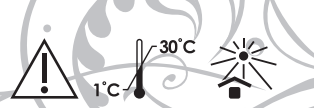
EN

INSTRUCTIONS
DATA AND REFERENCES
QUESTIONS AND ANSWERS

IMPORTANT:
READ ALL INSTRUCTIONS THOROUGHLY BEFORE USE.
KEEP THIS LEAFLET AND REFER TO IT PERIODICALLY.

Dental Adhesive Resin Cement
Super-Bond

FOR DENTIST USE ONLY



Super-Bond

Dental Adhesive Resin Cement

■Related Products of Super-Bond
(sold separately)

- **Porcelain Liner M**
  Adhesive primer for porcelain
- **V-PRIMER**
  Adhesive primer for precious metal alloys
- **Super-Bond SEP**
  Water Soluble release agent

■Accessories for Super-Bond
(sold separately)

Dispensing Dish (Ceramic)
Dispensing Stand
Dispensing Cups 40 pieces
Sponge (L・S)
Measuring Spoon (Standard) for the standard mix ratio
Measuring Spoon (Small) for 75% of the standard mix ratio
Measuring Spoon (Large) for 120% of the standard mix ratio
Brush Handle (Straight)
Brush Handle (Bent)
Brush Tips (Blue・Bulk-mix)
Brush Tips (Green・S・Brush-dip)
Brush Tips (Pink・L・Brush-dip)
Brush Tips (Purple・LL・Brush-dip)
Needle Tips (23G) 50 pieces and Needle Caps (Red) 2 pieces
Needle Tips (23G) 50 pieces and Needle Caps (Green) 2 pieces

Date of issue: 2020-08-06
J026E/1C

Made in Japan by
SUN MEDICAL CO.,LTD.
571-2, Furutaka-cho, Moriyama, Shiga, 524-0044, Japan
Phone : 81-77-582-9981 Fax : 81-77-582-9984
www.sunmedical.co.jp

Table of Contents

Instructions **PAGE**

CAUTION 2
1. What is Super-Bond? 2
2. Contents of Super-Bond kits 2
3. Precautions 4
3–1. Safety 4
3–2. Precautions on Catalyst V 4
3–3. Storage 5
3–4. To Get the Best Results with Super-Bond 5
4. How to use Super-Bond 6
Surface Preparation 6
BULK-MIX TECHNIQUE 8
BRUSH-DIP TECHNIQUE 8
5. Examples of Clinical Applications 20

Data and References

Table 1 Super-Bond Series 10
Table 2 List of Major Components 10
Table 3 Physical Properties of Polymerized Super-Bond 10
Fig. 1 Impact Fracture Energy of Adhesives 11
Fig. 2 Durability of Bond to Precious Metals using V-PRIMER 11
Table 4 Water Sorption and Solubility in Water of Various Luting Cements 11
Table 5 Bond Strength to Tooth Substance 11
Table 6 Bond Strength to Metals 11
Table 7 Bond Strength to Porcelain using Porcelain Liner M 11
Table 8 Effect of Polymer/Monomer on Working Time and Curing Time in Bulk-mix Technique 12
Table 9 Polymer Types and their Curing Times in Brush-dip Technique 12
Fig. 3 Effect of Temperature on Working Time 12
Table 10 Radiopacity using Polymer (Bulk-mix Radiopaque) 13
Table 11 Interaction of Porcelain Liner M and V-PRIMER 13
Table 12 Effect of Heat Treatment Condition of Porcelain Liner M Coated Surface on Bond Strength 13
Table 13 Effect of Dentin Treatment with Sodium Hypochlorite 13

Questions and Answers

Question 1 What is the adhesive monomer, "4-META"? 14
Question 2 Is the mechanical strength of Super-Bond lower than other adhesive resins? 14
Question 3 Does water absorption reduce Super-Bond's mechanical strength? 14
Question 4 What is the "TBB" Catalyst? 14
Question 5 How do I apply "Enamel Etchant Gel" and "Dentin Etchant Gel" to the enamel surface? 14
Question 6 Why is the "Dentin Etchant Gel" used for treating dentin? 15
Question 7 How do I treat a tooth surface that consists of both dentin and enamel? 15
Question 8 What is the purpose of treating dentin with sodium hypochlorite? How should it be used? 15
Question 9 How do I protect the surface of the prosthesis where I don't want the adhesive to bond? 16
Question 10 How much working time does Super-Bond allow? 16
Question 11 What is the difference between the Bulk-mix Polymer powders and the normal Polymer powders? 16
Question 12 Can I use Dispensing Cups and Dispensing Stand at the temperature above 25˚C? 16
Question 13 How long does the activated liquid remain active? 17
Question 14 Do I have to pre-wet the surfaces being cemented with the activated liquid? 17
Question 15 What are the different types of Polymer powders for? And how do I use them? 17
Question 16 How can I remove excess resin? 18
Question 17 What are the different types of Brush Tips for? And how do I use them? 18

CAUTION

①**Avoid contact**
Avoid contact with soft tissue, skin or eyes. A rubber dam is recommended for intraoral use. Dentist should use rubber or PVC dental gloves. Contaminated skin or mucosa should be wiped off immediately with alcohol and then thoroughly rinsed with running water, otherwise symptoms such as swelling may show. If Super-Bond enters the eye, immediately rinse thoroughly with running water. The patient should be examined by an ophthalmologist. When the cured adhesive contacts soft tissue, polish the adhesive surface.

②**Be careful of acidity**
As the Enamel Etchant Gel and Dentin Etchant Gel are acid, avoid contact with soft tissue, skin or eyes, and do not allow patients to swallow them while applying and washing them with water.

③**Be careful of flammability**
Catalyst V and Monomer are flammable. Do not store where they may be exposed to open flame.

④**Clean spilled Catalyst V immediately with wet towels**
The Catalyst V reacts with oxygen. If absorbed by a flammable material, it may raise the temperature enough to cause smoldering. If the Catalyst V is spilled, wipe it up immediately with a **WET(not dry)** disposable towel. Then rinse the towel to kill the catalyst thoroughly in running water.

1.What is Super-Bond?

Super-Bond is a self-cure dental adhesive resin cement based on MMA. It contains a high performance bonding monomer, "4-META"*1, and a catalyst, "TBB"*2. It shows excellent bond strength to tooth (enamel and dentin), metal*3, porcelain*4 and dental resins.
For three decades it has been used extensively in a wide range of dental applications. During this long period it has earned an excellent reputation for pulpal safety.
Super-Bond is widely known for its formation of a sound hybrid layer (resin impregnated layer) in both enamel and dentin. This layer reinforces the tooth surface against recurrent caries and prevents the post-operative hypersensitivity.

*1 See Table 2 and Question 1.
*2 See Table 2 and Question 4.
*3 Use V-PRIMER concurrently for precious metal alloys.
*4 Use Porcelain Liner M concurrently for porcelain.

2.Contents of Super-Bond kits

C&B kit

①Quick Monomer ---------- 10mL	⑨Measuring Spoon (Standard) ---------- 1
②Catalyst V ---------- 0.7mL	⑩Brush Handle (Bent) ---------- 1
③Polymer (Brush-dip Clear) ---------- 3g	⑪Brush Tips (Blue・Bulk-mix) ---------- 10
④Polymer (Bulk-mix Radiopaque) ---------- 5g	⑫Brush Tips (Pink・L・Brush-dip) ---------- 10
⑤Enamel Etchant Gel ---------- 3mL	⑬Brush Tips (Purple・LL・Brush-dip) ---------- 10
⑥Dentin Etchant Gel ---------- 3mL	⑭Needle Tips (23G) ---------- 5x2
⑦Dispensing Stand ---------- 1	⑮Needle Cap (Red) ---------- 1
⑧Dispensing Cups ---------- 20	⑯Needle Cap (Green) ---------- 1

■**Attached documents:**
Instructions / Pictorial Instruction Cards

Brush-dip kit

①Quick Monomer ---------- 10mL	⑦Brush Handle (Bent) ---------- 1
②Catalyst V ---------- 0.7mL	⑧Brush Tips (Pink・L・Brush-dip) ---------- 10
③Polymer (Brush-dip Clear) ---------- 3g	⑨Brush Tips (Purple・LL・Brush-dip) ---------- 10
④Enamel Etchant Gel ---------- 3mL	⑩Needle Tips (23G) ---------- 5
⑤Dispensing Stand ---------- 1	⑪Needle Cap (Red) ---------- 1
⑥Dispensing Cups ---------- 20	

■**Attached documents:**
Instructions / Pictorial Instruction Card

Bulk-mix kit

①Quick Monomer ---------- 10mL	⑦Dispensing Cups ---------- 20
②Catalyst V ---------- 0.7mL	⑧Measuring Spoon (Standard) ---------- 1
③Polymer (Bulk-mix Esthetic) ---------- 3g	⑨Brush Handle (Bent) ---------- 1
④Polymer (Bulk-mix Radiopaque) ---------- 5g	⑩Brush Tips (Blue・Bulk-mix) ---------- 10×2
⑤Dentin Etchant Gel ---------- 3mL	⑪Needle Tips (23G) ---------- 5
⑥Dispensing Stand ---------- 1	⑫Needle Cap (Green) ---------- 1

■**Attached documents:**
Instructions / Pictorial Instruction Card

3.Precautions

Read all instructions thoroughly before use.

3-1 Safety

Please keep the following precautions for safe use.
(Regarding Catalyst V, read 3-2 additionally.)

①Applications
Use Super-Bond only for the applications recommended in this publication.

②Past history of sensitivity
Super-Bond should not be used by clinicians or on patients who are methacrylic monomer-sensitive.

③Symptomatic irritation
Cease using Super-Bond immediately, if signs of irritation such as rashes appear, and see a physician.

④Avoid contact
Avoid contact with soft tissue, skin or eyes. A rubber dam is recommended for intraoral use. Dentist should use rubber or PVC dental gloves. Contaminated skin or mucosa should be wiped off immediately with alcohol and then thoroughly rinsed with running water, otherwise symptoms such as swelling may appear. If Super-Bond enters the eye, immediately rinse thoroughly with running water. The patient should be examined by an ophthalmologist. When the cured adhesive contacts soft tissue, polish the adhesive surface.

⑤Be careful of acidity
As the Enamel Etchant Gel and Dentin Etchant Gel are acid, avoid contact with soft tissue, skin or eyes, and do not allow patients swallow them during application or rinsing.

⑥Pulp protection
If the preparation approaches the pulp, apply a protective base.

⑦Give care to flammability
Catalyst V and Monomer are flammable. Do not store where they may be exposed to open flame.

3-2 Precautions on Catalyst V

Catalyst V reacts with air and water to generate heat and lose activity. Please abide by the following.

①Storage conditions
Avoid high temperature, high humidity and direct sunlight. The Catalyst should **NOT** be refrigerated. (The repeated temperature changes may shorten the Catalyst's shelf-life by causing the syringe to aspirate air.)
*After a long storage, the first drop of the Catalyst may be inactive, though the rest of the material remains active.
*The syringe is made of glass, therefore it must be handled with care to prevent shock, dropping, and other physical damage.

②Cap closure
The cap simply slides on and off. Recap the syringe immediately after each use. Air (oxygen and humidity) deactivates the Catalyst. Do not leave the cap off during the bonding procedure.

③Screwing
If the Catalyst does not come out of the syringe because of the tight screw, do not try too hard to trun it. The content may splash as the syringe breaks.

④After use
Unscrew the male-screw two turns counter-clockwise after each use to relieve pressure on the Catalyst. (Pressure buildup can cause leakage of the Catalyst or a crack of the syringe.)

⑤Clean spilled Catalyst immediately with wet towels
The Catalyst reacts with oxygen. If absorbed by a flammable material, it may raise the temperature enough to cause smoldering. If the Catalyst is spilled, wipe it up immediately with a **WET(not dry)** disposable towel. Then rinse the towel to kill the Catalyst thoroughly in running water.

⑥Cleaning of the tip of the syringe
Wipe the tip of the syringe with a dry gauze after each use to prevent residue buildup. Then rinse the gauze with water to kill any remaining activity. Buildup of the residue may prevent the cap from seating properly.

3-3 Storage

Please take the following precautions to maintain the quality.

①Storage conditions
As in the case of the Catalyst V, store the Monomer, Polymer, Enamel Etchant Gel and Dentin Etchant Gel in a cool, dark location. High temperature, high humidity and direct sunlight will shorten their shelf-life.

②Volatility
Monomer is highly volatile. Recap the bottle immediately.

③Contamination
Do not mix the bottle caps.

④Dispensing Cups and Brush Tips disposal
Both Dispensing Cups and Brush Tips are for one-time use. Dispose of them after use.

3-4 To Get the Best Results with Super-Bond

①Create and maintain a clean surface
Oil, blood, saliva and biofilm will lower the bond strength. Clean the tooth and prosthesis thoroughly before cementing. After cleaning, take care to avoid re-contamination.

②Dry the surfaces and prevent moisture contamination
After cleaning, dry the surface adequately. A rubber dam is highly recommended, as it will reduce the chance of contamination by saliva, humid breath or blood.

③Avoid eugenol-containing bases and cements
Eugenol is a polymerization inhibitor. Therefore, eugenol-contained bases and cements should not be used with resin cements. To avoid cross-contamination, reserve a mixing dish exclusively for Super-Bond. Do not use the same mixing dish for other adhesives.

④Time constraints
Super-Bond's working and setting times are very different from those of traditional cements. Follow the instructions carefully to get the best results.

⑤Do not re-use Polymer
After using Super-Bond in the Brush-dip technique, dispose of any excess Polymer left in the mixing dish. Do not return it into the container, as it has become contaminated with the Monomer.

⑥Prosthesis Design
To avoid stress concentration which encourages debonding regardless of the actual bond strength, design a prosthesis, such as wings of a bonded bridge, without thin unsupported area, which may flex during mastication.

As in any dental treatment, the patient's individual constitution and the unique requirements of clinical case at hand must be considered before selecting materials and conditions for use.

Super-Bond can be used either with the Bulk-mix technique or the Brush-dip technique. Choose the appropriate technique by referring to the table below.

Comparison of Techniques

	Bulk-mix technique	Brush-dip technique
Outline of technique	Polymer powder is mixed directly to the activated liquid*.	The powder/liquid ball is formed at the tip of a brush by dipping the tip first into the activated liquid* and then touching the Polymer powder.
Comparison of the two techniques	Use the powder/liquid mixture immediately.	The activated liquid must be used up within 5 minutes.
	Applicable to comparatively wide area.	Applicable to comparatively narrow area only.
	As the powder/liquid ratio is lower than that of Brush-dip technique, the working time is comparatively long but the curing is slow.	As the powder/liquid ratio is higher than that of Bulk-mix technique, the working time of mixed ball is comparatively short and the curing is fast.

*Mixture of 4 drops of Monomer and 1 drop of Catalyst V

Surface Preparation

It is essential that all surfaces to be bonded with Super-Bond should be properly prepared. Preparation varies depending on the nature of the materials.

Tooth Surface

Moisture control → **Cleaning**

Isolation by rubber dam or cotton roll is recommended.
*Remove scales beforehand

Remove contaminants and stains using a polishing brush and oil-free, fluoride-free pumice. Rinse thoroughly and dry.

Surface treatment → **Washing and drying**

Apply the appropriate Etchant directly from the syringe.

Rinse thoroughly with water and dry.

Treatment time

Etchant	Dentin Etchant Gel	Enamel Etchant Gel
Dentin	5-10 sec	—
Enamel	30-60 sec	30 sec

Do not use Enamel Etchant Gel on dentin.
Alternately, enamel may be prepared with Dentin Etchant Gel for 30-60 seconds.
(See Questions 5-7.)

Porcelain Surface

Cleaning → **Washing and drying**

Application of Porcelain Liner M → **Heat treatment**

Metal Surface

Cleaning → **Sandblasting**

Protection of adjacent surfaces → **Application of V-PRIMER**

Operation Steps (Contd.)

BULK-MIX TECHNIQUE

Preparation of Dispensing Stand

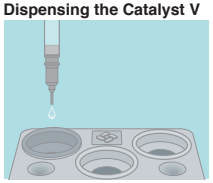
Place the Dispensing Cups

Preparation of the Activated Liquid

Dispensing the Monomer

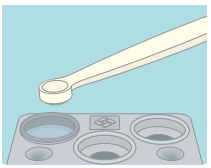
Hold the Monomer bottle vertical, and dispense the proper number of drops into a Dispensing Cup.

Dispensing the Catalyst V



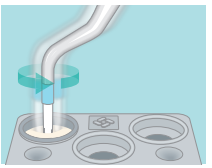
Hold the Catalyst V syringe vertical, and turn the screw to dispense the proper number of drops to the Monomer. Stir lightly with a brush. This mixture is called "activated liquid"
(See Question 13.)

Mixing the Polymer



Using the supplied measuring spoon, add the Polymer powder to the activated liquid. Stir lightly with a brush.
(See Question 15.)

Application of the Adhesive



Immediately after mixing, use a brush to apply the cement to the surface being bonded.
(See Question 14.)

Seating the Restoration

Insert the restoration immediately. After confirming that it is completely seated, hold in position until the cement sets.

*The curing time varies with temperature and the type of Polymer. (See Table 8.)

Post Treatment

Remove the excess cement. To facilitate this, protect beforehand unbonded surface properly and remove the excess resin timely.
(See Question 16.)

Mixing ratio

Monomer	Catalyst V	Polymer
4 drops	1 drop	1 small cup of Measuring Spoon
8 drops	2 drops	1 large cup of Measuring Spoon

Key points to achieve good seating

Work quickly, and seat the restoration before the mixture begins to gel.

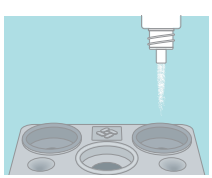
① The recommended temperature while using Super-Bond is below 25˚C.

② Mix Super-Bond at the last moment before bonding.

③ If the temperature exceeds 25˚C, use the pre-cooled ceramic Dispensing Dish.

BRUSH-DIP TECHNIQUE

Dispensing the Polymer



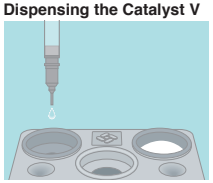
Dispense the appropriate amount of Polymer powder into a Dispensing Cup.

Preparation of the Activated Liquid

Dispensing the Monomer

Hold the Monomer bottle vertical and dispense the appropriate number of drops into another Dispensing Cup.

Dispensing the Catalyst V



Hold the Catalyst V syringe vertical, and turn the screw to dispense the proper number of drops into the Monomer. Stir lightly with a brush. This mixture is called "activated liquid"
(See Question 13.)

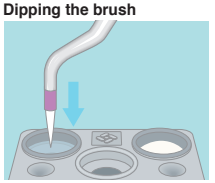
Application of the Activated Liquid

Brush the liquid onto the surface to be bonded.
(See Question 14.)

*The activated liquid decomposes gradually and loses activity.
Use it within 5 min. after preparation.

Brush-dip Procedure

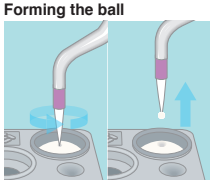
Dipping the brush



Dip the Brush Tip (for Brush-dip) into the activated liquid.

*When you repeat the procedure, clean up the brush with gauze before you dip it.

Forming the ball



Touch the brush to the Polymer powder in the Dispensing Cup.
A small ball of powder will be picked up on the wet tip of the brush.

Applying the ball

Brush the powder ball onto the pre-wet surface being bonded. As soon as it touches the surface, the powder will spread out to create a creamy, homogeneous layer.
If necessary, repeat the procedure until the entire surface is covered with the cement.

Seating the Restoration

Insert the restoration immediately. After confirming that it is completely seated, hold in position until the cement sets.

Post Treatment

Remove the excess cement.
To facilitate this, protect any adjacent surfaces you will not be bonding, and remove the excess resin before it sets.
(See Question 16.)

Mixing ratio

Monomer	Catalyst V
4 drops	1 drop
8 drops	2 drops

Data and References

Table 1 : Super-Bond Series

Product name	Super-Bond
Main use	Dental adhesive resin cement
Method of use	Bulk-mix technique and Brush-dip technique
Characteristics	(1)Self-curing dental adhesive cement based on MMA,"4-META" (bonding monomer) and "TBB" (polymerization catalyst). (2)Excellent bond strength to dentin, enamel, metal, porcelain and resins for dental use. (3)Super-Bond forms "Hybrid layer" with dentin. This layer produces ① protection against recurrent caries and ② isolation of the pulp from outer stimuli.

Product name	V-PRIMER	Porcelain Liner M
Main use	Adhesive primer for precious metal alloys	Adhesive primer for porcelain
Method of use	Single liquid application	Application of the mixture of two liquids
Characteristics	(1)One component adhesive primer for precious metal alloys. (2)Based on "VTD", a derivative of triazine dithiol. (3)A single coat of V-PRIMER improves remarkably the durability of Super-Bond to precious metal alloys. This primer eliminates the need for other bond-enhancing steps, such as heat treatment or tin plating.	(1)Two-component adhesive primer for porcelain. (2)Application of Porcelain Liner M improves remarkably the bond strength of Super-Bond to porcelain and its durability.

Table 2 : List of Major Components

Components

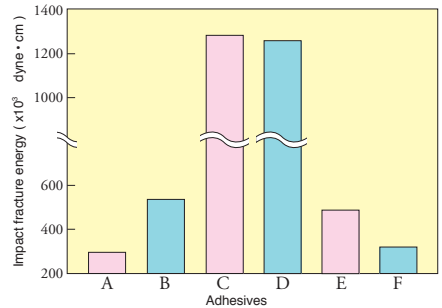
Components		Major Constituents	In the Kit
Catalyst V	0.7mL	TBB, Hydrocarbon	In all kits
Monomer	10mL	MMA, 4-META	Optional
Quick Monomer*	10mL	MMA, 4-META	In all kits
Polymer			
Clear	3g	PMMA	Optional
Esthetic	3g	PMMA, pigments	Optional
Opaque Ivory	3g	PMMA, pigments	Optional
Opaque Pink	3g	PMMA, pigments	Optional
Bulk-mix Clear	3g	PMMA	Optional
Bulk-mix Esthetic	3g	PMMA, pigments	Bulk-mix
Bulk-mix Radiopaque	5g	PMMA, radiopaque pigments	C&B, Bulk-mix
Brush-dip Clear	3g	PMMA	C&B, Brush-dip
Enamel Etchant Gel	3mL	Phosphoric acid	C&B, Brush-dip
Red Activator	5mL		Optional
Dentin Etchant Gel	3mL	Citric acid, $FeCl_3$	C&B, Bulk-mix
Green Activator	5mL		Optional

*Super-Bond Quick Monomer is a monomer with curing time faster than Super-Bond Monomer. Other features, such as working time and bond strength, are essentially the same as Super-Bond Monomer.

Table 3 : Physical Properties of Polymerized Super-Bond

Items	Values	Measured based on
Compression Strength [Elastic deformation limit]	84MPa	JIS T6602
Flexural Strength [Elastic deformation limit]	67MPa	ISO4049
Modulus of Flexural Elasticity	18X10²MPa	ISO4049
Brinell Hardness	11	JIS Z2243
Water Absorption	31μg/mm³	JIS T6514
Solubility	12μg/mm³	ISO10477
Film Thickness Standard Polymer/Monomer ratio Polymer reduced to 2/3 of the above	20-30μm 15-20μm	JIS T6602 JIS T6602

Fig. 1 : Impact Fracture Energy of Adhesives



A : Adhesive wax
B : Phosphate ester contained
C,D : 4-META contained
E : Carboxylate
F : Ionic polymer
(Adhered material is Crystalline Glass of Calcium Phosphate)
*quoted from the Quintessence Vol.4, No.2, 1985

Fig. 2 : Durability of Bond to Precious Metals using V-PRIMER

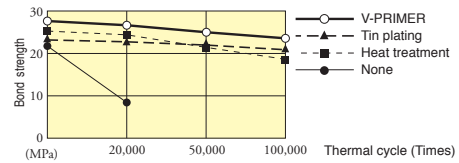


Table 4 : Water Sorption and Solubility in Water of Various Luting Cements

Cement	Water Sorption (μg/mm³)	Solubility in Water (μg/mm³)
EC (Zinc phosphate cement)	419.3	41.3
HC (Carboxylate cement)	309.3	33.8
FB (Glass ionomer cement)	211.6	34.4
BR (Resin cement)	24.2	14.2
ID (Resin cement)	31.5	9.5
PT (Resin cement)	32.2	17.8
Super-Bond	31.2	12.1

Table 5 : Bond Strength to Tooth Substance

Tooth Substance	Surface Treatment	Bond Strength (MPa)
Enamel	Enamel Etchant Gel	15
	Dentin Etchant Gel	13
Dentin	Dentin Etchant Gel	17

Table 6 : Bond Strength to Metals

Metal	Surface Treatment after Sandblasting	Bond Strength (MPa)
Gold alloy Type IV	V-PRIMER	28
	400˚C, 5min.	25
	Tin-plating	23
Gold/Silver/Palladium alloy	V-PRIMER	28
	400˚C, 5min.	24
	Tin-plating	22
Nickel-Chromium	-	30
Cobalt-Chromium	-	31
Hardened amalgam	-	10

Table 7 : Bond Strength to Porcelain using Porcelain Liner M

1. Bond Strength between VITA Porcelain (ground with #600 Emery paper) and Stainless Steel *1

Thermal Cycle (Times) (4˚C-60˚C)	Bond Strength *3 (MPa) 1,000	5,000	10,000
Porcelain Liner M, Super-Bond	20	19	13
A bonding agent for porcelain (Imported)	20	12	4
Super-Bond without Porcelain Liner M	8	-	-

2. Bond Strength between VITA Porcelain(glazed surface) and Stainless Steel *2

Thermal Cycle (Times) (4˚C-60˚C)	Bond Strength *3 (MPa) 1,000	5,000	10,000
Porcelain Liner M, Super-Bond	20	19	9
A bonding agent for porcelain(Imported)	20	5	3

3. Bond Strength between Ceramic Bracket and Acrylic Block

Thermal Cycle (Times) (4˚C-60˚C)	Bond Strength *3 (MPa) 1,000	5,000	10,000
Porcelain Liner M, Super-Bond	20	11	10

Notes: *1 Bonding of VITA(559)#600 to SUS304(Sandblasted)
*2 Bonding of the glazed surface of VITA(559) to SUS304(Sandblasted)
*3 Tensile bond strength after completion of thermal cycle

Data and References

Table 8 : Effect of Polymer/Monomer on Working Time and Curing Time in Bulk-mix Technique

Polymer		Working Time (23˚C)*1 (sec.)		Working Time (16˚C)*1 (sec.)		Curing Time (37˚C)*2 (min.)	
		Monomer	Quick Monomer	Monomer	Quick Monomer	Monomer	Quick Monomer
Bulk-mix Type	Clear	120		—	—	13	8
	Esthetic						
	Radiopaque	150		—	—	14	9
Normal Type	Clear	—	—	70		12.5	6
	Esthetic						
	Opaque Ivory	—	—	110		13.5	8
	Opaque Pink						

*1 Available time before threading starts (namely, in slurry or sol state) at 23°C/16°C
*2 Time to wait before occlusion

Table 9 : Polymer Types and their Curing Times in Brush-dip Technique

Polymer		Curing Time (37˚C) (min.)	
		Monomer	Quick Monomer
Brush-dip Type	Clear	10	5
Normal Type	Clear	11	5
	Esthetic		
	Opaque Ivory		7
	Opaque Pink		

Fig. 3 : Effect of Temperature on Working Time

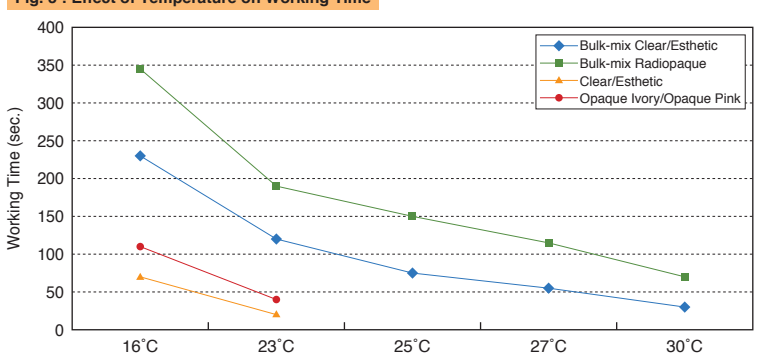


Table 10 : Radiopacity using Polymer (Bulk-mix Radiopaque)

Material	Ratio to Standard Polymer/Monomer Ratio	Radiopacity*1 (%)
Super-Bond using Polymer Bulk-mix Radiopaque	1	210
Enamel		180
Dentin		120

*1 Radiopacity of Aluminium is regarded as 100%
(Test Method is based on ISO 4049)

Table 11 : Interaction of Porcelain Liner M and V-PRIMER

Base Material	Primary Coating	Secondary Coating	Bond Strength (MPa)*
Gold/Silver/Palladium alloy	V-PRIMER	—	25
	Porcelain Liner M	V-PRIMER	24
	V-PRIMER	Porcelain Liner M	25
Porcelain	Porcelain Liner M	—	22
	Porcelain Liner M	V-PRIMER	12
	V-PRIMER	Porcelain Liner M	16

*Composite resin is bonded with Super-Bond after coating of the Primer(s) and bond strength is measured after 1,000 times of thermal cycles

Table 12 : Effect of Heat Treatment Condition of Porcelain Liner M Coated Surface on Bond Strength

Heating Condition	Treatment Time (min.)	Bond Strength (MPa)
Not heat treated	—	13
Heat treated with a dental blower (120-130˚C)	1	19
	2	20
Heat treated with a blow dryer (70-80˚C)	1	17
	3	21

Table 13 : Effect of Dentin Treatment with Sodium Hypochlorite (10% solution)

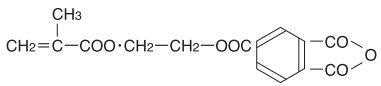
Treatment Time with Sodium Hypochlorite (sec.)	Bond Strength (MPa)*1
0	17
15	16
30	13
60	6

*1: The dentin surface is treated with sodium hypochlorite and then with the Dentin Etchant Gel, and bonded with Super-Bond

QUESTIONS and ANSWERS

Question 1 : What is the adhesive monomer, "4-META" ?

Answer : "4-META" is an abbreviation of "4-methacryloxyethyl trimellitate anhydride." It has the structure shown below. 4-META is a derivative of MMA and is polymerized with MMA into a co-polymer. It contributes to the excellent bonding property of Super-Bond.



Question 2 : Is the mechanical strength of Super-Bond lower than other adhesive resins?

Answer : Since the composition of Super-Bond is different from that of composite resin type adhesive with high load of inorganic fillers, it shows lower compressive strength and hardness, but less brittleness.
It permits a tougher, more flexible bonding layer that can disperse stress and help the prosthesis endure impact and torsion without loosening or fracturing. In fact, Super-Bond's unique flexibility due to its nature is an important factor contributing to its superb clinical reputation.

Question 3 : Does water absorption reduce Super-Bond's mechanical strength?

Answer : Some reports emphasize the water absorbency of Super-Bond and suggest that this may affect its durability.
Because it consists almost exclusively of PMMA, which contains a hydrophilic group but is basically a watertight resin. Water sorption and water solubility values of Super-Bond are as low as those of other resin cements. These values are almost negligible, if compared with inorganic cements such as zinc phosphate cements, carboxylate cements or glass ionomer cements. (See Table 4.)
According to a clinical report, Super-Bond exposed at the crown margin has been maintained for more than 10 years without color change. After a full decade in the mouth, the cement exhibited excellent margin seal with only minor surface abrasion.
When applied under normal seating conditions, Super-Bond prevents recurrent caries and post-operative sensitivity often observed with conventional cements and generally ascribed to cement washout. Crowns cemented with Super-Bond enjoy an excellent clinical prognosis.

Question 4 : What is the "TBB" Catalyst?

Answer : Super-Bond's "TBB" catalyst is crucial to the adhesive's remarkable performance.
Pure TBB (tri-n-butylborane), an organic boron component, is so reactive that it can be hazardous to use in a clinical situation. So to allow safe handling, the excessive reactivity has been reduced in the Catalyst V through partial oxidation and addition of diluents.
This modification does not reduce its effectiveness as a catalyst. The Catalyst reacts with oxygen in the air and water, and oxidizes into a peroxide. The peroxide further decomposes, forming radicals which initiate the polymerization of the MMA.
The key to the clinical success with TBB is that the reaction proceeds in the presence of oxygen and water (both of which are present in the tooth surface.) However, care should be taken when dispensing the catalyst, as unnecessary contact with air will cause gradual decomposition and degradation.

Question 5 : How do I apply “Enamel Etchant Gel” and “Dentin Etchant Gel” to the enamel surface?

Answer : When enamel is treated with acid, it becomes decalcified. An irregular scale-like surface composed of demineralized enamel rods is formed.
Super-Bond's excellent wetting properties and superb penetration into the interprismatic surface combine to form a tenacious enamel bond.
The phosphoric acid in the "Enamel Etchant Gel" is a stronger decalcifier than the citric acid in the "Dentin Etchant Gel". So we recommend the following selection criteria.
"Enamel Etchant Gel" : For enamel surfaces without tooth reduction. The "Enamel Etchant Gel" is particularly appropriate if the enamel has been treated with fluoride.
For enamel surfaces with shallow tooth reduction which has not exposed the dentin.
"Dentin Etchant Gel" : For tooth surfaces in which both enamel and dentin are exposed.

Question 6 : Why is the "Dentin Etchant Gel" used for treating dentin?

Answer : Super-Bond bonds to dentin through the formation of a resin-impregnated layer.
For the best resin penetration, the surface smear layer should be removed without excessive modification of the underlying dentin.
The "Dentin Etchant Gel" is ideal for treating dentin because it dissolves less hydroxyapatite, and minimizes damage to dentinal collagen. Treatment for 5-10 seconds with the "Dentin Etchant Gel" is adequate.
"Enamel Etchant Gel", on the other hand, tends to excessively decalcify the dentinal hydroxyapatite and denature the remaining collagen. This is not conducive to formation of a stable resin-impregnated layer, so bond strength deteriorates.

Question 7 : How do I treat a tooth surface that consists of both dentin and enamel?

Answer : If the areas involved are small, it may be virtually impossible to properly apply the two different etchants for two different periods to their respective surfaces.
In these cases we recommend applying "Dentin Etchant Gel" for 10 to 30 seconds, depending on the relative size of the enamel and dentin surfaces (the more enamel involved, the longer the application.)
When enamel surrounds a cavity where the preparation breaks the DEJ, first apply "Dentin Etchant Gel" to the enamel. After 30 seconds, apply "Dentin Etchant Gel" to the dentin and allow it to remain for just 5 seconds. Then rinse the tooth with water.

Question 8 : What is the purpose of treating dentin with sodium hypochlorite (NaOCl)? How should it be used?

Answer : a.To increase bond strength?
For some resin cements sodium hypochlorite is recommended to improve the bond strength to dentin. This is NOT true with Super-Bond. In fact, if sodium hypochlorite is used after treating the dentin with the "Dentin Etchant Gel", the bond strength will be significantly reduced. Sodium hypochlorite should NOT be used after the dentin has been prepared with the Dentin Etchant Gel.
b.For endodontics
A diluted aq. solution of sodium hypochlorite (below 10%) is often used during endodontic therapy to dissolve organic materials, to decontaminate surfaces, or to stanch bleeding.

When using Super-Bond on surfaces treated with sodium hypochlorite, (or acidic electrolyzed water), the following care should be taken to avoid compromising Super-Bond's exceptional bond strength.

1.Do NOT apply sodium hypochlorite after acid etching. Do NOT use sodium hypochlorite higher than 10% concentration. Sodium hypochlorite will dissolve the collagen exposed by acid treatment. Therefore, the Dentin Etchant Gel should be applied AFTER treatment with sodium hypochlorite.

2.Limit the treatment time with sodium hypochlorite to less than 30 seconds.
Short-term treatment does not significantly affect the bond. Prolonged treatment with sodium hypochlorite, however, will significantly decrease the bond strength:

<Super-Bond bonded to dentin after treatment with 10% solution of sodium hypochlorite for various time periods>

Treatment time with sodium hypochlorite	Seconds	0	15	30	60
Tensile Bond Strength	MPa	17	16	13	6

3. If NaOCl treatment time exceeds 30 seconds, neutralize the surface with a reducing agent before etching.
Method 1:
Apply Saforide RC™, containing 38mg/mL diamine silver fluoride ($Ag(NH_3)_2F$), for a length of time 1/2nd as long as the surface was treated with sodium hypochlorite. Rinse with water and dry. Treat with the Dentin Etchant Gel for 10 seconds. Rinse and dry. Then apply Super-Bond according to the ordinary procedures.

<The surface was treated for 60 seconds with a 10% solution of sodium hypochlorite, neutralized with Saforide RC™, and then bonded with Super-Bond.>

Treatment time with Saforide RC™	Seconds	30	60
Tensile Bond Strength	MPa	8	13

Caution: Saforide RC may darken tooth surfaces.

*Saforide RC™ is a product of Bee-brand Medico-dental.

Method 2:

Prepare a 10% aq. solution of ascorbic acid (or its Na or K salt). Apply the solution for a length of time 1/3rd as long as the surface was treated with sodium hypochlorite. Dry the surface. Treat with the Dentin Etchant Gel for 10 seconds, rinse and dry. Then apply Super-Bond according to the ordinary procedures.

Treatment time with NaOCl	Seconds	180		300	
Treatment time with ascorbic acid	Seconds	30	60	50	100
Tensile Bond Strength	MPa	7	16	6	17

4. Hydrogen peroxide (H_2O_2)

In alternate irrigation, a hydrogen peroxide solution is sometimes used in connection with a sodium hypochlorite solution. Hydrogen peroxide damages the dentin structure, thus compromises the bond strength, if treated for an extended period beyond 30 seconds. Consequently, the use of a hydrogen peroxide solution should be limited to 30 seconds.

5. Acidic electrolyzed water

When used on dentin, acidic electrolyzed water reduces the bond strength of Super-Bond much like sodium hypochlorite (though the strength reduction is less severe.) To achieve normal bonds after the tooth surface has been treated with acidic electrolyzed water, apply the Dentin Etchant Gel for 30 seconds (instead of the normal 10 seconds). Rinse and dry. Then apply Super-Bond according to the ordinary procedures.

Question 9 : How do I protect the surface of the prosthesis where I don't want the adhesive to bond?

Answer : Before cementing an inlay, onlay, crown or bridge with Super-Bond, all exterior surfaces should be polished and the interior surfaces sandblasted. Unfortunately, once it's allowed to cure, Super-Bond will adhere tenaciously even to the highly polished exterior surfaces. Once it has completely polymerized, removing the excess with a hand scaler is extremely difficult.

To facilitate cleanup, the exterior surfaces may be coated with a separator including Super-Bond SEP by Sun Medical.

Question 10 : How much working time does Super-Bond allow?

Answer : If you use Super-Bond in the Bulk-mix technique, the slurry-like cement gradually increases its viscosity and begins threading.

Super-Bond must be used before threading begins. Otherwise, the operation becomes quite difficult. The increase in film thickness may prevent seating of the prosthesis. (See Table 8, Fig. 3 and Question 11.)

*Unlike conventional cement, it is not necessary to spatulate Super-Bond. When using it for the first time, you may feel the mixture is too thin. Be assured that Super-Bond should be used in this state.

*Super-Bond undergoes the following stages from mixing to curing. For proper seating of the prosthesis, try to finish the bonding operation before the mixture has reached stage 3 (mild threading).

1. Slurry stage: The mixture is very thin, as when gypsum powder is mixed with a copious amount of water and the powder particles are still visible.
2. Sol stage: The powder particles are no longer visible, but the mixture still retains high fluidity and has not started threading.
3. Mild threading: The mixture becomes sticky and forms thin threads.

Question 11 : What is the difference between the Bulk-mix Polymer powders and the normal Polymer powders?

Answer : Because of its particle size, Bulk-mix Polymer powders do not require chilling of Dispensing Stand and Dispensing Cups as long as the temperature is below 25°C. On the other hand, the normal Polymer powders require a cooled ceramic Dispensing Dish. The curing reaction of Super-Bond is influenced by temperature: The higher the temperature, the more quickly Super-Bond cures. In a cooled Dispensing Dish, the curing reaction proceeds slowly, the working time is extended, and the bonding operation becomes easier. (See Fig. 3.)

Question 12 : Can I use Dispensing Cups and Dispensing Stand at the temperature above 25°C?

Answer : Dispensing Cups and Dispensing Stand are made of plastic and can not be chilled in a refrigerator. Instead, use the ceramic Dispensing Dish, which is sold separately, for cooling.

Question 13 : How long does the activated liquid remain active?

Answer : In contact with air, the "Catalyst" gradually decomposes and degrades.

Therefore, it is important to use the activated liquid (the mixture of Monomer and Catalyst V) as soon as possible after mixing. For the Bulk-mix technique, you should complete all the preparations for bonding before you begin preparing the activated liquid, then use it immediately.

For the Brush-dip technique, use the activated liquid within 5 minutes at the latest.

Question 14 : Do I have to pre-wet the surfaces being cemented with the activated liquid?

Answer : Brushing the activated liquid onto the surfaces to be bonded before cementing will assure intimate resin contact.

In the Brush-dip technique, the ball has a comparatively high Polymer/Monomer ratio, so pre-wetting the surface with the activated liquid is essential to assure maximum cement adaptation and to create the highest possible bond strength.

In the Bulk-mix technique, application of the activated liquid is not necessary, so long as you seat the prosthesis while the cement is in the slurry state. In this case, the mixture is fluid enough to assure maximum adaptation.

On the other hand, advanced-application of the activated liquid on the dentin surface is recommended to restrain the outflow of exudate from the surface of the prepared dentin and to prevent bacterial entry into the dentin tubules.

Question 15 : What are the different types of Polymer powders for? And how do I use them?

Answer : Eight different Polymers are available for Super-Bond, including those sold separately. They can be divided into 3 basic classes, the normal type, Bulk-mix Polymer and Brush-dip Polymer. Refer to the following list to select the best Polymer for your application. (See Tables 2, 8 and 9 and Fig.3.)

1. Clear, Brush-dip Clear and Bulk-mix Clear

Fine PMMA powder without pigment. When cured, its medium translucency and inconspicuous shade is ideal for temporary splinting of loose teeth, creation of temporary prostheses using a resin tooth or extracted tooth, or direct bonding of orthodontic brackets with the **Brush-dip Clear**. When the normal **Clear** polymer is used in the Bulk-mix technique, the working time before threading is rather short. Here, the **Bulk-mix Clear** is preferable, because it allows more working time.

2. Esthetic and Bulk-mix Esthetic

Tooth-colored **Clear** powder. When cured, its color is ivory with some translucency and little opacity. It is used for prostheses that require an esthetic appearance. Curing time and workability are the same as **Clear** powder and **Bulk-mix Clear** powder respectively.

3. Opaque Ivory

Opacity is produced by specially prepared pigments. The powder creates an extremely opaque cement film that is highly effective in masking metal surfaces. It is recommended for use when metal show-through might affect aesthetics (as when cementing inlay or adhesion bridges), or when repairing fractured prostheses with exposed metal. Its working time is slightly longer than **Clear** powder. The **Opaque Ivory** powder is widely used for routine cementation. Due to its opacity, any excess cement is extremely visible, which facilitates removing it.

4. Opaque Pink

Pale pink color is added to **Opaque Ivory**. This powder was originally intended for repairing denture bases, but it can be used for the same purposes as the **Opaque Ivory**. Some dentists prefer it to the **Opaque Ivory** as its pink color reflected on the surrounding teeth produces a more natural shade. Its handling and setting properties are similar to those of the **Opaque Ivory**.

5. Bulk-mix Radiopaque

This powder contains highly radiopaque filler. When it is used under the standard Polymer/Monomer ratio, the cured adhesive shows radiopacity equivalent to enamel. It creates a natural tooth-color and allows a longer working time for easier handling. However, it cures slightly more slowly than the **Clear** powder. For faster curing, increase the Polymer ratio to Monomer.

Question 16 : How can I remove excess resin?

Answer : When the object is seated, excess resin is expressed around the margins. If the excess resin is allowed to cure, it will bond to the surface of the prosthesis, and clean-up and polishing will be extremely difficult.
The following describes how to remove the excess resin:

①Before cementing apply as much protection as possible to surfaces that should not be bonded. (See Question 9.)
*Apply a separating agent on metal surfaces, wrap with "Parafilm," place retraction cord under the gingival margin, etc.
②Use the Opaque Polymer, as the excess resin will be more visible.
③Use a cotton pledget or a brush soaked with alcohol to remove as much excess resin as possible immediately after the prosthesis is seated (before threading begins). Resin extruded onto the interdental papilla should be removed immediately using floss, etc.
Resin spilled onto the gingiva should also be removed before it hardens.
④Using hand scalers, scrap off the residue after the threading stage is completed but before the cement is completely cured.
*Wait a while till the threading stage is completed.
*If you attempt to scrape off the excess during the threading stage, you may feel that you are removing all the cement, but a thin layer will remain bonded to the surface.
⑤If the surface was coated with a separating agent, even cured resin can be easily peeled off using hand instruments.
⑥Any remaining resin will be easily discovered by re-examination on the following day.

Question 17 : What are the different types of Brush Tips for? And how do I use them?

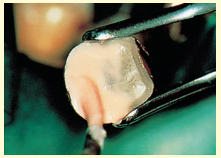
Answer : The Brush Tip Blue is a blunt-cut type and suitable for transportation of a large amount of the slurry in Bulk-mix technique. The Brush Tips Green (S), Pink (L) and Purple (LL) have pinpointed tips and are suitable for Brush-dip technique. The Brush Tips Pink (L) and Purple (LL) are longer than Brush Tip Green (S) while the bristles of Brush Tip Purple (LL) are thicker than the others. Refills of the respective types are available. Dispose of them after use.

CLINICAL APPLICATIONS using the BULK-MIX TECHNIQUE

Cementing of inlays,onlays and crowns

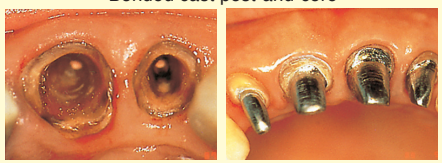
Occlusion reconstruction using bonded onlay

Bonded partial onlay crown

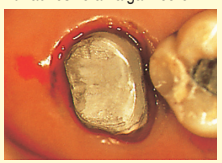


Cementing of posts and cores

Bonded cast post-and-core



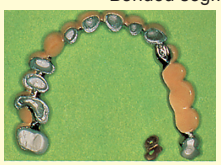
Bonded prefabricated posts with adhesive amalgam core



Cementing of bridges

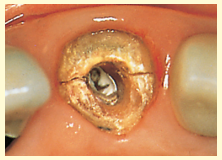
Anterior bonded bridge with crowns and retentive wings

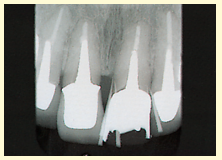
Bonded segmented bridge



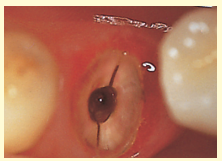
Salvaging fractured teeth

Bonding fragments directly to the post



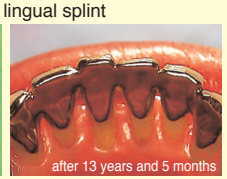


Extraction,cementation,and replantation



Cementing of periodontal splints

Cast metal lingual splint

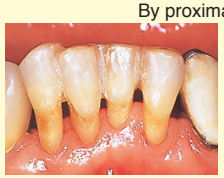


Adhesive splint made of mesh plate

CLINICAL APPLICATIONS using the BRUSH-DIP TECHNIQUE

Temporary periodontal splinting of mobile teeth

By proximal bonding

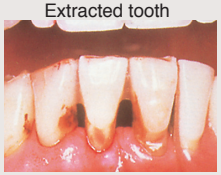


Temporary prosthesis using a resin tooth or an extracted tooth

Resin tooth

Resin tooth

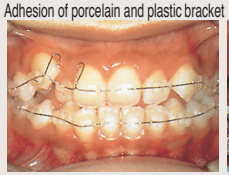
Extracted tooth



Orthodontic treatment

Adhesion of metal bracket

Adhesion of porcelain and plastic bracket



Adhesion of retainer

Repair of fractured crown