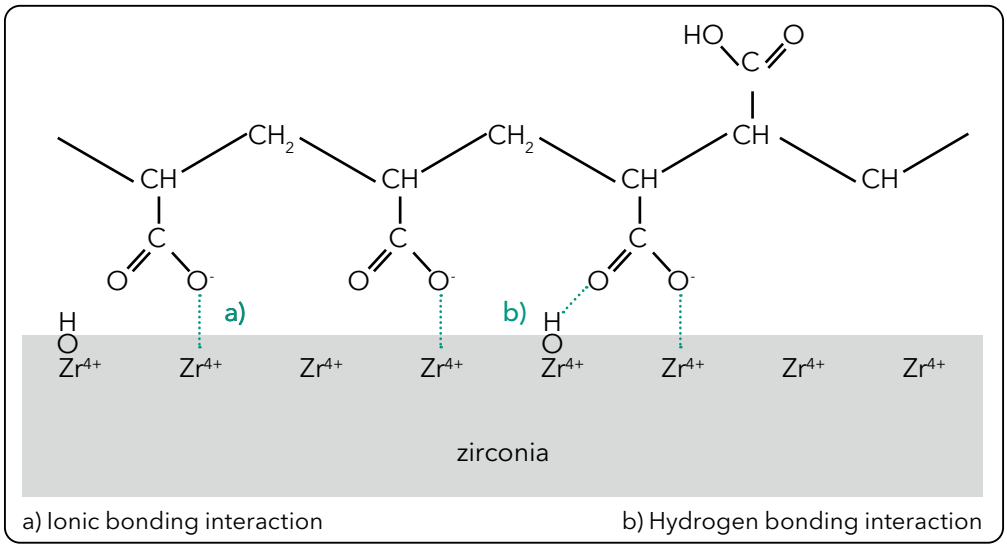
Three elements contribute to the improved adhesion to zirconia:

a) A chemical interaction between both materials.
b) The high wettability of FujiCEM Evolve to zirconia positively influences the bonding ability of the material.
c) The improvement of the flexural strength.

The above elements are further described below.

a) A chemical interaction

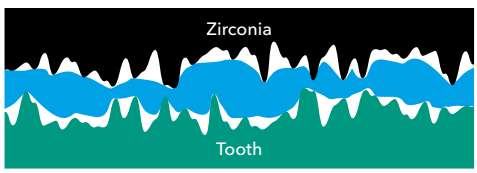
A chemical interaction between both materials, RMGIC and zirconia, through ionic & hydrogen bond has a positive influence on the adhesion strength. The ionic bonding potential is effective between polyacrylic acid and zirconia, also supported by hydrogen bonding.



a) Ionic bonding interaction b) Hydrogen bonding interaction

b) The high wettability of FujiCEM Evolve to zirconia

The wettability of a luting material plays an important role to penetrate the micro retention on the surface of the tooth and restoration, and create a strong interlocking.



In case of composite resin luting cement without primer, the limited wettability will decrease the bond strength.

FujiCEM Evolve displays a higher ability to wet the surface without any primer. This affinity to both natural tooth structure & zirconia will positively influence the bond strength by increasing the contact surface area.

c) **The improvement of the flexural strength**

The bond strength will also be influenced by the flexural strength of the material which will play a role in decreasing the cohesive fracture.

In case the material displays a high wettability, the main source of failure could remain the cohesive strength of the material itself. Improving the flexural strength will allow a higher cohesive strength to be maintained, and therefore will improve the durability of the adhesion.

In order to improve the flexural strength while maintaining a high wettability, GC has enhanced the "Force & Fusion technology" even further in FujiCEM Evolve. By adding super-long and more flexible monomer chains, the cement is reinforced, while also having a positive effect on the control of the expansion of the material. (Figure 3).

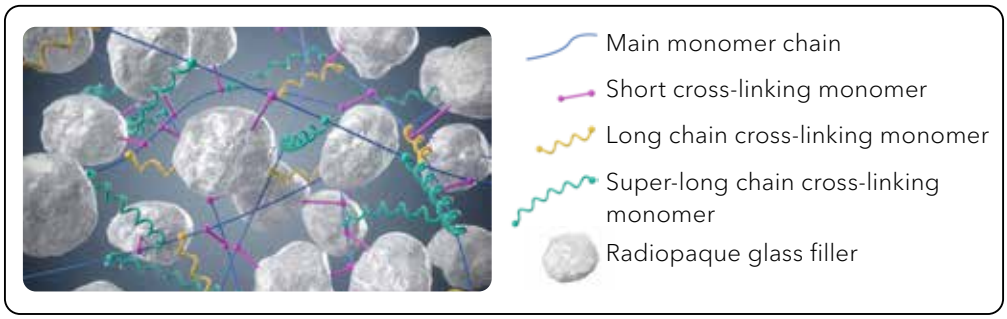


Figure 3: Schematic representation of the improved Force & Fusion technology inside FujiCEM Evolve.
The super-long chain cross-linking monomers cross-linking monomers are responsible for an improved flexural strength of the material

The distance between cross-linking points is increased, resulting in a more flexible network, capable of withstanding and buffering the masticatory forces applied onto the restoration.

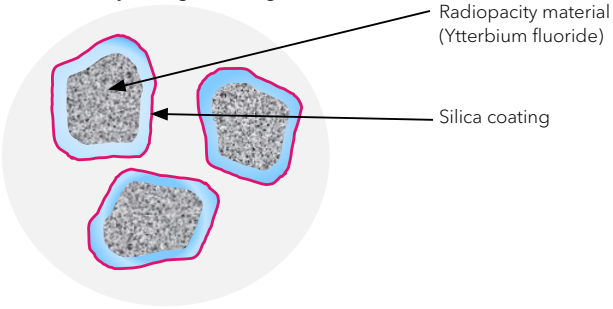
Clinically, this is translated into:
- Higher bonding durability of the cement.
- Improved sealing ability.
- Improved shade stability.

2.2.2 Tack-curing ability of excesses

The removal of excess is made easier by adding a photo-initiator which only impacts the resin setting of the material (tack-curing option). Light-curing the excess will induce a setting reaction until a gel stage is reached, at which excess are easy to remove in a very neat and clean manner.
The light-curing however does not impair the normal glass-ionomer setting reaction, and the excess will not become hard-to-remove than necessary. Thus, it prevents early marginal degradation.

2.2.3 Improved filler composition

Ytterbium fluoride is added to the composition in order to improve the radiopacity, and to ease the control of excess removal. The Force & Fusion technology is used with optimized coating of fillers benefitting the cohesion with the resin part of the matrix.



2.3 Composition

Table 4: Description of components in FujiCEM Evolve , their function in the material and their clinical relavance

PASTE A		
Component	**Function**	**Clinical relevance**
Fluoro-alumino-silicate glass	• Filler • Neutralize, gelate, and set the polyacrylic acid	✓ Working/setting time ✓ Mechanical strength ✓ Radiopacity ✓ Film thickness
Hydroxyethyl methacrylate (HEMA)	• Strengthen the glass-ionomer by polymerized HEMA chain • Mix polyacrylic acid aqueous solution and other resin monomers • Increase hydrophilicity of the resin network (for better bonding and ion reaction)	✓ Bonding ability ✓ Mixing ability ✓ Hygroscopic expansion
Dimethacrylate & Bis-MEPP	• Resin monomer • Links to HEMA chain and toughens the resin network	✓ Mechanical strength (in particular toughness)
Photo-Initiator	• Photo-Initiator	✓ Tack-cure ability
Inhibitor	• Adjust resin polymerization reaction rate	✓ Working time/setting time ✓ Shelf life
Silicon dioxide	• Adjust viscosity	✓ Flow ✓ Mixing ability (auto-mixing ability) ✓ Stability (suppress phase separation)
Pigments	• Colourant	✓ Aesthetic appearance

PASTE B		
Component	**Function**	**Clinical relevance**
Polyacrylic acid	• Main component of glass-ionomer cement • Bonding to tooth	✓ Working/setting time ✓ Mechanical strength ✓ Bonding ability
Polybasic carboxylic acid	• Adjust pH	✓ Working time/setting time ✓ Mechanical strength
Water	• Ionic reaction media • Diffusion media of ion	✓ Flow ✓ Working time/setting time ✓ Bonding ability
Initiator	• Initiate resin polymerization reaction	✓ Working/setting time ✓ Mechanical strength ✓ Bonding ability
Ytterbium fluoride	• Radiopacity filler	✓ Distinguishable on X-ray
Silicon dioxide	• Adjust viscosity	✓ Flow ✓ Mixing ability (auto-mixing ability) ✓ Stability (suppress phase separation)

3. Indications for use

FujiCEM Evolve is indicated for a large range of clinical situations.

The selection of the material will be guided by the following criteria:

- Retention of the preparation: the product is perfect for use for crown & bridge work. For non-retentive preparations such as for veneers, adhesive solutions are required.
- Isolation ability: in case of difficulty to isolate (e.g. sub-gingival margin), the moisture tolerance of a RMGIC would make it a material of choice.

1. Cementation of metal-based inlays, onlays, crowns and bridges
2. Cementation of resin inlays, onlays, crowns and bridges
3. Cementation of all ceramic (every type of ceramic) inlays
4. Cementation of high strength (e.g. zirconia based, lithium disilicate etc.) all ceramic inlays, onlays, crowns and bridges
5. Cementation of metal, ceramic and fibre posts

For more information on indication & material selection, please refer to the corresponding instructions for use. GC also developed a Luting App & a Luting Guide which provide guidance to select the most appropriate luting cement and also describe each luting step.

4. Features and Benefits

With FujiCEM Evolve, GC takes a step ahead by offering performance in luting, fitting the everyday needs. FujiCEM Evolve is an improved resin-modified glass-ionomer cement, made to provide easy of use and performance for your standard prosthetic works, from retentive metal-based to zirconia restorations.

1) Improve performance for all cases
   - FujiCEM technology at its best thanks to super-long chain monomer bringing strength & stability.
   - **Excellent bond strength to tooth and restoration, especially to zirconia.**
   - **High radiopacity of 258% allows easy control on X-rays.**

2) All the advantages of RMGICs
   - FujiCEM Evolve merits from the good features of FujiCEM 2 with a very simple protocol: no need for rubber dam and no need for pre-treatment.
   - Non-irritating to tooth structures or soft tissues, the cement poses no risk of post-op sensitivity for patients and helps protecting the tooth against recurring caries and decay.
   - FujiCEM Evolve also features a good working time (2'15) and fast setting time (4'30).

3) Easiness at hand
   - **A new ergonomic syringe, fitting all hands, enables use in automix (with mixing tips) and in handmix (without mixing tips).**
   - The economic "Push and Click" mixing tips can easily be attached and removed with one touch and are also available with endo tips.
   - **The tack-cure option makes it possible to remove excesses faster and easier.**

4) Convenience as a step forward
   - It has an ideal consistency for an easy extrusion with one hand.
   - Its low film thickness (12 µm) ensures a perfect adaptation.
   - FujiCEM Evolve is available in Universal shade, to match all clinical situations.

5. Scientific research on GC FujiCEM Evolve

5.1 Tensile bond strength to tooth tissue

Bovine enamel and dentine specimens were polished with P600 SiC paper. No chemical pre-treatment was applied. The bonded area was 3 mm in diameter, marked with plastic tape. Stainless steel rods were cemented as tensile appliance with the respective cement (self-cure mode) and stored at 37°C for 24h.
Tensile bond strength was measured at 24 hours from start of mix.

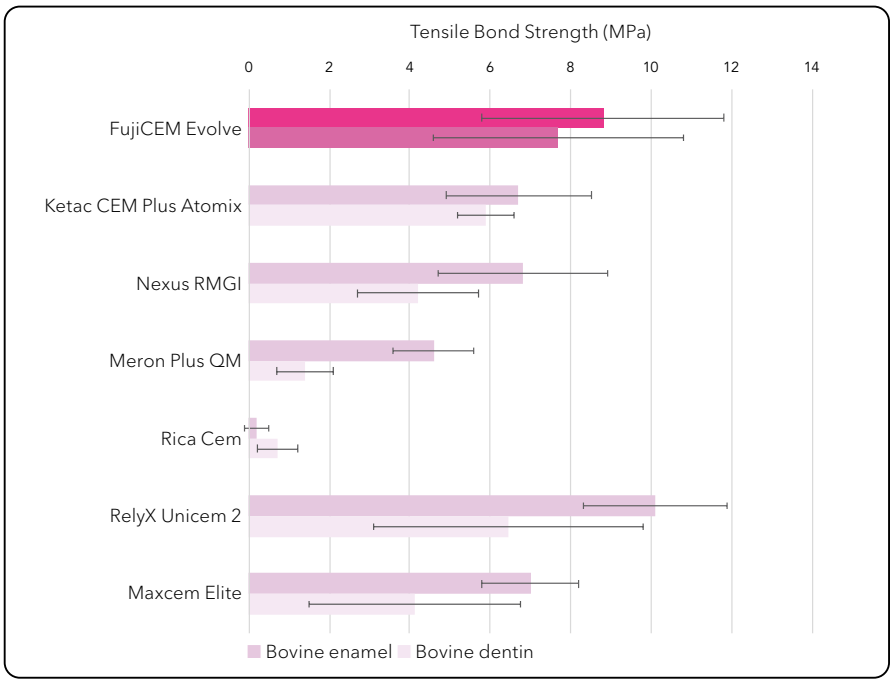


Figure 5: Bond strength to bovine teeth of FujiCEM Evolve in comparison with other RMGICs.
Source: GCC R&D, Japan. Data on file.

The above data demonstrates a high bond strength both on enamel and on dentine compared to other products used in this test.

5.2 Tensile bond strength to zirconia

Zirconia specimens were vertically sandblasted with 80 micrometer alumina at 4 kgf/cm^2 from 2-3 mm distance. The bonded area was 3 mm in diameter, marked with plastic tape. Stainless steel rods were cemented as tensile appliance with the respective cement (self-cure mode) and stored at 37°C for 24h.
Tensile bond strength was measured at 24 hours from start of mix.

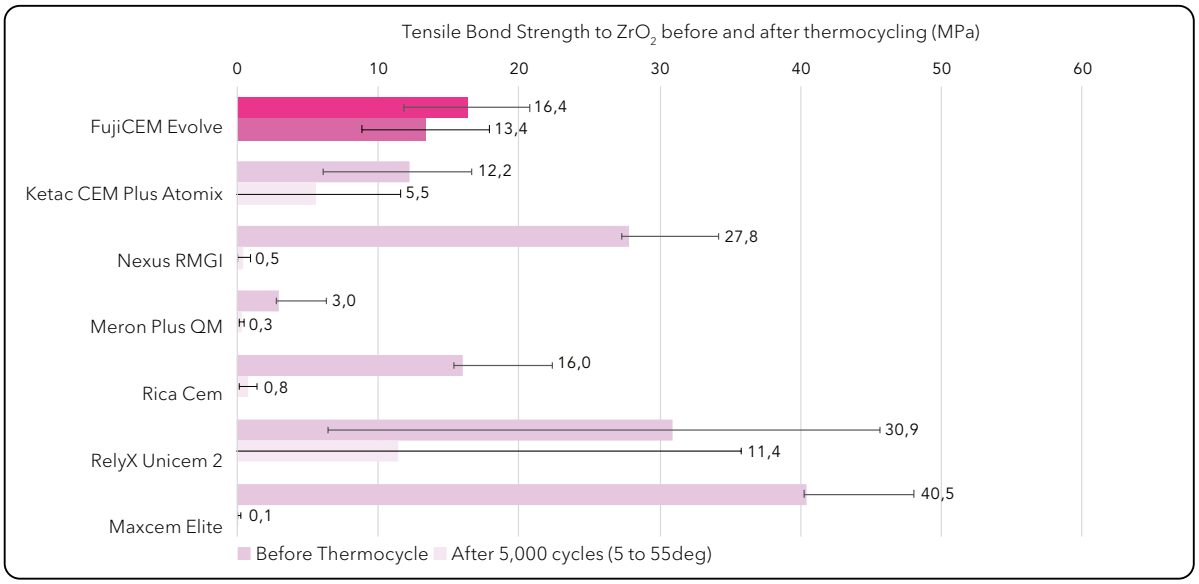


Figure 6: Bond strength to sandblasted, untreated zirconia of FujiCEM Evolve in comparison with other RMGICs, tested according to ISO/TS 11405:2015.
Source: GCC R&D, Japan. Data on file.

FujiCEM Evolve has an excellent wetting ability and adheres well to a zirconia surface as a result from intermolecular interactions and well-balanced surface forces.
The bond strength after thermocycling suggests that the bonding remains stable.

5.3 Tensile bond strength to other restoratives

The lithium disilicate, composite and leucite-reinforced glass-ceramic specimens were polished with P600 SiC paper. The feldspathic ceramic specimens were polished with P120 SiC paper. No chemical pre-treatment was applied. The bonded area was 3 mm in diameter, marked with plastic tape. Stainless steel rods were cemented as tensile appliance with the respective cement (self-cure mode) and stored at 37°C for 24h.
Tensile bond strength was measured at 24 hours from start of mix.

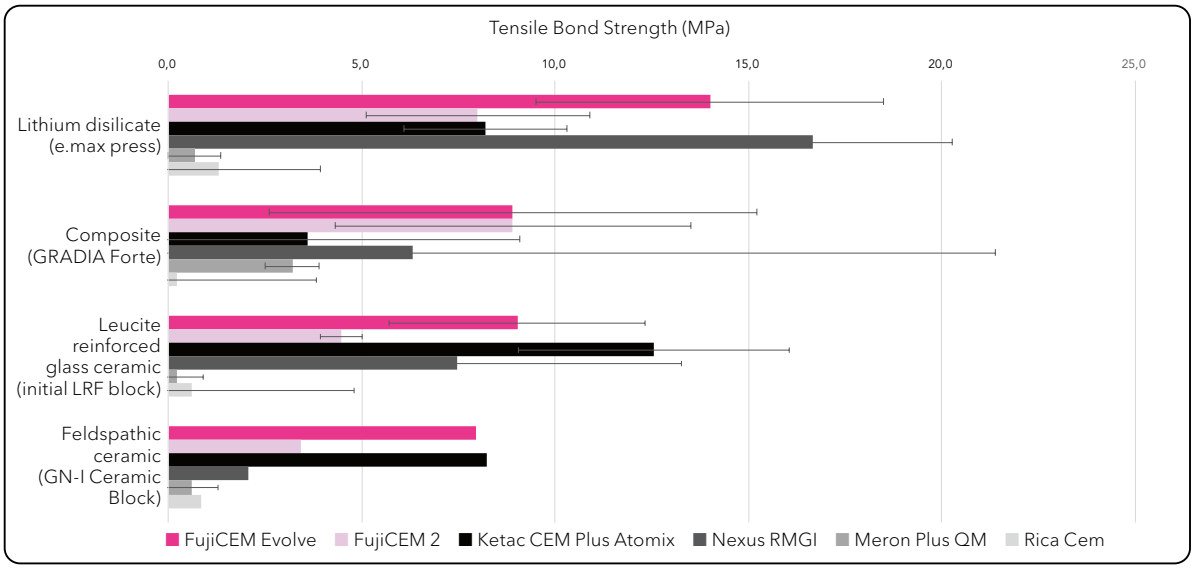


Figure 7: Bond strength to various restoratives of FujiCEM Evolve in comparison with other RMGICs.
Source: GCC R&D, Japan. Data on file.

The above data suggests that FujiCEM Evolve should perform well independently of the substrate used.

5.4 Flexural strength

Flexural strength is an indication of how well a material can resist deformation and how much force it can endure before it actually breaks. This is essential to withstand the stresses of a restoration in function.

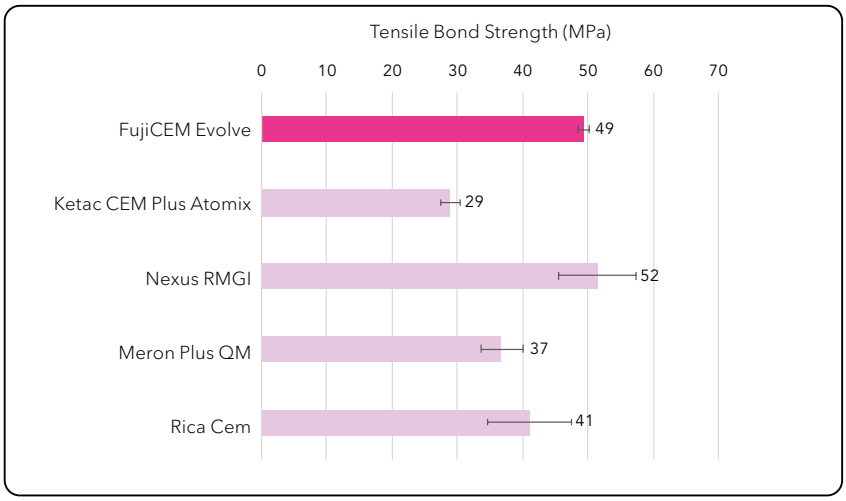


Figure 8: Flexural strength (MPa) of FujiCEM Evolve in comparison with other RMGICs, *tested according to ISO 9917-2:2017. Source: GCC R&D, Japan. Data on file.*

FujiCEM Evolve demonstrates a good flexural strength, compared to all main competitors. This is explained by its Force & Fusion technology, with reinforced super-long chain cross-linking monomers. It makes the cement stronger and increases the durability of the restoration.

5.5 Water sorption

Dental materials have to withstand the oral environment. Water sorption may cause discoloration and tension due to expansion of the cement. Mixed cements were filled in metal molds (4 mm diameter, 6 mm height) and left to self-cure. After water storage (37°C), the height was measured at several time points (24h =day 0; day 7; day 14; day 28) and linear expansion was calculated.

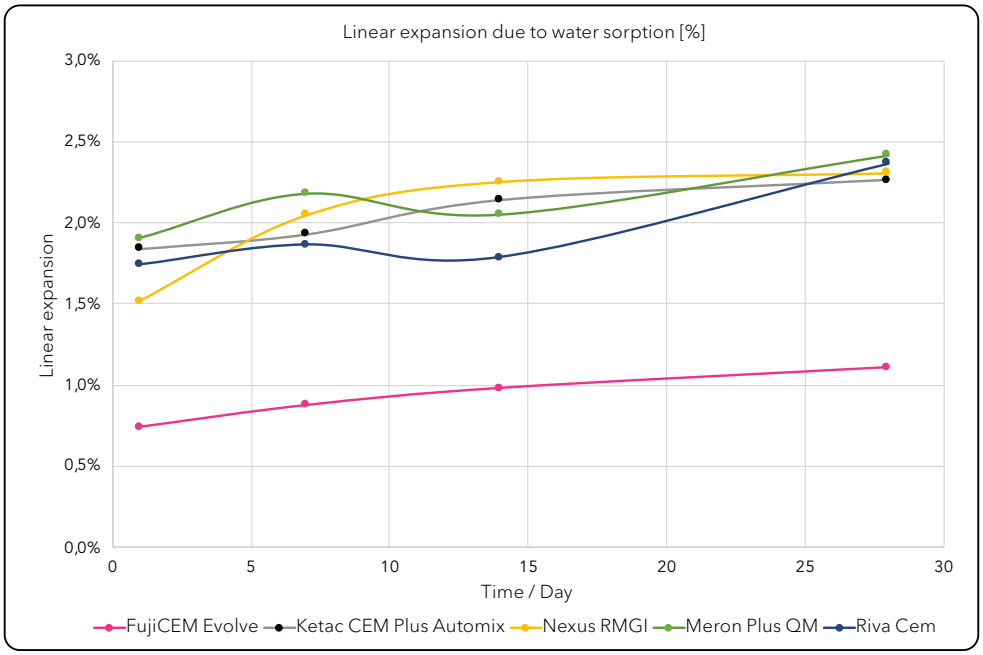


Figure 9: Linear expansion due to water sorption (%) of FujiCEM Evolve in comparison with other RMGICs (self-cure mode), tested after 24h storage in distilled water at 37°C.
Source: GCC R&D, Japan. Data on file.

FujiCEM Evolve had the lowest expansion due to water sorption, which is beneficial for the colour stability and dimensional stability of the cement. A cement with high stability causes less residual tension after cementation.

5.6 Radiopacity

Radiopacity can be an important element to detect remaining excess and thus to avoid periodontal complications.

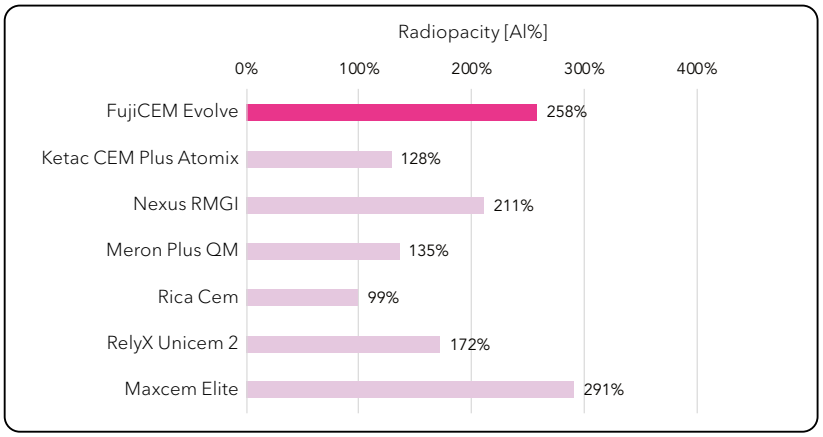


Figure 10: Radiopacity (Al%) of FujiCEM Evolve in comparison with other RMGICs
Source: GCC R&D, Japan. Data on file.

Radiopacity of FujiCEM Evolve is higher than dentine whose radiopacity is approximatively 100%. Thus, X-ray diagnosis of secondary caries and verification of residual cement excess is facilitated.

5.7 Film thickness

Film thickness measures the maximum space used by the cement between the tooth structure and the restoration. A considerable film thickness will imply a low flowability of the cement and can endanger the fit of the restoration.
To evaluate the film thickness, the difference before and after deposition of cement on 2 plates of glass is measured.

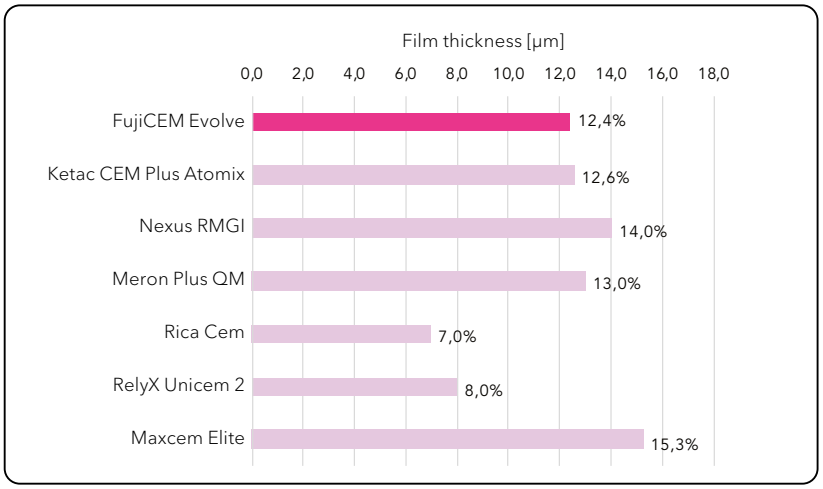


Figure 11: Film thickness (µm) of FujiCEM Evolve in comparison with other RMGICs.
Source: GCC R&D, Japan. Data on file.

The film thickness of FujiCEM Evolve is far below the maximum thickness of 25 µm as specified in the ISO Standard (ISO 9917-1:2007. Dentistry – Water-based cements – part 1: powder/liquid acid-base cements). This enables a good adaptation of the cemented restoration.

5.8 Water solubility

Dental materials have to withstand the oral environment. The water solubility of a cement should be kept low to prevent washout of exposed margins and to maintain good marginal integrity.

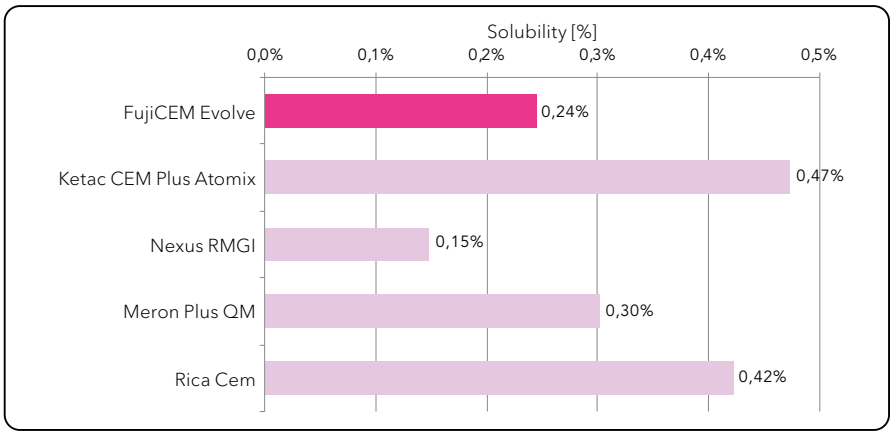


Figure 12: Water solubility (%) of FujiCEM Evolve in comparison with other RMGICs,
tested for 23h in water at 37°C in accordance with ISO 7489:1986. Source: GCC R&D, Japan. Data on file.

FujiCEM Evolve has an excellent stability in water, translated in a low solubility compared to main competitors. It can be explained by its reinforced Force & Fusion technology, demonstrating a stronger and long-lasting composition. Namely, FujiCEM Evolve guarantees a durable marginal integrity.

6. Step-by-step procedure

6.1 Tooth disinfection

Cleaning of the prepared tooth surfaces before cementation of indirect restorations is the first step of an effective luting procedure. Removal of grease, debris and remnants of provisional cement can be easily done using pumice slurry. However, it is also advised to disinfect the prepared tooth surface. This would supposedly reduce the possibility of bacterial growth under the restoration. On the other hand, some of these disinfectants may negatively influence the bond strength of luting solutions to the dental surface. That's why it's crucial to follow tooth cleaning and disinfection guidelines for the long-term success of the luting procedure.

Solutions for cleaning/disinfecting tooth preparation	Effect/Action	FujiCEM Evolve
Pumice slurry	Cleaning	✓
Hydrogen peroxide (H_2O_2)	Disinfecting, hemostatic	Possible but not advised
Sodium hypochlorite (NaClO)	Disinfecting	✓
EDTA-based solutions	Demineralising	✓
Chlorhexidine-based solutions	Disinfecting, MMP-inhibiting	✓
Alcohol	Disinfecting	✗

- Hydrogen Peroxide releases oxygen, which inhibits the polymerization of resin-based materials. FujiCEM Evolve includes a resin component at 16%. Thus, hydrogen peroxide could endanger the cementation.
- EDTA promotes the partial removal of the smear layer. It does not affect the bond strength of GICs and RMGICs. Dentin Conditioner, Cavity Conditioner and Fuji PLUS Conditioner can be used for the same purpose with the advantage of improving the bond strength of GICs and RMGICs to dentine and enamel.
- Chlorhexidine inhibits the action of metalloproteinases, host-derived enzymes responsible for the degradation of the bonding interface over time.
- Alcohol should not be used since it dehydrates the surface, which can cause post-operative sensitivity and decrease of bond strength.

In all cases, always rinse and dry after cleaning the tooth.

6.2 Restoration pretreatment

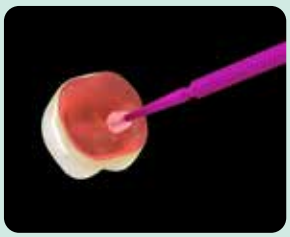
After cleaning the tooth, the restoration also needs to be pretreated, either by sandblasting or by etching.
In the case of retentive restorations such as crown and bridge to be luted with resin-modified glass-ionomer, the most common substrates used are metal, porcelain-fused-to-metal and zirconia. In these cases, sandblasting can be done in the laboratory. It is important to be advised on what has been done upfront.
In case of glass-ceramics, etching with hydrofluoric acid is advised.

PRETREATMENT OF METAL, PORCELAIN-FUSED-TO-METAL, COMPOSITE, HYBRID CERAMIC, ZIRCONIA, ALUMINA RESTORATIONS

If not done by the lab, sandblast (Al_2O_3 ≤ 50µm).

Rinse and dry.

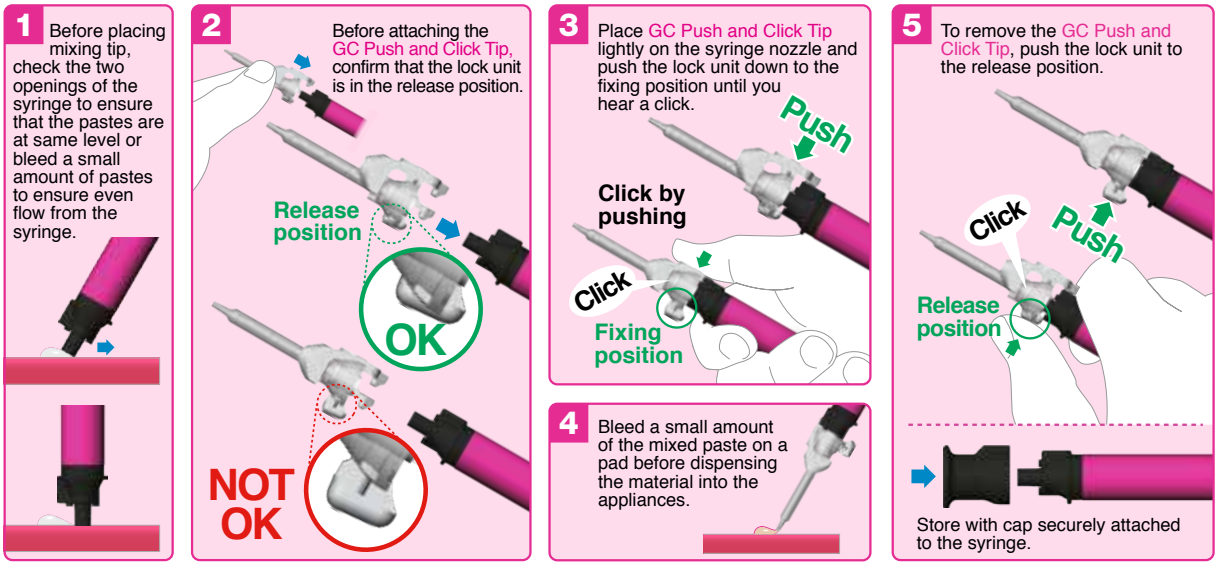
PRETREATMENT OF GLASS-CERAMIC RESTORATIONS (feldspathic ceramics, leucite-reinforced ceramics & lithium disilicate)



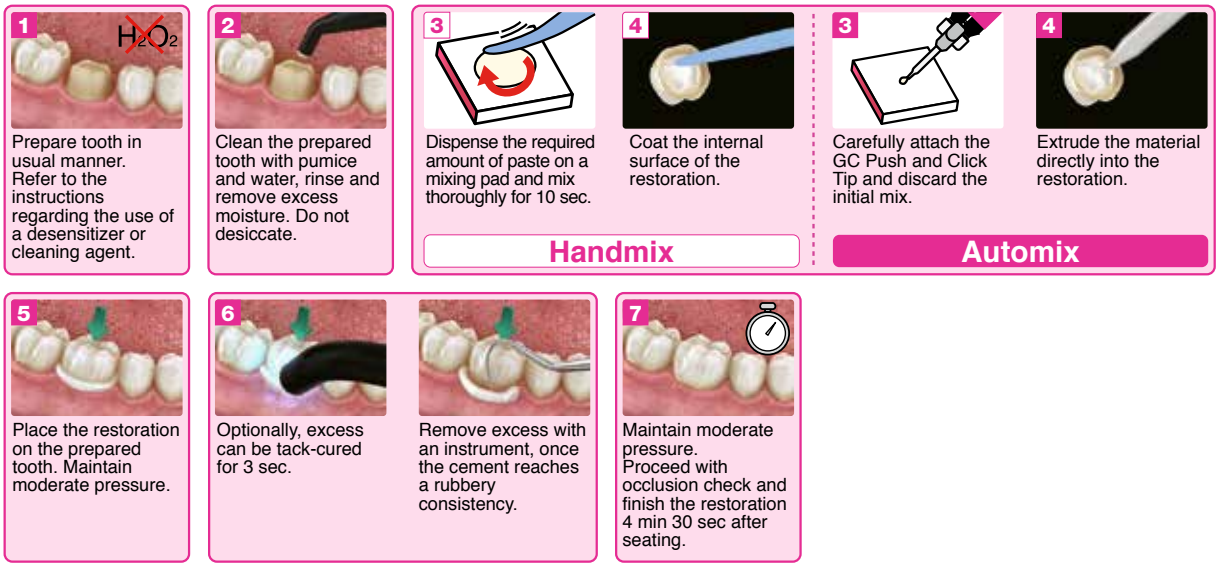
Etch with hydrofluoric acid (~ 5-9%) for 60 sec. in case of feldspatic & leucite-reinforced ceramics and for 20 sec. in case of lithium disilicate.

Rinse and dry.

6.3 “Push and Click” tip lock



6.4 Cementation protocol



7. Clinical cases

7.1 Cementation of an anterior zirconia bridge

courtesy of Dr. Javier Tapia Guadix, Spain

After cleaning the preparations, the zirconia bridge can be cemented without any pre-treatment of the teeth or the restoration. The cement excesses are easily removed after tack-curing, which makes them rubbery.

1. Pre-operative

2. Removal of old bridge and preparation

3. Provisionals in place

4. Final work

5. Cleaning of the preparation

6. Finished preparations

7. Placement of FujiCEM Evolve

8. Insertion of the final restorations

9. Tack-curing of the cement

10. Excess removal

11. Finished restorations

12. Final result

7.2 Cementation of anterior zirconia crowns

courtesy of Dr. Roberto Sorrentino, Italy

A 43-year-old male patient treated and stabilised for a previous severe chronic periodontitis asked for the aesthetic rehabilitation of both dental arches. According to the patient's requests and taking the aesthetic needs and biomechanical drawbacks of the case (i.e. deep bite, long lever arms) into consideration, 6 cubic translucent zirconia single crowns were planned, in order to achieve a natural tooth-like appearance of the restorations and optimal mechanical resistance during function.
The cementation procedure was done two by two; a good fit of all crowns was obtained.

1. Extraoral pre-operative view

2. Intraoral pre-operative view

3. Maxillary front teeth preparations for single crowns

4. Layered cubic zirconia anterior single crowns.
A internal view
B buccal view

5. PTFE-assisted cementation of the maxillary central incisors

6. Cervical cement excess removal from central incisors

7. Interproximal cement excess removal from central incisors

8. PTFE-assisted cementation of the maxillary lateral incisors

9. Light-curing of the prosthetic margins of the zirconia crowns through the oxygen barrier

10. 2-week soft tissues healing after cementation: front view of the cubic zirconia single crowns

11. Post-operative view: layered cubic zirconia single crowns at the maxillary arch and injected direct composite restorations at the mandibular arch

12. Extraoral post-operative view

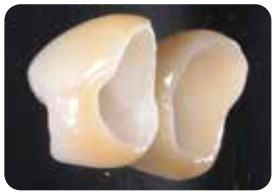
7.3 Cementation of a premolar zirconia crown

courtesy of Dr. Roberto Sorrentino, Italy

FujiCEM Evolve is ideal to cement a posterior zirconia crown, without the need for rubber dam placement. Since the cement is highly radiopaque, it can easily be verified on the post-operative X-ray that all cement excesses are properly removed.

1. Pre-op buccal

2. Pre-op occlusal



3. Monolithic tetragonal zirconia crown intaglio

4. Monolithic tetragonal zirconia crown outer

5. Cementation tip

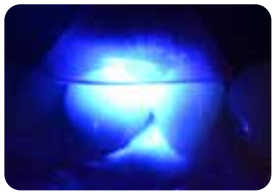
6. Cement extrusion

7. Field isolation

8. Cement excess occlusal

9. Cement excess buccal

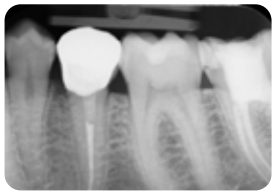
10. Cement excess removal



11. Light curing

12. Interproximal flossing

13. Occlusal check



14. Post-op X-ray

15. 2-week post-op buccal

15. 2-week post-op occlusal

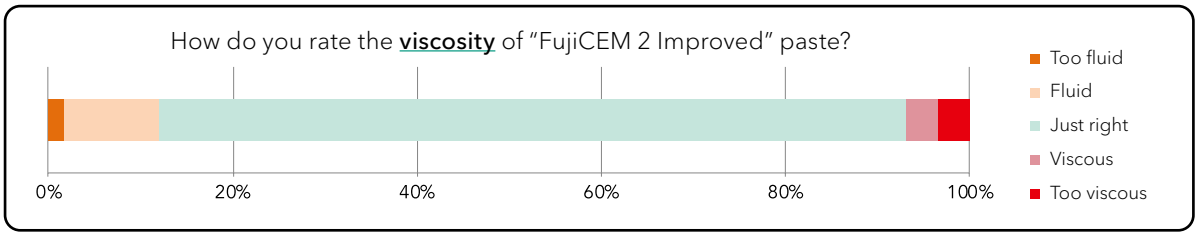
8. Clinical investigations

Based on the survey prior to launch, 58 dentists have been invited to test FujiCEM Evolve and to give anonymous feedback.
Answers were collected and treated in a confidential manner to guarantee honest replies.

Source: Survey Monkey FujiCEM 2 Improved, Questionnaire. N=58

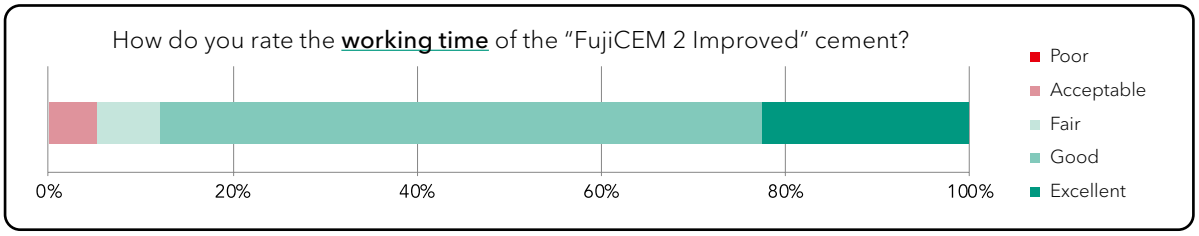
8.1 Product usage

Viscosity:



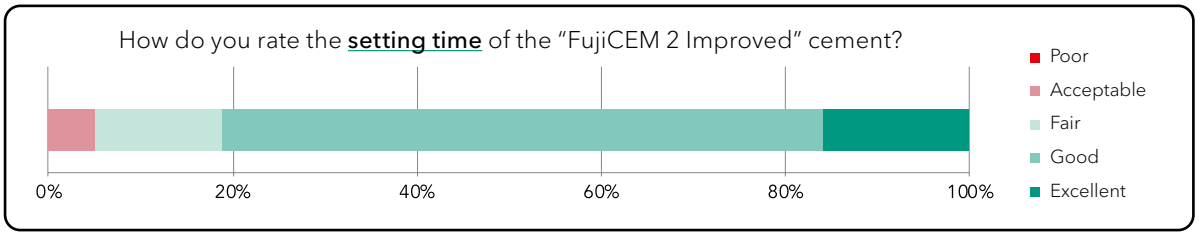
Viscosity of the cement was perceived as "Just right" for the suggested indications, for 81% of the respondants.

Working time:



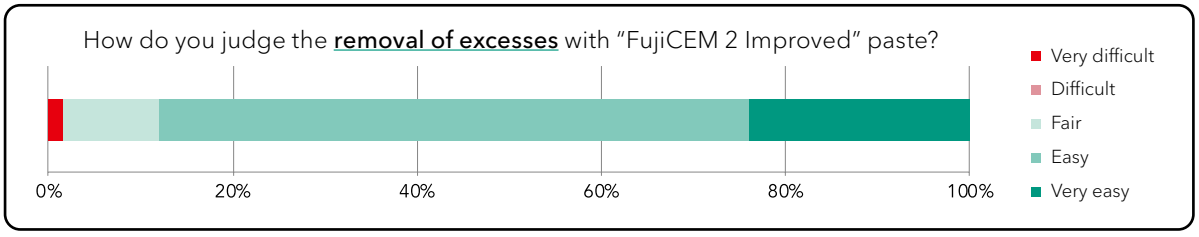
Based on current advantages of FujiCEM 2, working time remains at 2'15.

Setting time:



As for the working time, the setting time remains at 4'30 as for FujiCEM 2. It is appreciated by users, for an optimal work. 81% considered it "Good" or "Excellent".

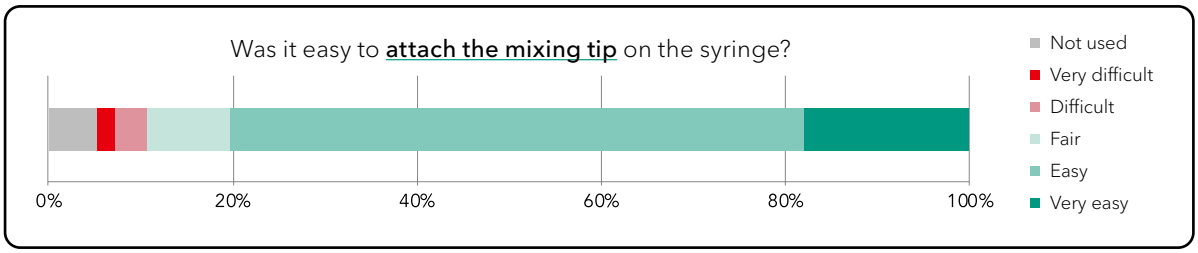
Excess removal:



The viscosity, as well as the working/setting time, has a direct impact on the excess removal. Above features having positive results, it is beneficial to make excess removal easy. On top, FujiCEM Evolve has the possibility to tack-cure the excesses to make them rubbery. It enables an easy removal, all at once.
This step is often considered tricky within the cementation procedure. For FujiCEM Evolve, excess removal was judged at 88% as "Easy" or "Very easy".

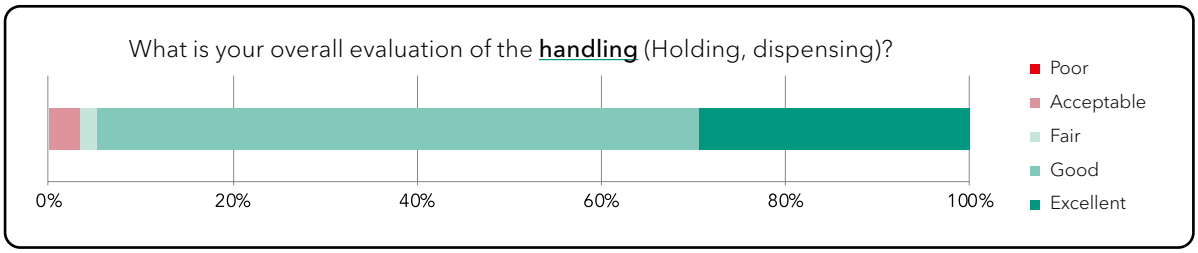
8.2 Handling & Delivery system

Mixing tips:



With FujiCEM Evolve, GC wanted to introduce a new and easy-to-use "Push and Click" mixing tip. It enables to lock with one hand, without the help of an assistant. It is a risk-free tip, as there is no wrong direction to insert the mixing tip.
All these features are translated in the field-test results, with 80% convinced of the easy tip placement.

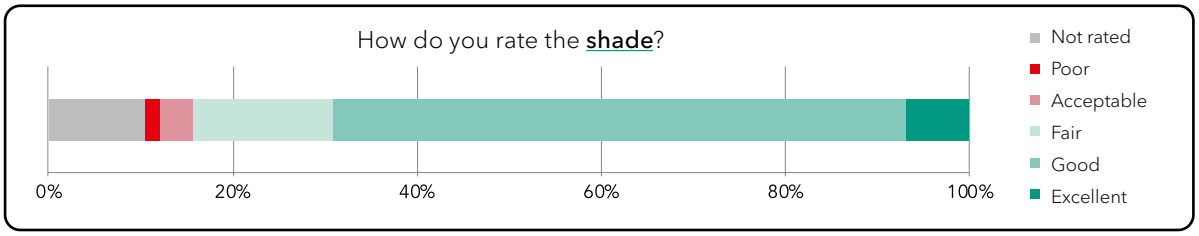
System handling:



Overall, resin-modified glass-ionomer cements are convenient products to use in luting.
For FujiCEM Evolve, the easiness is further enhanced. The syringe shape, combined with the "Push and Click" tips, makes it an easy product to handle according to 90% of the respondents.

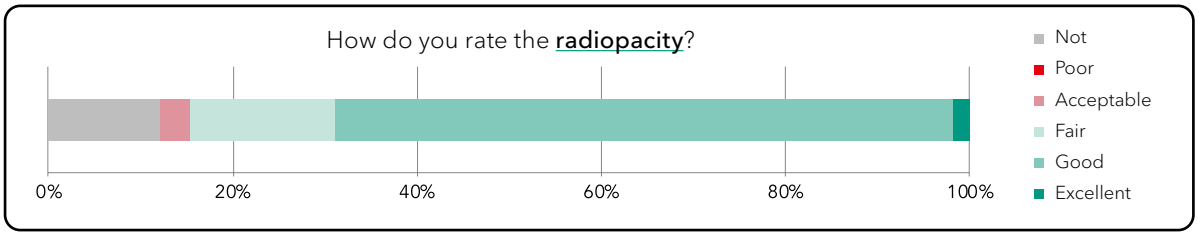
8.3 Additional features

Shade:



The FujiCEM Evolve shade has been improved to reach a universal color.
70% of respondents, making it ideal to match all routine clinical cases.

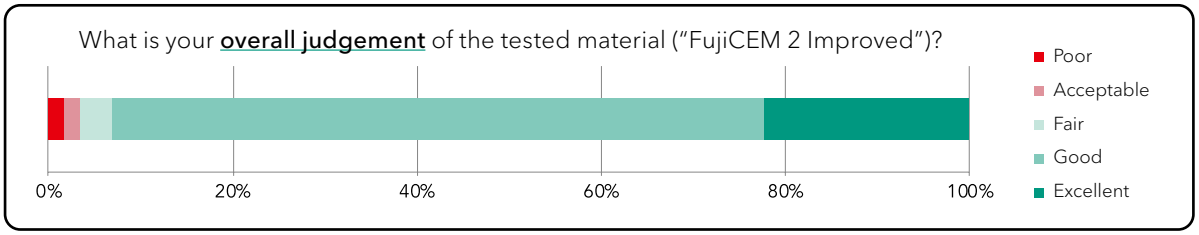
Radiopacity:



Radiopaque ytterbium fillers are used in the formulation of FujiCEM Evolve. They help to reach a better radiopacity for an easier check of cement on an X-ray. Higher radiopacity facilitates a better diagnosis of secondary caries and check for residual cement excesses.

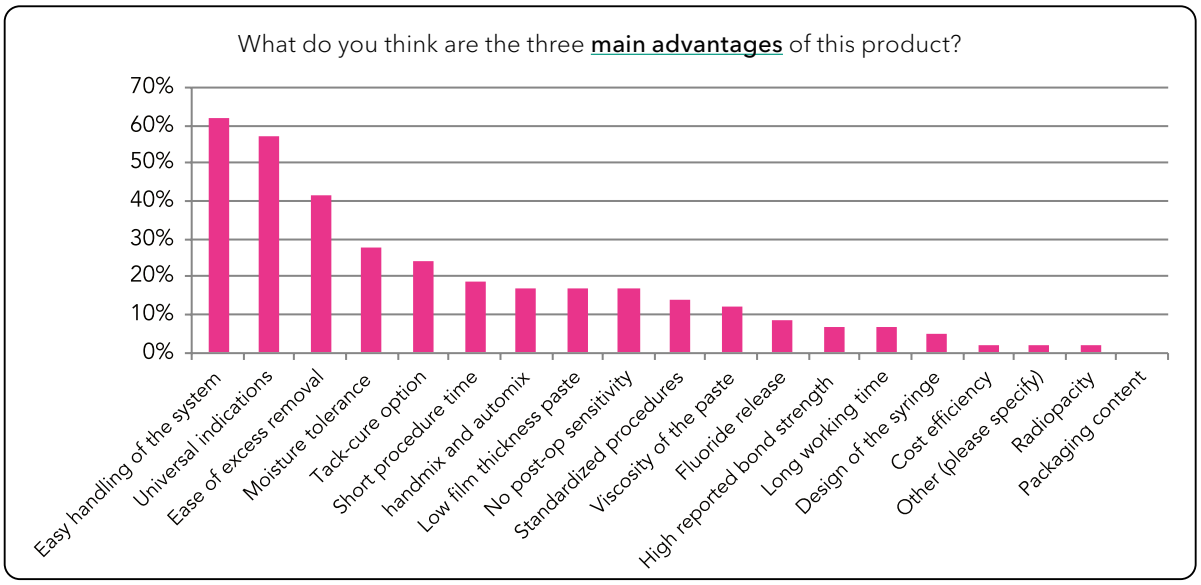
8.4 Overall judgement

Judgement:



Product is elected as "Good", even "Excellent" for 93% of the respondents. Once again, the GC leadership is confirmed in RMGIC, and positions the brand as a trend-setter in the segment.

Advantages:



When asked to go deeper into the advantages of FujiCEM Evolve respondents have clear preferences, the key features appear clearly: easy handling with the syringe shape and the "Push and Click" mixing tip, universal indications with the bonding to zirconia and easy excess removal thanks to the optimal viscosity and the tack-cure option.

9. Packaging

9.1 Packaging description

FujiCEM Evolve has been developed in different packs, in order to accomodate to all needs from traditional dental offices to large dental clinics.

	Article code WEP	Article code EEP	Description
	012948	012951	GC FujiCEM Evolve Single Pack 1 x GC FujiCEM Evolve syringe (9.2 g / 5.0 ml) 15 x GC Push and Click Tip Regular
	012949	012952	GC FujiCEM Evolve Triple Pack Handmix 3 x GC FujiCEM Evolve syringe (9.2 g / 5.0 ml) 1 x Mixing Pad #22
	012950	012953	GC FujiCEM Evolve Triple Pack Automix 3 x GC FujiCEM Evolve syringe (9.2 g / 5.0 ml) 45 x GC Push and Click Tip Regular
	013584		GC FujiCEM Evolve Clinic Pack 8 x GC FujiCEM Evolve syringe (9.2 g / 5.0 ml) 2 x Mixing Pad #22
	012954		GC Push and Click Tip Regular (x15)
	012955		GC Push and Click Tip Endo (x15)

9.2 Number of applications

FujiCEM Evolve contains on average 15 applications in a 9.2g syringe.

	Cement required (g)	Remaining cement in mixing tip (g)	Total (g)	Number of applications
For a small crown, bridges	0.15	0.35 (0.2mL)	0.5	9.2/0.5 = 18.4
For a large crown, bridges	0.30		0.65	9,2/0,65 = 14,2

10. References

10.1 Scientific sheets - in vitro studies

Simulated Generalized Wear of Luting Cements using PVS Impression Technique

Markham M, Tsujimoto A, Barkmeier W, Latta M. J Dent Res, Vol 99 (Spec Iss A): 0731
https://iadr2020.zerista.com/event/member/677730

Creighton UNIVERSITY School of Dentistry

What Is Being Tested?	• The study evaluated the simulated generalized wear of FujiCEM Evolve (FE); • Results were compared to those obtained with RelyX Luting Plus (RP), 3M.
Results	• Volume loss of wear facets were: FE=0.792 mm^3; RP=1.391 mm^3; • Mean facet depth: FE=55.3 µm; RP= 94.4 µm; • Volume loss and mean facet depth of FE were significantly lower than those of RP.
FujiCEM Evolve presented a higher wear resistance when compared to RelyX Luting Plus.	

Bonding Durability of Novel Resin-Modified Glass-Ionomer Luting Cement to Zirconia

GC CORPORATION

Ayaka F,Koji T, Daizaburo M, Tomohiro K.

https://iadr.abstractarchives.com/abstract/19iags-3176192/bonding-durability-of-novel-resin-modified-glass-ionomer-luting-cement-to-zirconia

What is being tested?

- The tensile bond strength (TBS) of FujiCEM Evolve (FCE) to Zirconia (Aadva Zr, GC) before and after thermocycling (5000 cycles);
- Results were compared to results obtained by two current luting cements, named FujiCEM 2(FC2) and RelyX Luting Plus Automix (RLPA,3M).

Results

- After thermocycling, FCE presented higher TBS values than RLPA;

TBS (MPa) (S.D.)	FCE	FC2	RLPA
0TC	16.0(4.4) Aa	12.0(4.5) Aa	12.2(4.5) Aa
5000TC	13.4(4.5) Aa	6.4(3.9) Ba	5.5(6.0) Bb

Tensile bond strength of FCE to Zirconia was not significantly affected by thermocycling.

Comparison of Different RMGI Cements Bond Strength to Zirconia

G. Joshi et al. J Dent Res J Dent Res Vol 99 (Spec Iss A): 1316, https://iadr2020.zerista.com/event/member/677792, 2020

GC AMERICA INC.

What is being tested?

- The shear bond strength (SBS) of FujiCEM Evolve (FCE) to Zirconia (GC Initial Zirconia HT) at 24h and after 5000 thermocycles;
- Results were compared to the ones obtained by other cements, named Meron Plus QM (MQM, VOCO), Nexus RMGI (NEX, Kerr Dental), RelyX Luting Plus (RLP, 3M).

Results

- FCE showed significantly higher bond strength than other cements before and after thermocycling;
- NEX showed significantly lower bond strength after thermocycling;
- All failure modes were adhesive to substrate.

Shear Bond Strength to Zirconia, MPa*

FCE	**24h**	**15.3 (2.8)**
	5000 TC	**18.7 (3.7)**
MQM	**24h**	**4.0 (2.1)**
	5000 TC	**5.8 (1.8)**
NEX	**24h**	**10.3 (2.1)**
	5000 TC	**0.5 (0.6)**
RLP	**24h**	**7.8 (1.3)**
	5000 TC	**11.3 (3.6)**

*All means were significantly different at the p=0.05 level

FujiCEM Evolve had the highest bond strength to zirconia among all the materials tested.

10.2 Scientific Sheet - Product awards

FujiCEM Evolve - 2021 Product Award

https://www.dentaladvisor.com/evaluations/fujicem-evolve/

Overview

- 34 Clinical Evaluators
- 421 Total Uses
- 96% Clinical Rating

Indications

- High-strength, all-ceramic (zirconia) crowns and bridges;
- Composite inlays, onlays, crowns, and bridges;
- All-ceramic inlays;
- Metal and porcelain-fused-to-metal (PFM) crowns and bridges.

Unique attributes

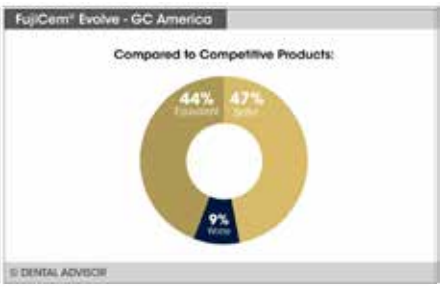
- Highest bond strength to zirconia among RMGI cements tested at DENTAL ADVISOR biomaterials lab
- High radiopacity
- Three-second tack cure
- 4 minute 30 second set time after seating
- No primer necessary when cementing retentive zirconia, lithium disilicate, or PFM restorations
- Moisture tolerant

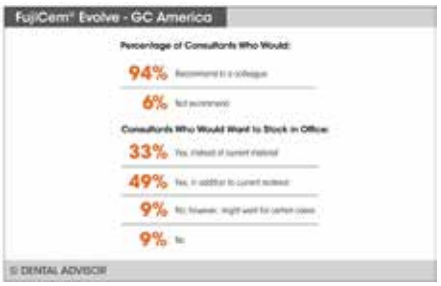
RMGI CEMENT

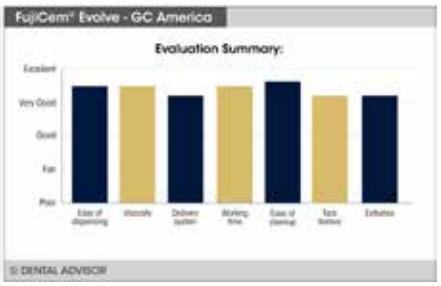
2021 TOP AWARD WINNER

DENTAL ADVISOR

GC FujiCEM® Evolve
(GC America Inc.)







10.3 Resin-modified glass-ionomer scientific sheets

Short-term clinical evaluation of a resin-modified glass-ionomer luting cement *Yoneda S , Morigami M, Sugizaki J, Yamada T.* *Quintessence Int . 2005 Jan;36(1):49-53.*	
What is being tested	• The short-term clinical performance of FujiCEM, when used for the final cementation of indirect restorations, such as inlays, crowns, and fixed partial dentures.
Design	• Short-term, 21-month, clinical evaluation; • 290 restorations (165 crowns, 71 inlays, 15 onlays, 36 fixed partial dentures, 3 implant superstructures) placed in 268 patients.
Results	• No clinical failures (eg, dislodgment, secondary caries, irritation of soft tissue, and postoperative sensitivity) were observed.
FujiCEM had promising clinical performance with inlays, crowns, onlays, fixed partial dentures, and implant superstructures at 21 months after service.	

Clinical performance of resin-modified glass-ionomer cement, flowable composite, and polyacid-modified resin composite in noncarious cervical lesions: One-year follow-up *J Conserv Dent. 2018 Sep-Oct; 21(5): 510–515.* *doi: 10.4103/JCD.JCD_51_18*	
What is being tested	• The clinical performance of a RMGIC (Fuji II LC capsules), a flowable composite (Filtek Z 350 XT) and a PMCR (Dyract extra) in NCCLs.
Design	• Short-term, 1-year follow up, randomized clinical trial; • 101 restorations were evaluated at baseline, 6 and 12 months.
Results	• All materials presented retention rates above 95% at 12 months; • RMGIC has shown superior performance than flowable composite and PMCR regarding marginal adaptation and marginal discoloration.
RMGICs are superior regarding marginal adaptation and esthetics for restoring NCCLs.	

Notes

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