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# SCIENTIFIC PRODUCT INFORMATION

## *CLEARFIL™ SA LUTING*

*SELF-ADHESIVE RESIN CEMENT*

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# 1. INTRODUCTION

CLEARFIL™ SA LUTING is a self-adhesive resin cement that features a dual-cure (light- and/or self-cure) formulation and is fluoride-releasing. It has been developed for cementing indirect restorations made of metal, all-ceramic (Zirconia, Alumina), composite resin.

CLEARFIL™ SA LUTING does not require phosphoric acid treatment or any special primer or adhesive for bonding to tooth structures. This simplified self-adhesive resin cement provides a relatively higher level of adhesion and mechanical strength compared with other general-purpose cements (such as other self-adhesive cements, glass ionomer cements, resin-modified glass ionomer cements, zinc phosphate cements, or polycarboxylate cements); thereby resolving problems encountered with complicated procedures and insufficient bond strength in the cementing of crowns, bridges, inlays and onlays, or fixing prefabricated dental posts in daily clinical cases.

CLEARFIL™ SA LUTING is almost not affected by the dryness on the adherend surface of the tooth structure due to Kuraray'sadhesion technology (based on a proprietary adhesive phosphate monomer). In addition, the water sorption of CLEARFIL™ SA LUTING is lower than that of general luting cements and thereby is very forgiving of clinical technique.

Furthermore, this reliable and simplified self-adhesive cement offers unrivaled easy removal of excess cement. This makes it possible to achieve easier clean-up with short chair time and without damaging the gingiva.



# 2. HISTORY AND TECHNOLOGY

## RESIN CEMENTS (COMPOSITE CEMENTS)

Resin cements can be further segmented into three types according to their polymerization method: light-cure, self-cure and dual-cure types. Moreover, it is possible to find low, medium, high, or ultra-high viscous resin cements. In general, chemical polymerization is induced by a redox catalyst using peroxide and amine, and light polymerization is induced by a photo-polymerization initiator (dl-Camphorquinone). Pure light-cure cement is rarely used in the actual clinical setting except for making veneer restorations. For most of indirect restorations, self-cure or dual-cure cements are used.

The bond strength of dental cements to tooth structures and various prosthetic materials has recently been improved, thanks to striking advances in adhesion technology. The use of adhesive resin monomer in restorative dental materials has particularly opened the new era of “adhesive dentistry” that can not only be used for direct restorations but also for indirect ones.

PANAVIA™ EX, developed by Kuraray in 1983, was the world’s first adhesive resin cement containing adhesive monomer MDP and is one of the materials that have contributed greatly to indirect restorations. At that time, it was difficult to polymerize adhesive monomer sufficiently with conventional redox catalysts, although the adhesive monomer held the promise of providing excellent adhesion. To achieve a cement containing adhesive monomer that would have the hoped-for adhesive and mechanical properties and also cure well, Kuraray created a novel type of redox catalyst (a peroxide/amine/aromatic sulfinic acid salt). Even now, many researchers are studying the development of new adhesive monomers and polymerization initiators.
Adhesive resin cements have advantages over conventional or hybrid cements for cementing dental restorations in the oral cavity. They can be used in a variety of indications, thanks to their high resistance to compression and outstanding bond strength. Since adhesive resin cements are nearly insoluble in water, there is no elution of this cement in effect, in contrast to conventional cements. There is also no need for the remaining tooth structure to be shaped into an extreme retention form.

The current thinking concerning restoration procedures is that the amount of tooth reduction should be minimized, to conform to the ideal of minimal intervention (MI). From this perspective, it is desirable to avoid relying too much on the principle of mechanical interlocking force, particularly in the preparation of inlays or onlays. High performance resin cement systems, concomitantly used with an adhesive or self-etching primer, have thus been developed to improve the bond strength of cements to tooth structure. In addition, various adhesive primers are now commercially available, used with a view to enhancing the bond strength of cements to prosthetic materials.

The high performance resin cement system is not used very often in a daily indirect restoration treatment, however, because of its complicated bonding procedure. Its use is generally limited to cases which require very strong bond strength, such as: adhesion bridges, veneer restorations, or cases where so much tooth structure is lost that it is difficult to make a proper retention form.

In spite of the MI concept, conventional cements are still being widely used. In the context of current clinical realities, recently self-adhesive resin cements with simplified procedure like conventional luting cements have been developed and got many people's interest.

A self-adhesive resin cement essentially does not require any special adhesive or primer. Although it does not bond quite as strongly as high performance resin cements, its ease of handling and excellent physical properties make it superior to conventional cements in many regards, and thus it is becoming a mainstream cement material for indirect restoration.

Resin cements are classified into the following three categories.

### TOTAL-ETCHING SYSTEM

» Phosphoric acid agent / Primer / Bond / Cement

» Phosphoric acid agent / Bond / Cement

### SELF-ETCHING PRIMER SYSTEM

» Self-etching primer / Bond / Cement

» Self-etching primer / Cement

### SELF-ETCHING CEMENT SYSTEM

» Self-adhesive cement

Self-adhesive cements have very mild acidity and show lower post-operative sensitivity like a self-etching primer system. Moreover, self-adhesive cements that are both easy to use and show excellent physical properties are suitable for the cementation of crowns, bridges, inlays, and onlays as well as the fixation of prefabricated dental posts in a daily indirect restoration. A new self-adhesive resin cement, **CLEARFIL™ SA LUTING**, that has been developed recently by Kuraray, provides a reliable bond between a tooth and a metal or ceramic restoration material.

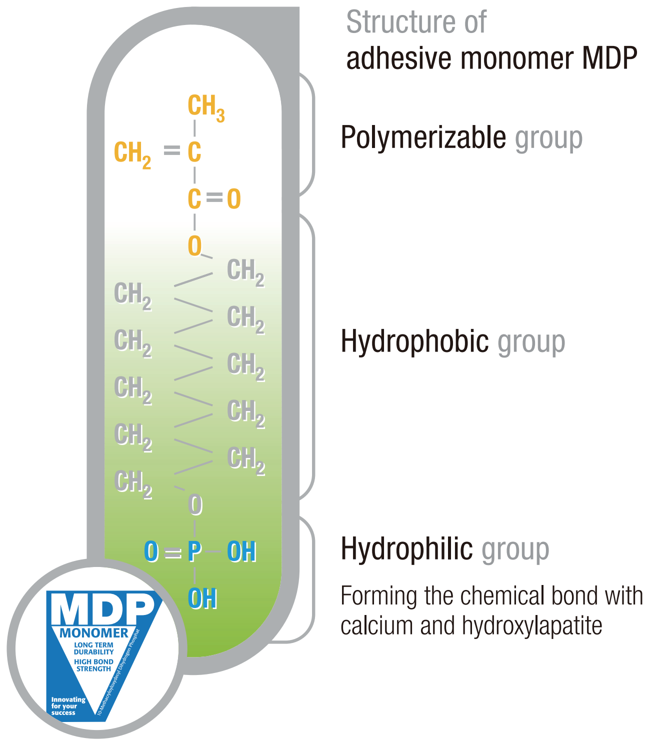


## CHARACTERISTICS OF AN ADHESIVE PHOSPHATE MONOMER (MDP)

**MDP** (10-methacryloyloxydecyl dihydrogen phosphate) created by Kuraray is an excellent adhesive phosphate resin monomer. The adhesive monomer shows high bond strength to hard tissue (e.g. hydroxylapatite, dentin, enamel), metal (e.g. gold, silver, titanium, stainless, aluminum), metal oxide (e.g. zirconia, alumina), composite resin including inorganic filler. The exceptional adhesive characteristics are led due to its unique structure formula which is composed of polymerization group, dihydrogen phosphate group and long carbon (long alkylene) chain. In addition, the dissolvability of the calcium salt of the acid has been comparatively studied. A lower dissolvability is the expression of a very stable chemical bond to the hydroxylapatite surface. Studies conducted with the help of the atomic absorption spectroscopy (Yoshida et al., I Dent Res 83(6) 454 - 458, 2004) have demonstrated major differences between the systems. The dissolvability rate of the calcium salt of 4-MET monomer (4-methacryloxyethyl trimellitic acid) (1.36 g/L) was about 200 times greater than that of **MDP** monomer (6.79 mg/L). The calcium salt created from **MDP** thus turns out to be especially stable in hydrolysis and effective in the chemical bonding to dentin and enamel. **MDP** is thus the key to **CLEARFIL™ SA LUTING**.

Fig. 3

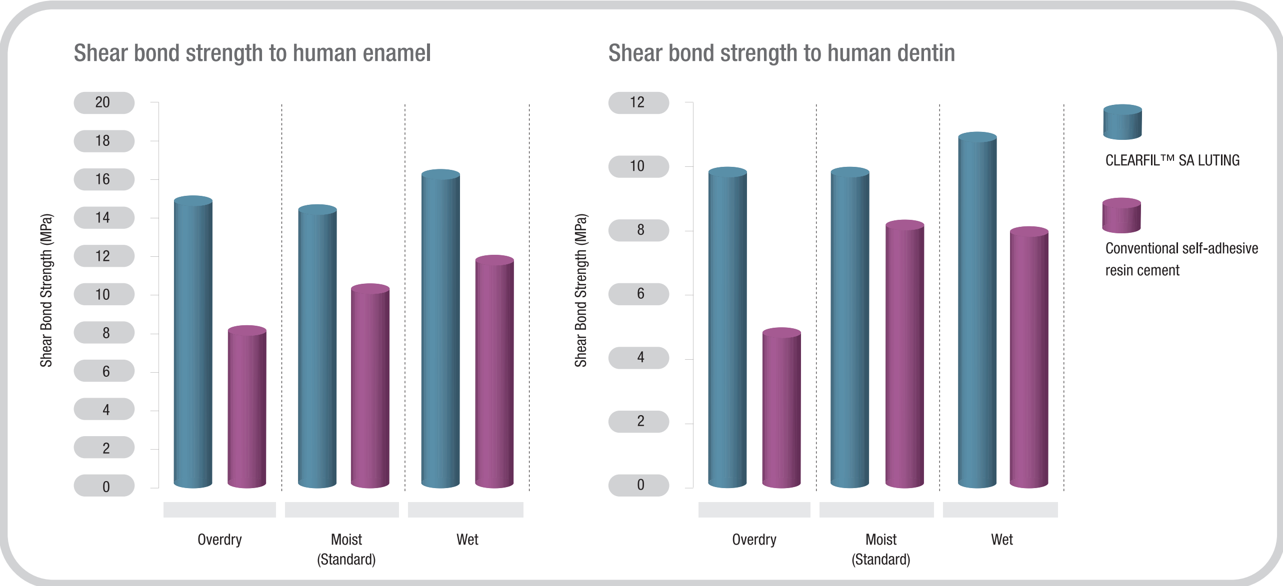
Structure of the adhesive monomer MDP




- **MDP** is a dihydrogen phosphate adhesive monomer with mild acidity.
- The chemical structure contains unique hydrophobic group, but it is easy to penetrate into dentin due to the superior surface-active property.
- The chemical bond to the hydroxylapatite is established quickly. A stable adhesive bond is thus created during the clinical preparation.
- The high chemical bonding capacity to hydroxylapatite provides good adhesion to the enamel even without a deep etching pattern.
- The dissolvability of the calcium salt which is formed is very low. This significantly improves the longterm adhesive effect to tooth structures.
- The excellent adhesion durability characteristics are created not only to tooth structures but also to metal, metal oxide or composite including inorganic filler.

The affinity of **CLEARFIL™ SA LUTING** for tooth structure has been improved by Kuraray's long cultivated bonding technology. The technology has enabled **MDP** to penetrate effectively into the tooth structures. **CLEARFIL™ SA LUTING** is so designed that its bond strength is hardly affected by dryness on the tooth surface with a view to getting the most out of the self-adhesive system.

Fig. 4
Influence of surface condition (wet/dry) for shear bond strength to human tooth structures (Source: Kuraray Noritake Dental Inc., Japan)






# 3. PRODUCT DESCRIPTIONS: CLEARFIL™ SA LUTING

**CLEARFIL™ SA LUTING** is a self-adhesive resin cement that features a dual-cure (light- and/or self-cure) formulation and is fluoride-releasing. It has been developed for cementing indirect restorations made of metal, all-ceramic (Zirconia, Alumina), composite resin. **CLEARFIL™ SA LUTING** does not require phosphoric acid treatment or any special primer or adhesive for bonding to tooth structures.

This simplified self-adhesive resin cement provides a relatively higher level of adhesion and mechanical strength compared with other general-purpose cements (such as other self-adhesive conventional luting cements); thereby resolving problems encountered with complicated procedures and insufficient bond strength in the cementing of crowns, bridges, inlays and onlays, or fixing pre-fabricated dental posts in daily clinical cases.

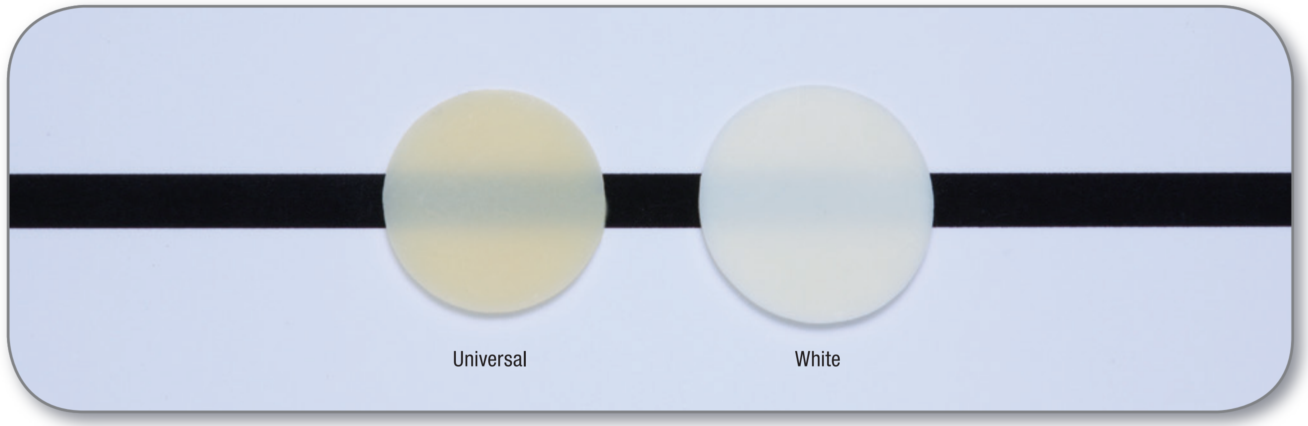
## 3.1 INDICATIONS

[1] Cementation of crowns, bridges, inlays and onlays made of ceramic (such as zirconia or alumina), composite resin or metal.
[2] Cementation of metal cores, resin cores, metal posts or glass fiber posts.

## 3.2 SHADES

**CLEARFIL™ SA LUTING** comes in two shades, Universal and White. The Universal shade closely resembles tooth color and provides good color matching. The White shade provides high visibility due to contrast, so it can be distinguished easily from the tooth or restorations, making it easier to remove excess cement paste.

Fig. 5
Shades of CLEARFIL ™ SA LUTING



## 3.3 COMPOSITION AND PRINCIPLE INGREDIENTS

**CLEARFIL™ SA LUTING** has a inorganic filler load of 65wt% (44vol%). **CLEARFIL™ SA LUTING** has sufficient adhesive monomer **MDP** to provide the self-adhesive characteristics to the cement. The cement's affinity for tooth structure has been improved by Kuraray's long cultivated bonding technology. This has enabled the **MDP** to penetrate effectively into the tooth structures. In addition, with a view to getting the most out of the self-adhesive system, the cement also contains Kuraray's proprietary dual-cure catalyst (the original redox catalyst and photo-polymerization initiators). A clinically appropriate curing speed and excellent physical properties are also achieved. Furthermore, **CLEARFIL™ SA LUTING** assures stable, reliable quality thanks to the newly discovered "special distribution technology for the polymerization accelerator."

In addition to benefiting from the skillful use of catalyst technology, **CLEARFIL™ SA LUTING** also contains cross-linking monomers that provide good polymerization characteristics, and create a dense cross-linking structure. Its inorganic filler content (65wt%) contributes to great mechanical strength, thus making it possible to make a stable indirect restoration even when the restoration has a loose marginal adaptation. Pastes A and B contain barium glass filler to provide high x-ray opacity (130%Al).

### CLEARFIL™ SA LUTING

#### PASTE A

Bis-phenol A diglycidylmethacrylate **(Bis-GMA)**
Triethyleneglycol dimethacrylate **(TEGDMA)**
10-Methacryloyloxydecyl dihydrogen phosphate **(MDP)**
Hydrophobic aromatic dimethacrylate
Silanated barium glass filler
Silanated colloidal silica
dl-Camphorquinone
Benzoyl peroxide
Initiator

#### PASTE B

Bis-phenol A diglycidylmethacrylate **(Bis-GMA)**
Hydrophobic aromatic dimethacrylate
Hydrophobic aliphatic dimethacrylate
Silanated barium glass filler
Silanated colloidal silica
Surface treated sodium fluoride
Accelerators
Pigments



## 3.4 IN VITRO INVESTIGATIONS

### 3.4.1 BOND STRENGTHS

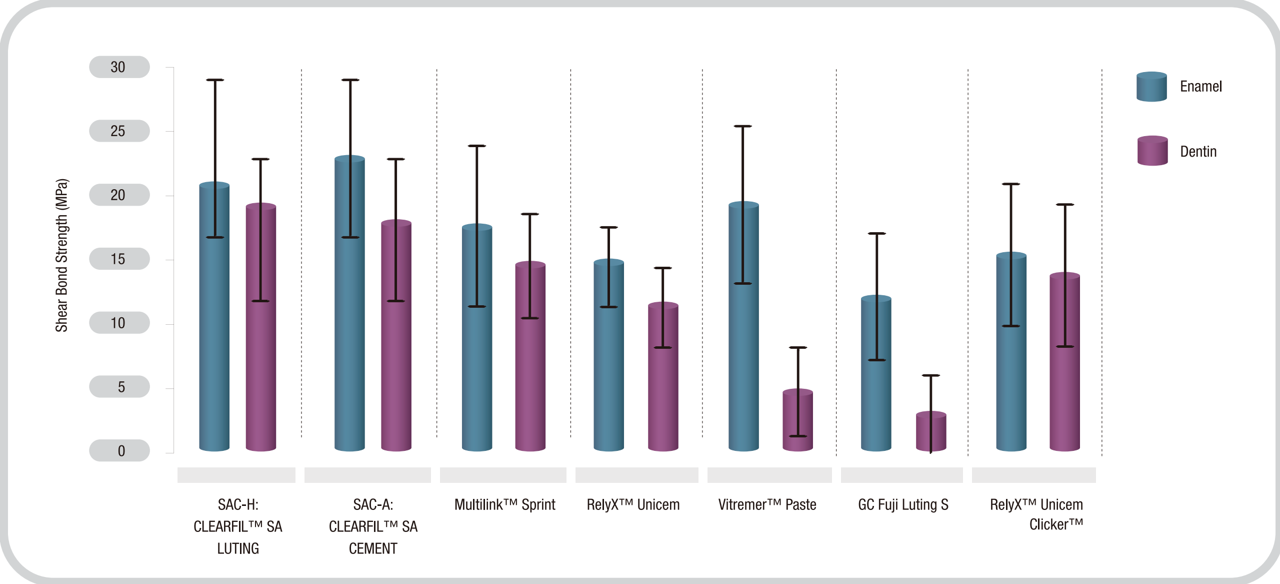
#### BOND STRENGTH TO TOOTH STRUCTURES

SHEAR BOND STRENGTH TO ENAMEL AND DENTIN

(N.Iwamoto, S.Uctasli, M.Ikeda, M.Nakajima, J.Tagami, Tokyo Medical and Dental University, Japan).

Superficial enamel and dentin surface from extracted human molars were used for the study. Tooth specimens were ground flat and polished with wet #1000 grit silicon carbide paper and embedded in a plastic ring. SUS tip was cemented on the prepared surface with one of the self-adhesive cements and stored in water for 24 h at 37°C before testing. Rings were placed into the alignment and shear bond strength was tested at a cross head speed of 1 mm/min. Experimental self-adhesive cement (SAC-H): **CLEARFIL™ SA LUTING** and (SAC-A): **CLEARFIL™ SA SEMENT** had a tendency to show the highest shear bond strength for both enamel and dentin.

Fig. 6
Shear bond strength to enamel and dentin (Source: N. Iwamoto, S. Uctasli, M. Ikeda, M. Nakajima, J. Tagami, Tokyo Medical and Dental University, Japan)



## SHEAR BOND STRENGTH TO ENAMEL AND DENTIN

(Kuraray Noritake Dental Inc., Japan)

All specimens (human enamel or dentin) were dressed using wet SiC papers of up to 1000 grit. Stainless steel cylinders were adhered to the substrate surfaces with each luting material, which were cured by dual-curing (for dual-curing cements) or self-curing (for self-curing cements) according to each manufacturer's instruction. Shear bond strengths of **CLEARFIL™ SA LUTING** and some commercialized luting materials were measured at a cross head speed of 1 mm/min after storage in 37˚C water for 24 h and after subsequent thermal cycling (4°C/60°C, 3000 cycles). **CLEARFIL™ SA LUTING** showed relatively higher bond strength to human enamel and dentin than the tested other self-adhesive luting materials.

Fig. 7

Shear bond strength to human enamel (Source: Kuraray Noritake Dental Inc., Japan)

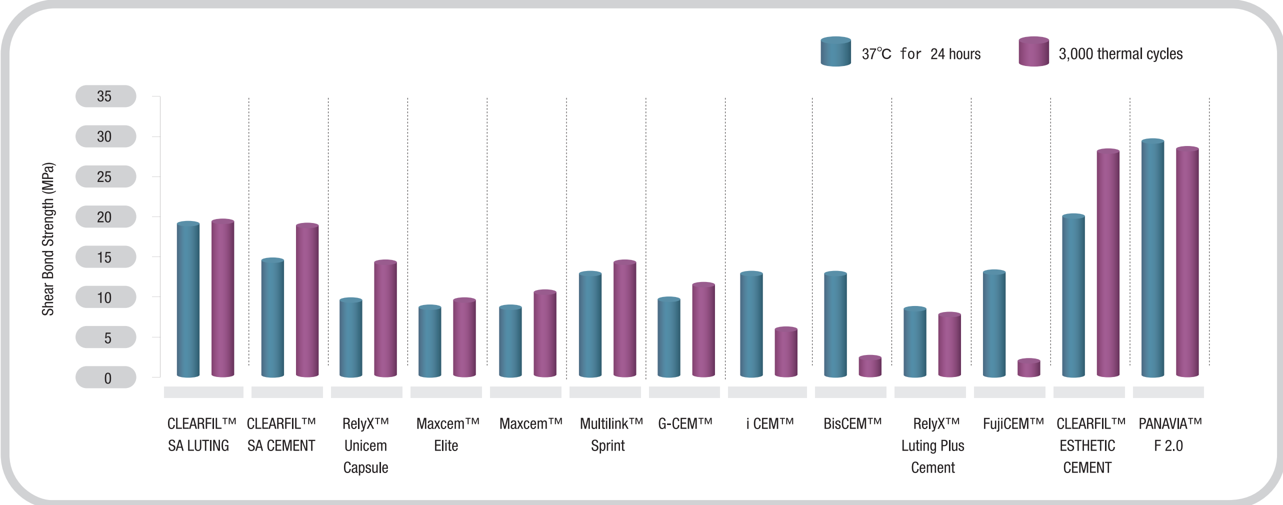
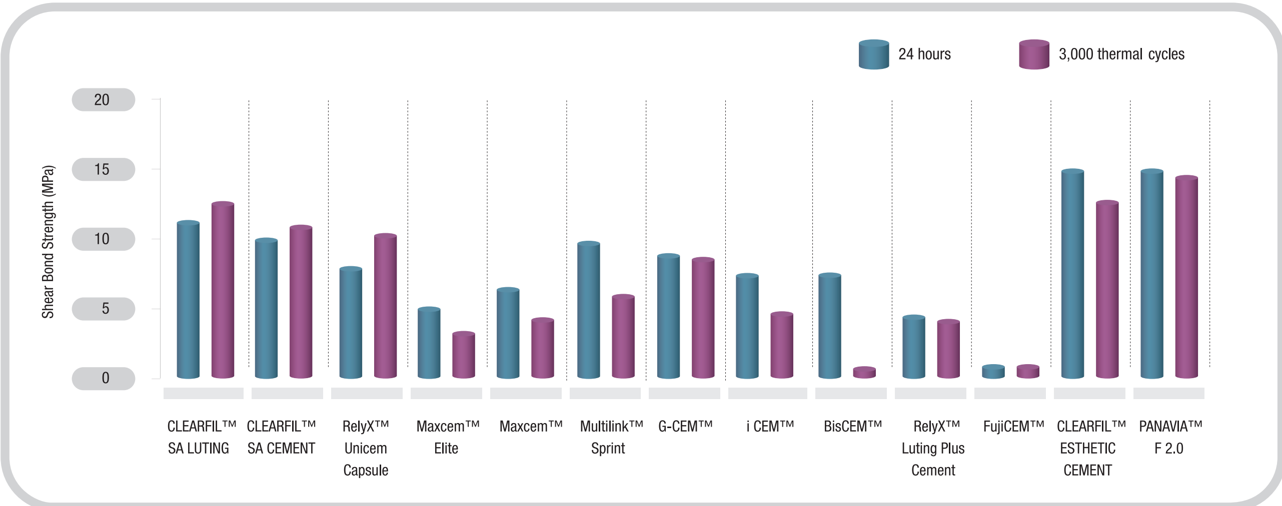



Fig. 8

Shear bond strength to human dentin (Source: Kuraray Noritake Dental Inc., Japan)






## BOND STRENGTH TO METAL OXIDE CERAMIC

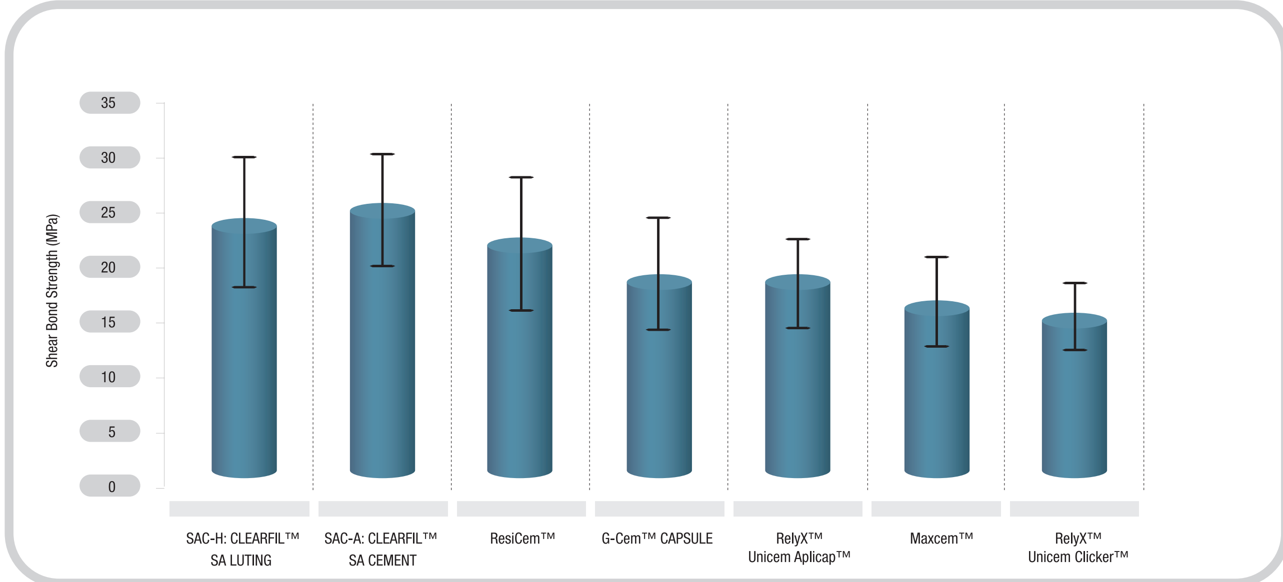
### SHEAR BOND STRENGTH TO ZIRCONIA (Lava™)

(M. Irie, M. Oka, Y. Maruo, G. Nishigawa, S. Minagi, K. Suzuki, Okayama University, Japan)

Six self-adhesive resin cements and an adhesive resin cement: ResiCem™, as a control, were used in this study. The surface of Lava™ was pretreatd by sandblasting with 50 micron aluminum-oxide particles. The case of ResiCem™ was pretreated by manufacturer's instruction. A stainless steel rod (SUS) inlay, approximately 3.5 mm in diameter and approximately 2 mm in height, was prepared and inserted into a Teflon mold, 3.6 mm in diameter and 2.0 mm in height, using seven resin cements. The measurement of shear bond strength between the SUS inlay and Lava™ was performed using a universal testing machine after one-day storage. The experimental self-adhesive cement (SAC-H): **CLEARFIL™ SA LUTING** and (SAC-A): **CLEARFIL™ SA SEMENT** showed good bond strength to zirconia (Lava™).

Fig. 10

Shear bond strength of self-adhesive resin cement to zirconia (Lava™)
(Source: M. Irie, M.Oka, Y.Maruo, G. Nishigawa, S. Minagi, K. Suzuki, Okayama University, Japan)

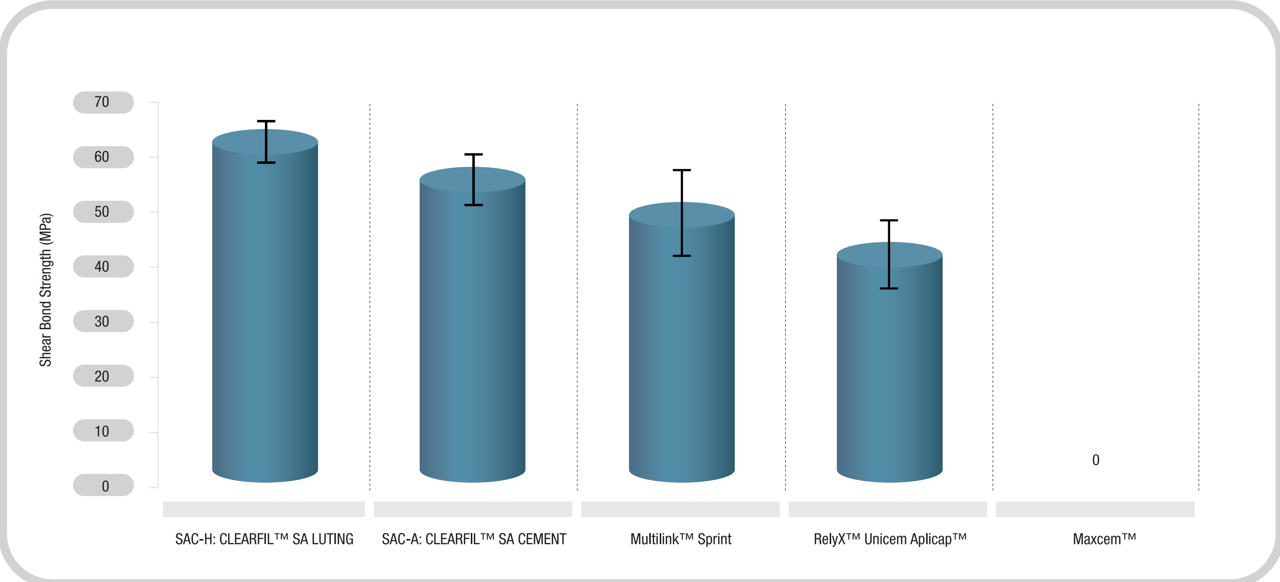


## SHEAR BOND STRENGTH TO ZIRCONIA (Cercon™)

(S. Murahara, H. Minami, H. Kurashige, S. Hori, K. Sakoguchi, T. Onizuka, T. Tanaka, Kagoshima University, Japan)

Pairs of disk specimens (10 mm in diameter by 3 mm in thickness, and 8 mm in diameter by 3 mm in thickness) were prepared using a dental zirconia system (Cercon™). Bonding surfaces of disks were polished with 600-grid silicon carbide paper and air abraded with 50 µm alumina particles. Bonding area was regulated using an adhesive tape with an opening (5 mm in diameter). Shear bond specimens were fabricated by bonding a pair of disks using one of four self-adhesive cements. Number of test specimens was 5 for each group. Test specimens were immersed in 37°C distilled water for 24 h. Shear bond strength was determined after thermo-cycling (4°C - 60°C, 1-minute dwell time, 50,000 cycles) at a crosshead speed of 1.0 mm/min. The experimental self-adhesive resin cement (SAC-H): **CLEARFIL™ SA LUTING** and (SAC-A): **CLEARFIL™ SA CEMENT** provided excellent and clinically acceptable bonding to zirconia compared to other self-adhesive cements.

Fig. 11
Shear bond strength of self-adhesive cements to zirconia (Cercon™) after 50,000 thermo-cycling.
(Source: S. Murahara, H. Kurashige, H. Minami, S. Hori, K. Sakoguchi, T. Onizuka, T. Tanaka, Kagoshima University, Japan)



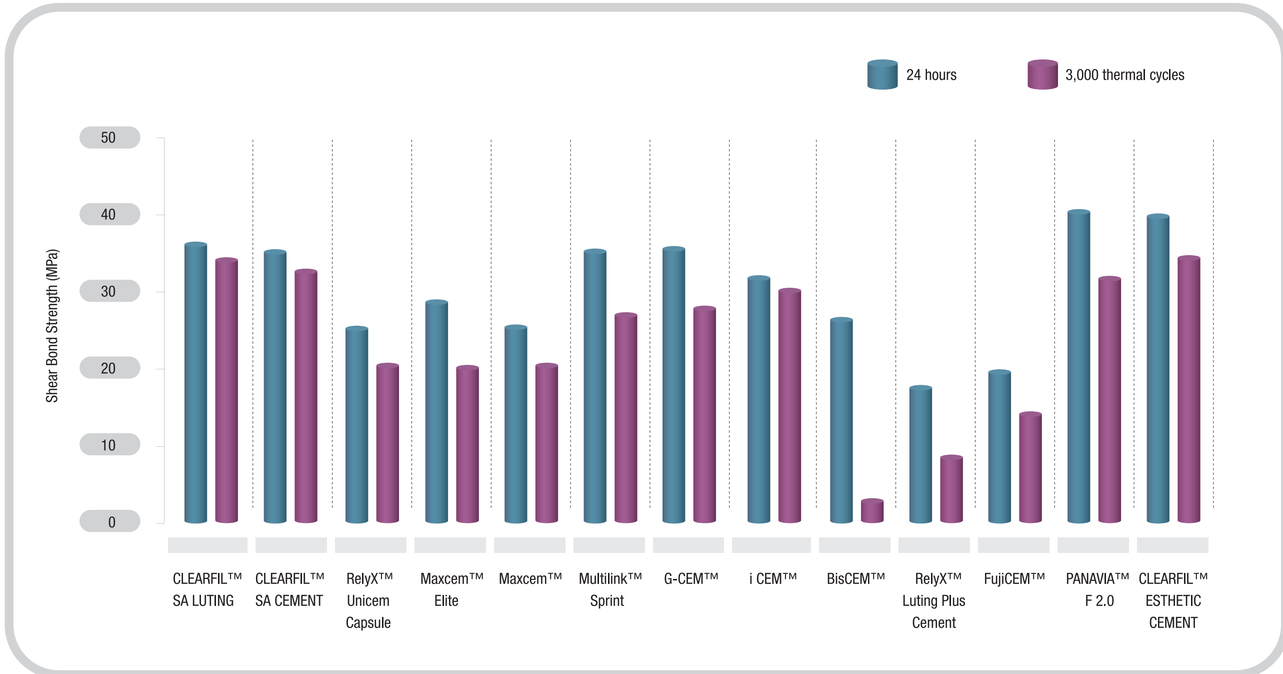



## SHEAR BOND STRENGTH TO ZIRCONIA (Cercon™)

(Kuraray Noritake Dental Inc., Japan)

All specimens were dressed using wet SiC papers of up to 1000 grit and treated by sandblast (50 µm alumina particles). Stain-less steel cylinders were adhered to the substrate surfaces with each luting material, which were cured by dual-curing (for dual-curing cements) or self-curing (for self-curing cements) according to each manufacturer's instruction. Shear bond strengths of **CLEARFIL™ SA LUTING** and some commercialized luting materials were measured at a cross head speed of 1 mm/min after storage in 37˚C water for 24h and after subsequent thermal cycling (4°C/60°C, 3000 cycles). **CLEARFIL™ SA LUTING** showed relatively higher bond strength and adhesion durability to zirconia (Cercon™) than the tested other self-adhesive luting materials.

Fig. 13
Shear bond strength to zirconia (Cercon™) (Source: Kuraray Noritake Dental Inc., Japan)



## BOND STRENGTH TO METAL

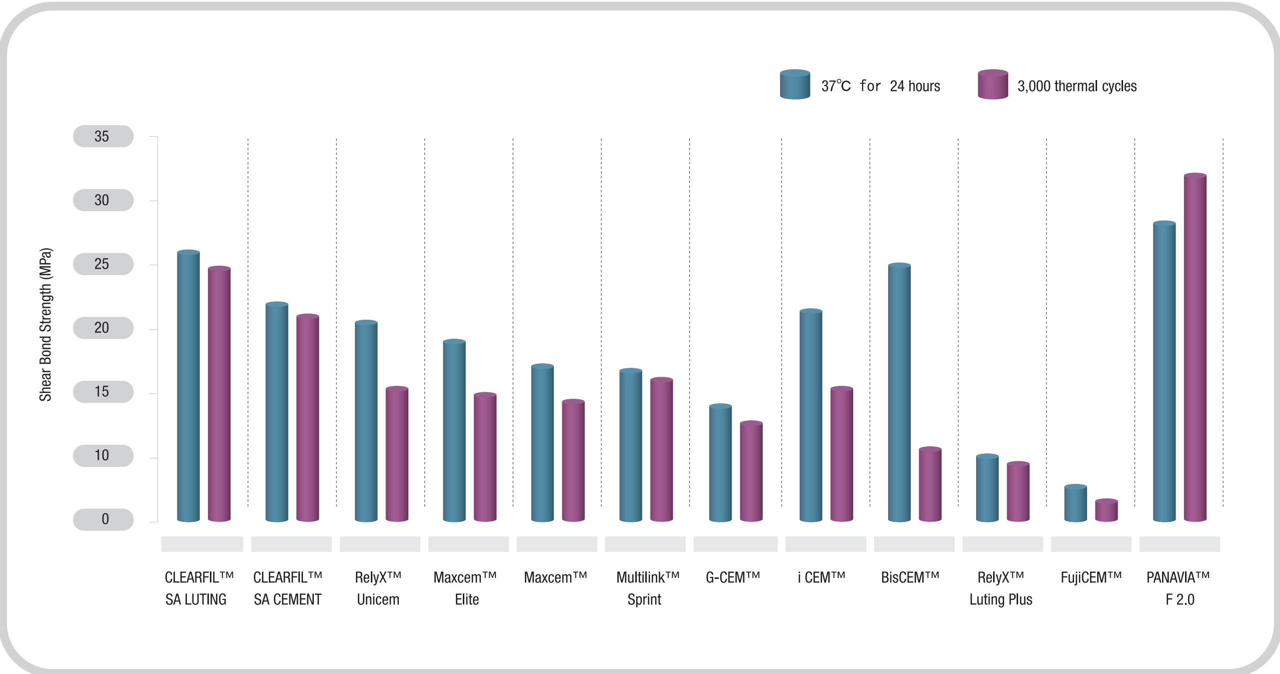
### SHEAR BOND STRENGTH TO GOLD ALLOY (Type IV)

(Kuraray Noritake Dental Inc., Japan)

All specimens were dressed using wet SiC papers of up to 1000 grit and treated by sandblast (50 μm alumina particles). Stain-less steel cylinders were adhered to the substrate surfaces with each luting material, which were cured by dual-curing (for dual-curing cements) or self-curing (for self-curing cements) according to each manufacturer's instruction. Shear bond strengths of **CLEARFIL™ SA LUTING** and some commercialized luting materials were measured at a cross head speed of 1 mm/min after storage in 37˚C water for 24 h and after subsequent thermal cycling (4°C/60°C, 3000 cycles). **CLEARFIL™ SA LUTING** showed relatively higher bond strength and adhesion durability to gold alloy than the tested other self-adhesive luting materials.

Fig. 14

Shear bond strength to gold alloy (Type IV) (Source: Kuraray Noritake Dental Inc., Japan)




## BOND STRENGTH TO COMPOSITE RESIN

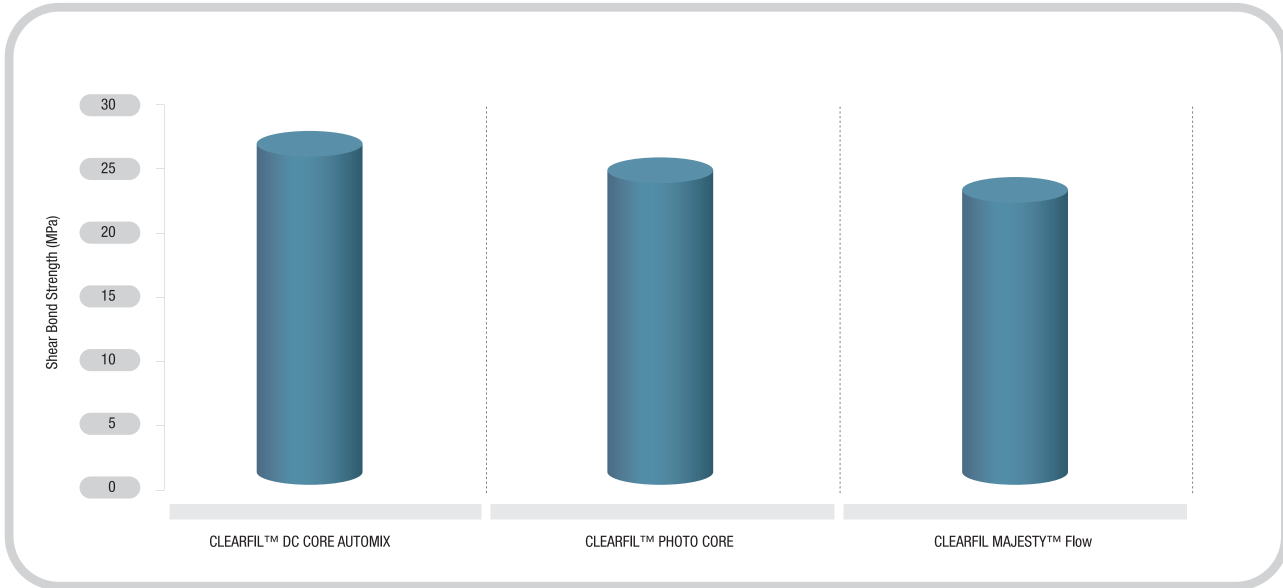
### SHEAR BOND STRENGTH TO COMPOSITE RESINS

(Kuraray Noritake Dental Inc., Japan)

All specimens were dressed using wet SiC papers of up to 1000 grit. Stainless steel cylinders were adhered to the substrate surfaces with **CLEARFIL™ SA LUTING**, which were cured by dual-curing. Shear bond strengths to each cured composite resin **(CLEARFIL™ DC CORE AUTOMIX, CLEARFIL™ PHOTO CORE, CLEARFIL MAJESTY™ Flow)** were measured at a cross head speed of 1 mm/min after storage in 37˚C water for 24 h. **CLEARFIL™ SA LUTING** showed relatively high bond strength to each cured composite resin.

Fig. 15

Shear bond strength to composite resins (Source: Kuraray Noritake Dental Inc., Japan)



## 3.4.2 PHYSICAL PROPERTIES

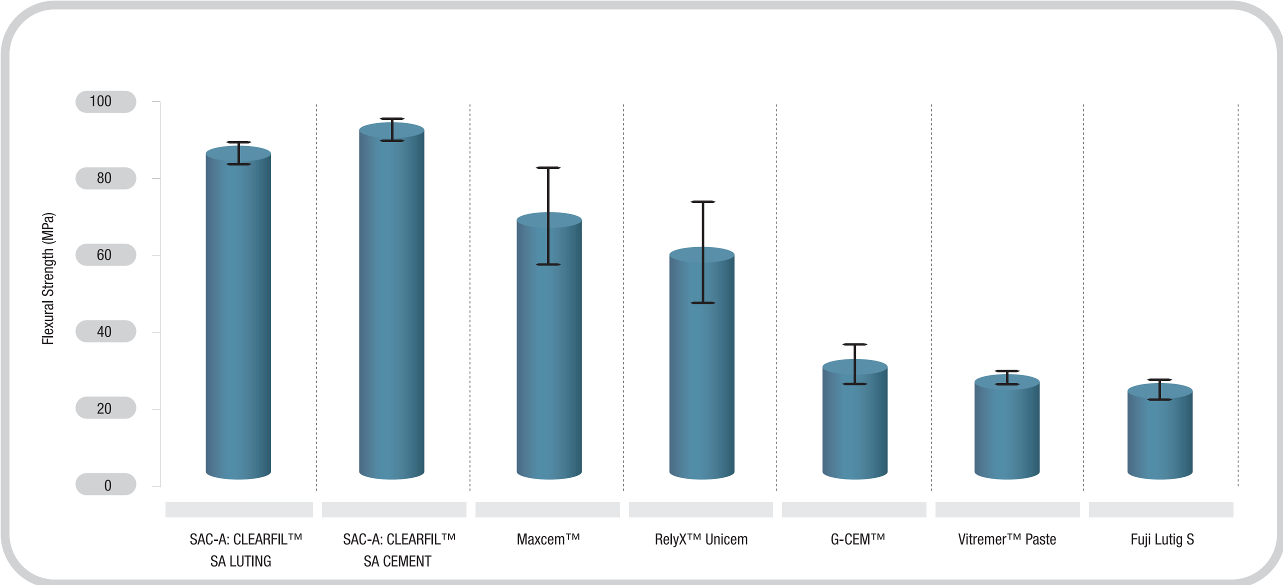
### FLEXURAL STRENGTH 1

(H.Yamamoto, T.Nakamura, K.Wakabayashi, A.Okada, S.Kinuta, H.Yatani, Osaka University, Japan)

Four self-adhesive resin cements and two resin-modified glass ionomer cements were used. Three point bending test was conducted in accordance with ISO 4049:2000. The experimental self-adhesive resin cement **(SAC-H): CLEARFIL™ SA LUTING** and **(SAC-A): CLEARFIL™ SA CEMENT** showed the highest flexural strength among the tested routine luting materials.

Fig. 17

Flexural strength of self-adhesive cements (Source: H. Yamamoto, T Nakamura, K Wakabayashi, A. Okada, S. Kinuta, H Yatani, Osaka University, Japan)





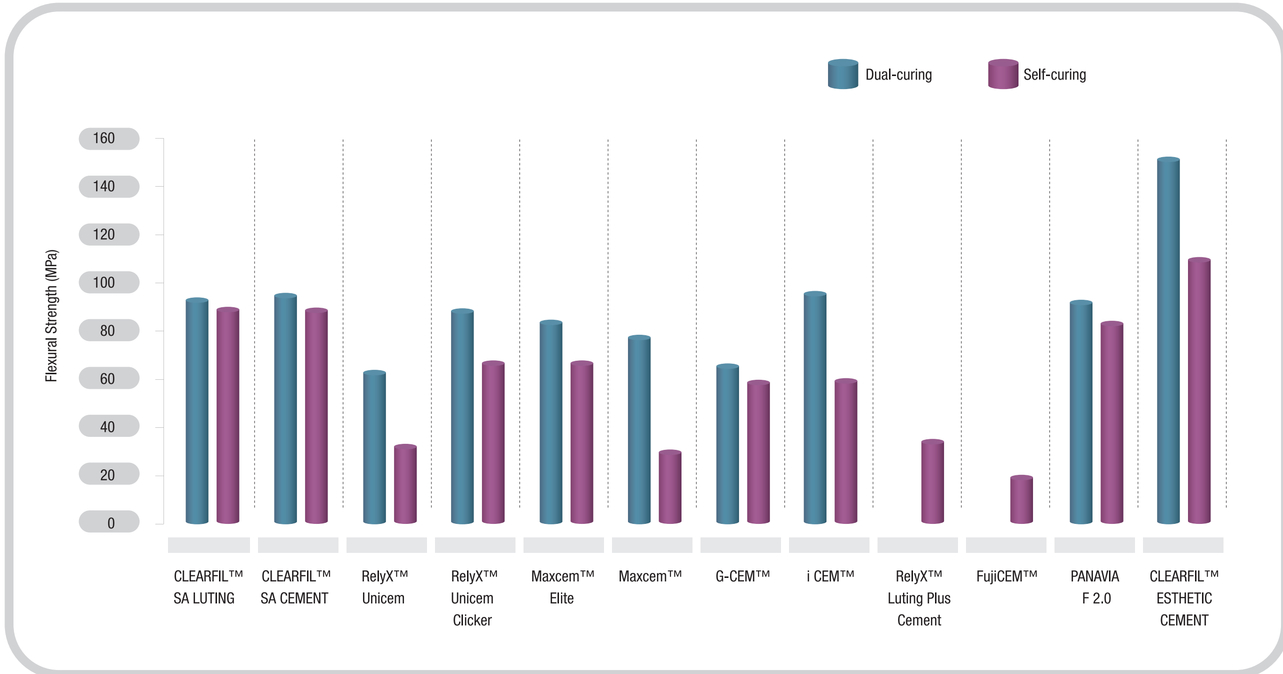

### FLEXURAL STRENGTH 2

(Kuraray Noritake Dental Inc.)

The luting materials were polymerized by light-curing unit (dual-cure) or by self-cure in the mold (30x2x2 mm) in accordance with ISO 4049: 2000. The cured specimens were submerged in distilled water at 37°C for one day. Then flexural strength of each luting material was measured using an Autograph Model AG-I at a cross head speed of 1 mm/min. **CLEARFIL™ SA LUTING** showed high flexural strength among the tested self-adhesive resin cements.

Fig. 18

Flexural strength (Source: Kuraray Noritake Dental Inc., Japan)



## LINEAR EXPANSION & WATER SORPTION

### COEFFICIENT OF LINEAR EXPANSION BY WATER UPTAKE & WATER SORPTION

(H.Yamamoto, T.Nakamura, K.Wakabayashi, A.Okada, S.Kinuta, H.Yatani, Osaka University, Japan)

Four self-adhesive resin cements and two resin-modified glass ionomer cements were used. Linear expansion and water sorption (ISO 4049) was conducted. The experimental self-adhesive resin cement (SAC-H): **CLEARFIL™ SA LUTING** and (SAC-A): **CLEARFIL™ SA CEMENT** showed significantly lower expansion rates than commercial self-adhesive cements and glass iomoner cements after 4 weeks water storage. Moreover,the water absorption of the experimental self-adhesive resin cement (SAC-H): **CLEARFIL™ SA LUTING** and (SAC-A): **CLEARFIL™ SA CEMENT** was significantly lower than **Maxcem™** and **G-CEM™**.

Fig. 19
Linear expansion by water uptake of self-adhesive cements
(Source: H. Yamamoto, T Nakamura, K Wakabayashi, A. Okada, S. Kinuta, H Yatani, Osaka University, Japan)

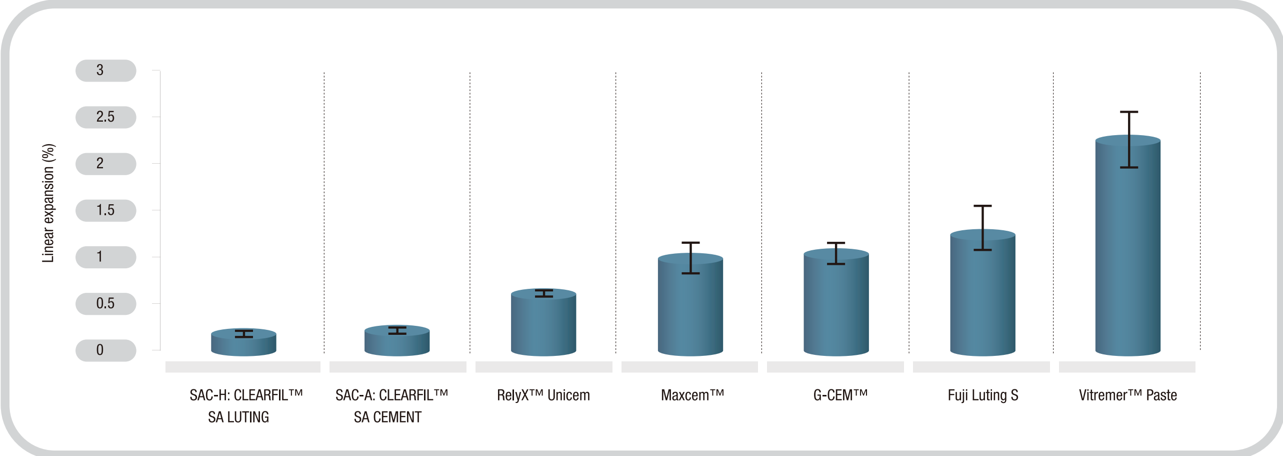
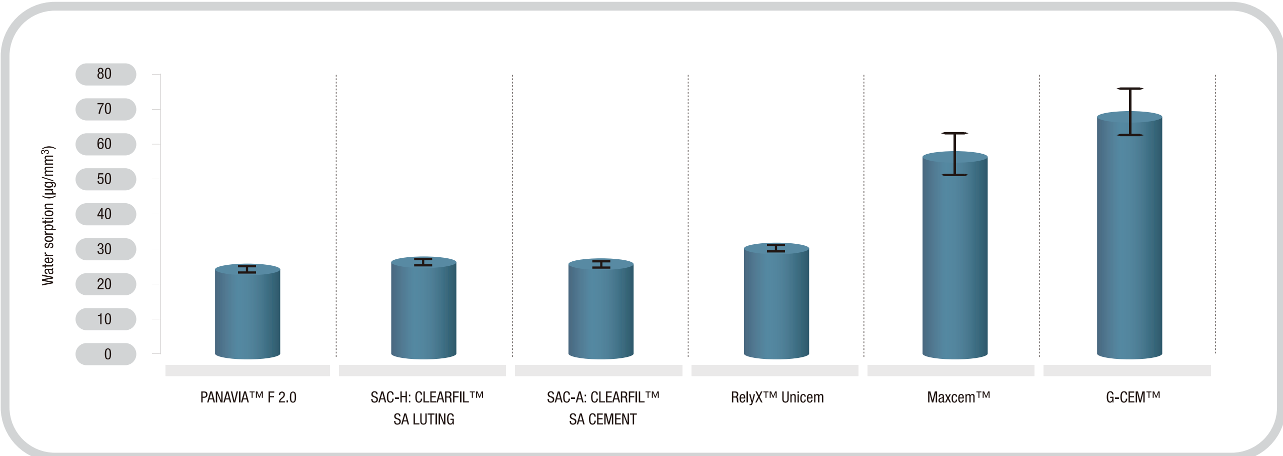



Fig. 20
Water sorption of self-adhesive cements (ISO 4049: 2000)
(Source: H. Yamamoto, T Nakamura, K Wakabayashi, A. Okada, S. Kinuta, H Yatani, Osaka University, Japan)






# 4. CLINICAL APPLICATION

## 4.1 REMOVAL OF EXCESS CEMENT

It is easy to remove any excess **CLEARFIL™ SA LUTING** paste, using a dental explorer instrument. First, mount the restoration and light-cure for 2 to 5 seconds as a preliminary step, to semi-cure the paste into a gel. This light semi-cure method reduces chair time. The cement paste is designed so that, when it is exposed to light for a short time, it is not overly cured, no matter what type of light-curing unit (halogen or LED) is used. If the excess paste hasn't light-cured, leave it for 2 to 4 minutes after placement of the prosthetic restoration, as is also done with glass ionomer cements or hybrid cements. This semi-cures the excess paste so you can remove it as one lump, giving you plenty of working time. The ease of removing excess paste not only helps to minimize the procedure of finishing the restoration, but also avoids the development of gingivitis induced by cement remaining on the gingiva or root surface.

Fig. 26
Paste characteristic of CLEARFIL™ SA LUTING

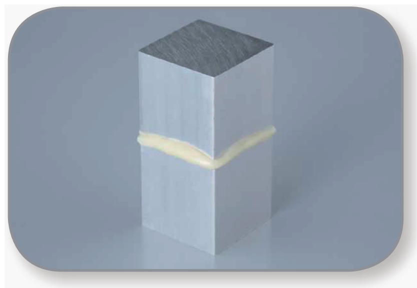


Fig. 27
Clinical step procedure of CLEARFIL™ SA LUTING

Mounting a prosthesis restoration

Semi-cure by light

Removal of excess paste

Clean-up

## 4.2 FINAL CURING

**CLEARFIL™ SA LUTING** will chemically cure when the restoration is left in place for 5 minutes after it has been mounted (for cementation of crowns, bridges, inlays and onlays). Light cannot reach to the inner surfaces of most restorations (e.g. all-ceramic, metal, and composite resin). Therefore, the mounted restoration must be held in place for about 5 minutes; have the patient bite down on absorbent cotton or some such. If the restoration is clearly translucent (e.g. ceramic inlay), expose the entire restoration and the margins of the cement paste to a light source for a specified period of time, to light-cure the cement paste inside the restoration.

For cementation of cores and posts, after semi-curing to remove the excess paste, the margin of cores and posts have to be cured by light for the specified length of time. And, for cementation of cores, about 10 minutes is required to seat the core in place and make sure the cement has been completely cured before preparing the abutment tooth. For cementation of posts, after placing the post.

Fig 28
Cementing procedure of CLEARFIL™ SA LUTING

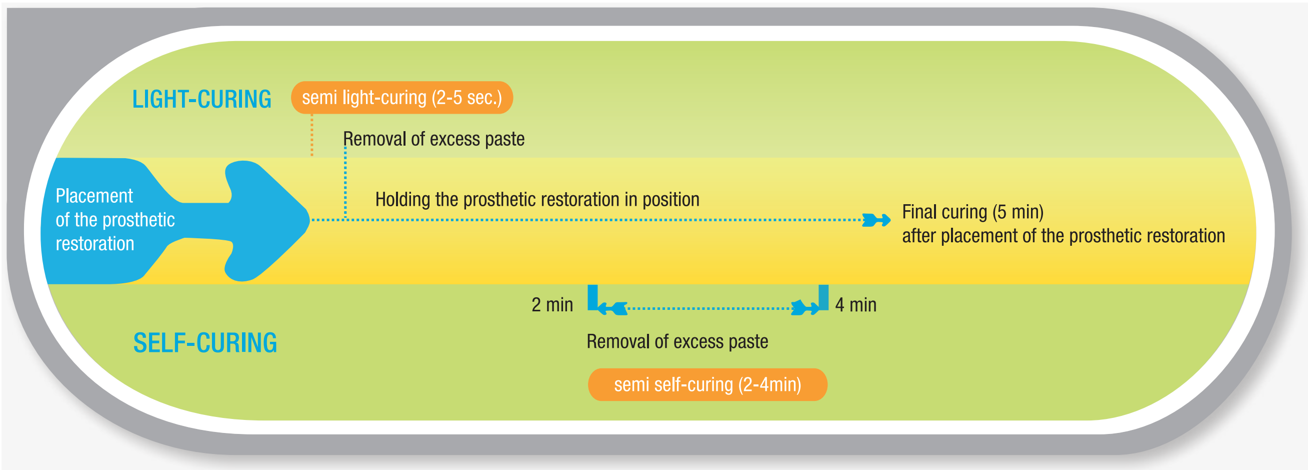





Fig. 29
Pretreatment for restoration materials

| RESTORATION MATERIALS | PRETREATMENT |
|---|---|
| Metal (e.g. Gold Alloy) | Sandblast: roughen the adherend surface by sandblasting with 30 - 50 µm alumina powder at an air pressure of 0.1- 0.4 MPa (1-4 kg/cm²). |
| Metal oxide ceramics (e.g. Zirconia) | |
| Composite | |
| Glass fiber post | Please do not sandblast |

Fig. 30
Working time and setting time (for cementation of crowns, bridges, inlays and onlays)

| | |
|---|---|
| WORKING TIME AFTER INITIAL DISPENSING (23°C) | 2 minutes |
| WORKING TIME AFTER INSERTION OF THE PASTE INTO THE CAVITY (37°C) | 40 seconds |
| SEMI-CURING FOR REMOVAL OF EXCESS PASTE | |
| light-cure | 2 - 5 seconds |
| self-cure | 2 - 4 minutes |
| FINAL CURING AFTER PLACEMENT OF THE RESTORATION | |
| light-cure (for transparent restoration) | 20 seconds ( Conventional halogen, LED )<br>5 seconds ( Fast halogen, Plasma arc ) |
| self-cure (for not transparent restoration) | 5 minutes ( Fast halogen, Plasma arc ) |

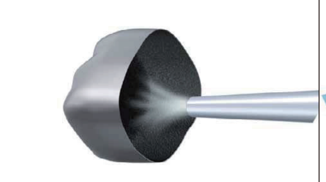
## 4.3 CLINICAL PROCEDURE

### CLEARFIL™ SA LUTING

Cementation of crowns, bridges, inlays and onlays made of ceramic, composite resin or metal
(For the metal oxide ceramic crown such as zirconia)

Clean and dry the abutment surfaces, and then trial fit the prosthetic restoration.

1. Sandblast(30-50μm alumina powder, air pressure 0.1-0.4MPa), then ultrasonic clean and dry.



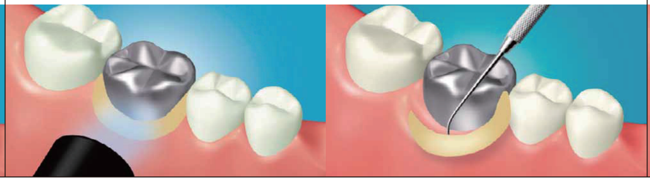
2. Dispense equal amounts of the paste A&B.

3. Mix the paste A&B for 10 seconds.
※The mixed paste must be covered by a light blocking plate and should be used within 2 minutes after mixing.

4. Apply the mixed paste to the restoration.
※If the mixed paste is applied on the abutment, you must start step 5 within 60 seconds.

5. Place the prosthetic restoration on the abutment.

6. Light cure for 2 to 5 seconds or chemical cures for 2 to 4 minutes, then remove the excess cement.



7. Maintain isolation for 5 minutes.
※For the translucent restoration, light cure the entire surface and margins. Refer to the table for light curing time.

Cementation of metal cores, resin cores, metal posts or glass fiber posts (For the metal post)

Clean and dry the prepared cavity, and then trial fit the post.

1. Dispense equal amounts of the paste A&B.

2. Mix the paste A&B for 10 seconds.
※The mixed paste must be covered by a light blocking plate and should be used within 2 minutes after mixing.

3. Apply the mixed paste to the post.
※If the mixed paste is applied into the cavity using CR syringe , you must start step 4 within 40 seconds.

4. Place the post quickly into the cavity slightly vibrating it to prevent the inclusion of air bubbles.
Spread the excess paste over the remaining tooth crown or post head.

5. Light cure the remaining tooth crown or post head. Refer to the table for light curing time.

6. Load a core build-up composite resin according to the Instructions for Use.

Table : Light curing time

| Dental curing unit | Light curing time |
|---|---|
| Conventional halogen | 20 seconds |
| LED | 20 seconds |
| Fast halogen | 5 seconds |
| Plasma arc | 5 seconds |



## 5. LITERATURE


**M. IRIE, M. OKA, Y. MARUO, G. NISHIGAWA, S. MINAGI, K. SUZUKI, and D.C. WATTS:** Bond Strength of Self-adhesive Luting Cements to Zirconia after Thermocycling, *IADR Meeting, Toronto, 2008, Abstract # 2313*

**S. MURAHARA, H. MINAMI, H. KURASHIGE, S. HORI, K. SAKOGUCHI, T.ONIZUKA, and T. TANAKA:** Bond Strength of Self-adhesive Resin Cements to Zirconia, *IADR Meeting, Toronto, 2008, Abstract # 2298*

**H. SHINODA, and M. TAKEI:** Adhesive Properties of A New Self-Adhesive Resin Cement, *IADR Meeting, Toronto, 2008, Abstract # 0373*

**T. GHUMAN, R.S. ZADEH, D. CAKIR, J. BURGESS, L.C. RAMP, and P. BECK:** Shear Bond Strength of Self Adhesive Cements, *AADR Meeting, Dallas, 2008, Abstract # 0359*

**H. YAMAMOTO, T. NAKAMURA, K. WAKABAYASHI, A. OKADA, S. KINUTA, and H. YATANI:** Mechanical Properties of New Self-adhesive Resin Based Cement, *International Symposium for Adhesive Dentistry 2008 in Kanazawa, Abstract # P-28*

**M. IRIE, M. OKA, Y. MARUO, G. NISHIGAWA, S. MINAGI, K. SUZUKI, and D.C. WATTS:** Bond Strength of Self-adhesive Resin Cements to Zirconia, *International Symposium for Adhesive Dentistry 2008 in Kanazawa, Abstract # P-39*

**N. IWAMOTO, S. UCTASLI, M. IKEDA, M. NAKAJIMA, and J. TAGAMI:** Shear Bond Strength of New Self-adhesive Cement to Enamel and Dentin, *International Symposium for Adhesive Dentistry 2008 in Kanazawa, Abstract # P-24*

# 6. KURARAY TECHNICAL DATA

## CLEARFIL™ SA LUTING

Fig. 31
Physical and Chemical Properties

| | |
|---|---|
| FILLER LOAD | 65 wt% (44 vol%) |
| FLEXURAL STRENGTH (ISO 4049:2000) | 92.7 MPa |
| MODULUS OF ELASTICITY | 6.8 GPa |
| COMPRESSIVE STRENGTH | 264.4 MPa |
| WATER SORPTION (ISO 4049:2000) | 23.3 µg/mm$^3$ |
| WATER SOLUBILITY (ISO 4049:2000) | < 1 µg/mm$^3$ |
| LINEAR EXPANSION (AFTER 28 DAYS) | 0.13% |
| RADIOPACITY (ISO 4049:2000) | 170 %Al |
| FILM THICKNESS (ISO4049: 2000) | 19 µm |
| FLUORIDE RELEASING (CUMULATIVE AMOUNT; 28 DAYS, 37°C) | 138 µg/g (SELF-CURE) |

Fig. 32
Adhesive Properties

| SHEAR BOND STRENGTH | 37°C for 24 HOURS | 3,000 THERMAL CYCLES |
|---|---|---|
| HUMAN ENAMEL[1)] | 19.1 MPa | 19.5 MPa |
| HUMAN DENTIN[1)] | 11.2 MPa | 12.6 MPa |
| ZIRCONIA (Cercon™)[2)] | 36.1 MPa | 34.1 MPa |
| ALUMINA (Procera™)[2)] | 31.0 MPa | 30.7 MPa |
| GOLD ALLOY (Type IV)[2)] | 26.9 MPa | 24.4 MPa |
| TITANIUM (Titan 100)[2)] | 43.9 MPa | 31.0 MPa |

1) The specimens were dressed using wet SiC papers of up to 1000 grit.

2) The specimens were dressed using wet SiC papers of up to 1000 grit and treated by sandblast (50 µm alumina particles).



## NOTE:

Please read Instructions for use thoroughly before using the product.

## WARRANTY:

All data other than from the courtesy of researchers of University, herein are based on actual measurements performed by Kuraray Noritake Dental inc.

Kuraray Noritake Dental inc. will replace any product that is proved to be defective. KURARAY NORITAKE DENTAL INC. does not accept liability for any loss or damage, direct, consequential or special, arising out of the application or use of or the inability to use these products. Before using, the user shall determine the suitability of the products for the intended use and the user assumes all risk and liability whatsoever in connection therewith.