1. Clearfil Repair
   Kuraray

2a. Porcelain Repair Kit
   Bisco

2b. Versa-Link Porcelain Bonding and Repair System
   Sultan Chemists

3a. Porcelain Prep Kit
   Pulpdent

3b. Porcelain Repair Kit
   Ultradent
Repairs to restorations are inevitable. These kits were designed to facilitate repairing ceramic restorations. As with other products of this type, you can certainly perform repairs without a dedicated kit. You probably have most of these materials anyway. But having a kit sometimes is handy, since all the materials you need to use are right in front of you.

**Do You Need HF?**

As the products in this category demonstrate, the reliance on HF may be decreasing, especially since the top product worked without it. On the other hand, while these initial bond strengths are certainly not meaningless, the durability of the repairs completed with and without the help of HF still needs to be determined.

### Bond Strength Test

While ease of use always is important, these products, above all, must perform. To compare their performance, we followed their directions and compared bond strength to our control, which was bonded as follows:

1. Ceramco II porcelain was sandblasted with aluminum oxide for 10 seconds.
2. Rinsed with water for 30 seconds.
3. Air-dried for five seconds.
4. 9.5% HF gel for one minute.
5. Rinsed with water for 10 seconds.
6. Air-dried for five seconds.
7. Silane applied for five seconds.
8. Air-dried for five seconds.
9. Heliobond applied.
10. Light-cured for 20 seconds.
11. Tetric Ceram A2 applied.
12. Light-cured for 40 seconds.

**Control Bond Strength = 26.0 MPA**

Please see the commentary for each product to see how they compared to our control.
Manufacturer’s Recommended Technique for Ceramic Only (no exposed metal)
1. Roughen with diamond.
2. Apply K-Etchant Gel to the surface to be repaired and leave for 5 seconds.
3. Wash and dry. No specific time suggested.
4. Mix one drop of Clearfil SE Bond Primer with one drop of Clearfil Porcelain Bond Activator and apply to surface for five seconds.
5. Dry gently but completely with air.
6. Apply Clearfil SE Bond resin (also called Bond) and spread with air to make a uniform layer.
7. Light-cure for 10 seconds.
8. Place composite. (We used Tetric Ceram.)
9. Light-cure for 40 seconds.
10. Finish and polish.

Bond Strength (MPa)
20.7 (slightly lower than control).

Packaging
Cardboard box with rear-attached lid and cardboard dividers securing the contents. Also includes a Clearfil SE Bond dispenser.

Directions
Coated paper booklet in three languages. Includes 12 color illustrations along with the directions. Information is straightforward and easy to understand. Includes instructions to store in refrigerator and bring to room temperature before using. Also includes folded plain paper instructions on dispenser.

Cost: $220.00
Includes:
• 1 syringe of Clearfil Opaquer (4g)
• 1 btl of Clearfil SE Bond resin (5ml)
• 1 btl of Clearfil SE Bond Primer (6ml)
• 1 btl of Clearfil Porcelain Bond Activator (4ml) ($53.00)
• 1 btl of K-Etchant gel (6ml)

Shelf life: 2 years refrigerated
MSDS: Not included
Manufacturer’s Recommended Technique for Ceramic Only (no exposed metal)

1. Apply Porcelain Etchant to sandblasted porcelain surface for 3-4 minutes (we chose 3.5 minutes).
2. Rinse with copious amounts of water. No specific time suggested. (We used 10 seconds.)
3. Dry with air. No specific time suggested. (We used five seconds.)
4. Apply two coats of Porcelain Primer to treated surface and allow to dwell for 30 seconds, followed by air. No specific time suggested for the drying. (We used five seconds.)
5. Apply one coat of One-Step and dry. No specific time suggested for the drying. (We used five seconds or when One-Step was no longer moving.)
7. Place composite. (We used Tetric Ceram.)
8. Light-cure for 40 seconds.

Bond Strength (MPa)
20.0 (lower than control).

Packaging
Non-resealable white plastic bag with contents loose. Expiration dates are on each squeeze bottle and on the bag.

Directions
Plain paper foldout. Includes products not included in the kit.
Manufacturer’s Recommended Technique for Ceramic Only (no exposed metal)
1. Sandblast. No specific time suggested.
2. Cut open the pipette of 6% HF gel and apply to repair surface for 90 seconds.
3. Rinse thoroughly and dry. No specific times suggested.
4. Break open the ampule of Silane Porcelain Primer and apply several drops to the repair site and allow to set for 90 seconds.
5. Air-thin the silane with air. No specific time suggested.
6. Manufacturer skipped this step but we applied Heliobond, which was thinned with air and light-cured for 20 seconds.
7. Place composite. (We used Tetric Ceram.)
8. Light-cure 40 seconds.

Bond Strength (MPa)
21.8 (lower than control).

Packaging
Corrugated cardboard box with sealed plastic bags, each one of which holds a unidose kit. The label on each kit has the product and manufacturer’s name. The glass ampule of silane is sealed under a nitrogen atmosphere to ensure a long shelf life and maximum potency when it is finally opened and used. To open it, break at its scored neck. The empty pipette is meant to siphon the silane and dispense it directly to the repair site. But for small repairs, using the applicator tip gives you better control.

The sealed pipette of HF needs to be cut with scissors — a scored area for easy opening without scissors would be preferred. Squeeze the bulb of the pipette to express the gel, but be careful since the gel has a tendency to spurt out. And the plastic pipette is not very precise, so intraoral placement directly from it is risky. Best to use a brush.

The labels on both the HF and silane have their respective expiration dates, as does the cardboard box.

Directions
Plain paper. Straightforward, easy to understand, with numerous black and white illustrations, but color clinical photos would be better. Gives background on product and single dose advantages.
Manufacturer’s Recommended Technique for Ceramic Only (no exposed metal)

1. Apply Porcelain Etchant Gel to porcelain surface for two minutes. There were no suggestions for preparing the porcelain with a diamond and/or a sandblaster.
2. Rinse with copious amounts of water for two minutes. Because no clinical dentist will rinse for this ludicrous time period, we reduced it to 30 seconds, which is more than enough time.
3. Dry with air. No specific time suggested.
4. Apply Dry-Rite to treated surface, followed by gentle air. No specific time suggested for either the application or the drying.
5. Apply Silane Bond Enhancer and allow to dry naturally or with gentle flow of air. We dried with air for 10 seconds. There were no specific directions concerning adhesives or composites at this point, so we completed the procedure using our control protocol.
6. Apply Heliobond.
7. Light-cure for 20 seconds.
8. Place composite. (We used Tetric Ceram.)
9. Light-cure for 40 seconds.

Bond Strength (MPa)
15.3 (lower than control).

Packaging
Clear plastic tray securing syringes with slide-off lid made out of cardboard instructions. The yellow Porcelain Etch Gel is 9.6% hydrofluoric acid. Dry-Rite is ethyl alcohol, which presumably helps to dry etched porcelain, enhancing the performance of the silane.

Directions
Cardboard doubling as the lid in English plus plain paper in five languages. Straightforward, easy to understand, but could be more specific.
Manufacturer’s Recommended Technique for Ceramic Only (no exposed metal)

1. Sandblast.
2. Apply Porcelain Etch (hydrofluoric acid) for 1 minute.
3. Apply EtchArrest.
4. Rinse thoroughly (no specific time).
5. Dry with air (no specific time).
6. Apply Silane for 60 seconds.
7. Dry with air (no specific time).
8. Apply PQ1 for 15 seconds.
9. Light-cure for 20 seconds.
10. Apply composite (we used Tetric Ceram).

Cost: $89.99
Includes:
- 1 syringe of OpalDam (1.2ml)
- 1 syringe of EtchArrest (1.2ml)
- 1 syringe of Silane (1.2ml)
- 1 syringe of PQ1 (1.2ml)
- 1 syringe of PermaFlo (1.2ml)
- 1 syringe of Porcelain Etch (1.2ml)
- 20 Inspiral brush tips
- 20 Black Mini brush tips
- 20 Black Mini tips
- 20 Micro 20 Gauge tips

Shelf life: 1.5 years
MSDS: Included

Bond Strength (MPa)
16.4 (lower than control).

Packaging
Cardboard box with removable white plastic tray securing the contents. Syringes are typical Ultradent. The expiration date is on the bottom of the kit and embossed into the syringes.

Directions
Two-page coated sheet combined with MSDS. Has 11 color clinical photos and one line drawing demonstrating the technique.
Clearfil Repair was the only product in this category to perform well without sandblasting and HF. However, its bond strength was slightly lower than the control.

Porcelain Repair Kit (Bisco) utilizes a lower concentration HF for more safety and is the second lowest priced product in this group. Its bond strength was slightly lower than the control.

Versa-Link Porcelain Bonding and Repair System is the only unidose kit in this group, giving it the ultimate in convenience, but it also relies on HF and its cost per unit was high. It also did not include adhesive in the kit. Its bond strength was slightly lower than the control.

Porcelain Prep Kit is a compact kit and is the least expensive in this group, but still relies on HF and did not include adhesive in the kit. Its bond strength was lower than the control.

Porcelain Repair Kit (Ultradent) features those ever-popular Ultradent syringes. But using HF really did not give it any real boost. Its bond strength was lower than the control.

OTHER PRODUCTS IN THIS CATEGORY

Ceramic Repair
Ivoclar Vivadent
Cimara
Voco

Embrace WetBond
Restoration and PFM Repair Kit
Pulpdent
Porcelain Repair Kit
Dent Zar