

A black and white close-up photograph of a woman's face, looking directly at the camera with a serious expression. Her hair is dark and straight, framing her face.

Forgives Nothing

Forgives Almost Anything

**XPBOND<sup>®</sup>**  
... for eXtra Performance

Science Update

For better dentistry

**DENTSPLY**

# Shear bond strength on wet and dry dentin (Ultradent)

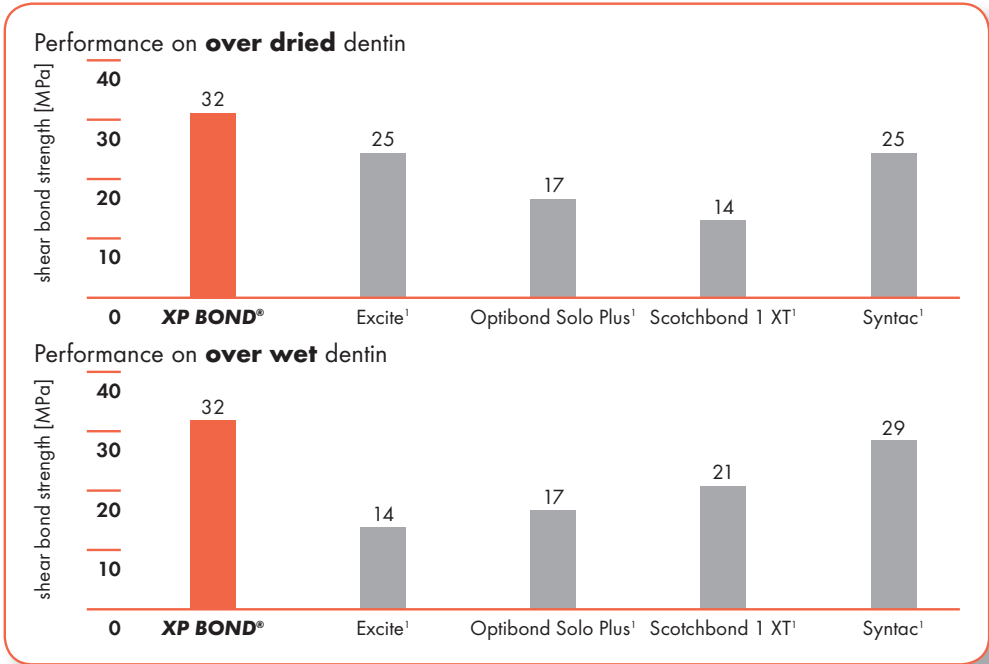


Latta M, Omaha

Since etching of dentin with phosphoric acid was introduced, one focus of research has been the question whether the demineralised collagen network can be infiltrated by the resin of the adhesive to form a homogenous hybrid layer. In addition, it became obvious that etched dentin is very sensitive to the degree of moisture. Etched and desiccated dentin is not only difficult to infiltrate and hybridize but it would hinder penetration towards the unaffected dentin leading to lower bond strength.

Dentin was prepared according to the instructions for use (moist; data not shown) and to simulate either over wet or over dried dentin. Over wet dentin was achieved by applying 2.5 µl water onto a 4.0 mm round area. Flat dentin specimens were air-dried for 10 seconds with an air-syringe to create over dried dentin. This is not recommended following phosphoric acid etching. Thus the robustness of the adhesive towards surface moisture was investigated. (J Dent Res 89(Spec Iss B):0004, 2010)

The investigator stated: “XP BOND® has shown promise, as it is relatively insensitive to the amount of residual dentin moisture. This characteristic can effectively widen the window of opportunity for bonding to demineralized dentin, and can generate a system with excellent dentin adhesion under a wide range of clinical conditions.”



<sup>1</sup> Excite, OptiBond Solo Plus, Scotchbond 1 XT and Syntac are not registered trademarks of DENTSPLY International, Inc.

Data on file.

## Application on wet and dry dentin



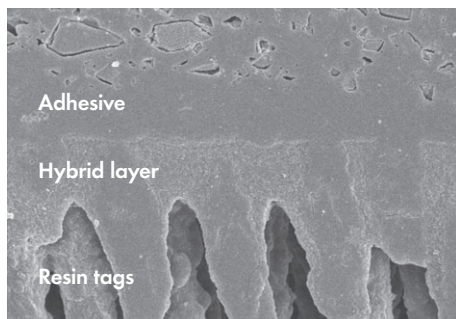
Perdigão J., Minneapolis

For both adhesives tested with moist dentin, OptiBond Solo Plus<sup>1</sup> and XP BOND®, SEM micrographs of the adhesive dentin interface show a distinct adhesive layer, a well and homogenously infiltrated hybrid layer, and well infiltrated peritubular dentin resulting in tags and filled intertubular spaces.

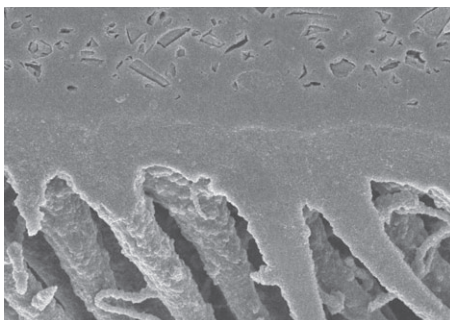
When dentin was air-dried for 10 seconds, detachment of the adhesive from the underlying dentin could be seen for OptiBond Solo Plus<sup>1</sup> in one specimen.

The investigator stated: "The morphology of the hybrid layer when XP BOND® was applied on dried dentin was not very distinct from the morphology corresponding to the application of the same adhesive on moist dentin."

### SEM of XP BOND®

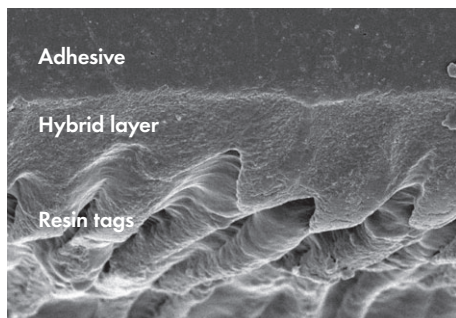


On moist dentin.

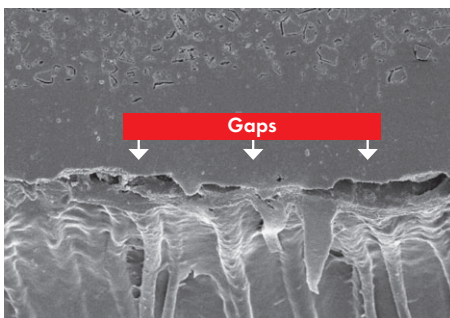


Dentin over dried for 10 seconds.

### SEM of Optibond Solo Plus<sup>1</sup>



On moist dentin.



Dentin over dried for 10 seconds.

<sup>1</sup> OptiBond Solo Plus is not a registered trademark of DENTSPLY International, Inc.

# Shear bond strength after thermo cycling (Gel-Cap Method)



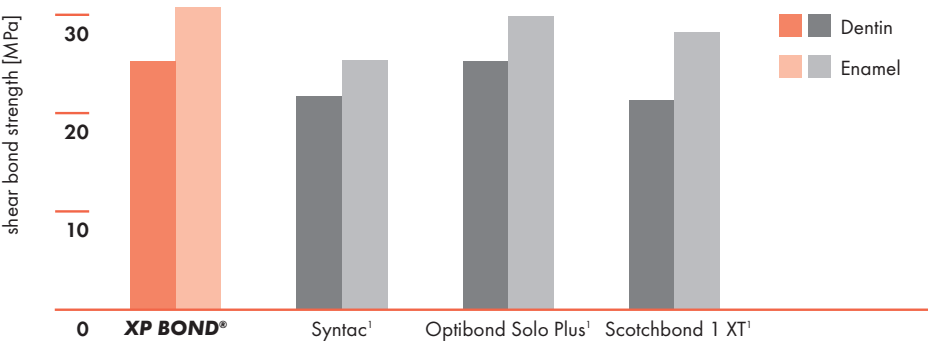
Latta M, Omaha

One experienced operator performed all samples for testing. Shear bond strength (SBS) after 1800 thermo cycles was compared to SBS measured after 6000 thermo cycles.

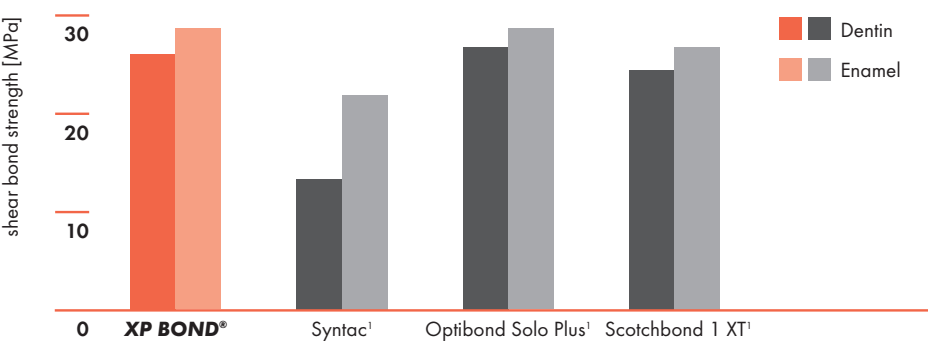
The multi bottle system included as control was adversely affected by higher numbers of thermo cycles.

However, XP BOND® and the other one bottle Etch&Rinse adhesives were not affected by higher numbers of thermo cycles and performed on a significantly higher level.

after **1800** thermo cycles (5/55 °C); n=10; 5 mm/min



after **6000** thermo cycles (5/55 °C); n=10; 5 mm/min



<sup>1</sup> OptiBond Solo Plus, Scotchbond 1 XT and Syntac are not registered trademarks of DENTSPLY International, Inc.

Data on file.

# Micro-Shear Fatigue Limit



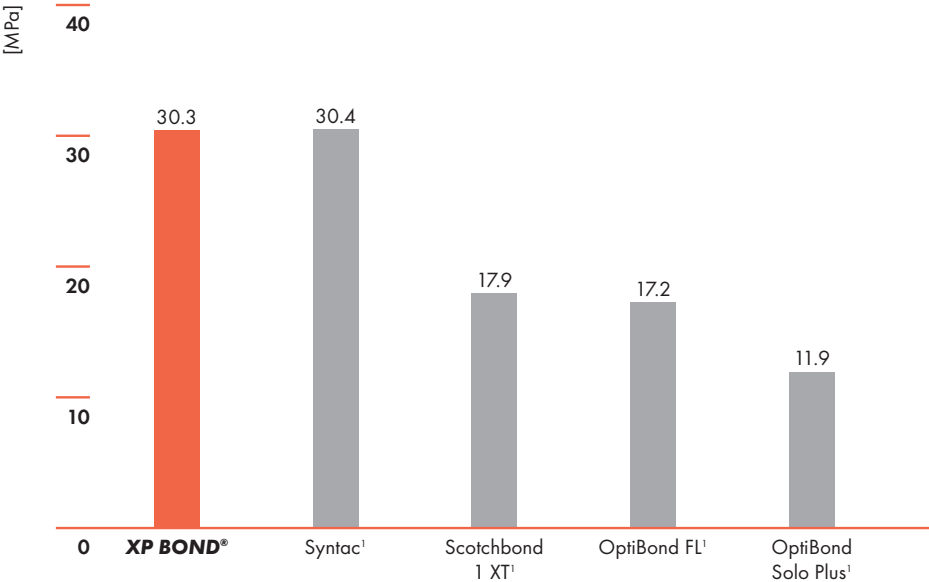
Braem M, Antwerpen

Achieving a long lasting bond between the restoration and the tooth substance is the ultimate goal of adhesive dentistry. Besides chemical degradation, it might be expected that the adhesive degrades mechanically through fatigue.

Cyclic loading of the adhesive interface was achieved by a micro shear fatigue set up, following a staircase approach, where the stress level at which 50% of the specimens fail after 10.000 cycles was calculated as the median micro shear fatigue Resistance ( $\mu$ SFR).

XP BOND® showed a very high fatigue limit that surpassed most other competitive adhesives including a filled multi bottle system.

$\mu$ SFR (Micro Shear Fatigue Resistance) 10.000 at 2 Hz (35 °C) steps:  $\pm$  8% (immediate testing)



¹ OptiBond Solo Plus, OptiBond FL, Scotchbond 1 XT and Syntac are not registered trademarks of DENTSPLY International, Inc.

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# Shear Bond Strength after 6.000 Thermo Cycles (Ultradent)

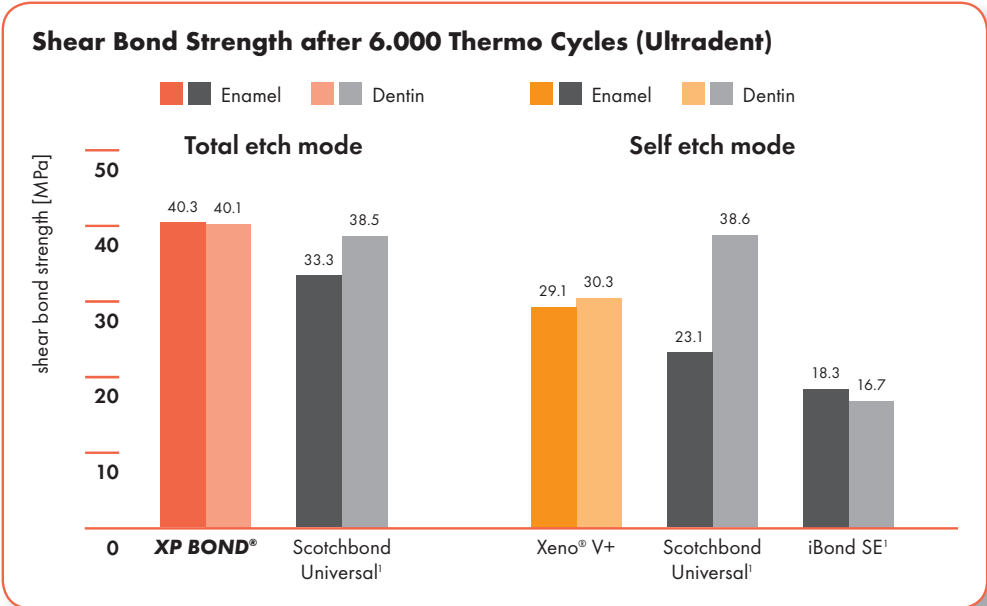


Latta M, Omaha

Using the Ultradent method, shear bond strength of Scotchbond Universal<sup>1</sup> was tested in self etch mode and in total etch mode.

In total etch mode, XP BOND<sup>®</sup> shows significantly better results on enamel than Scotchbond Universal<sup>1</sup>.

In self etch mode, Xeno<sup>®</sup> V+ shows significantly better performance than Scotchbond Universal<sup>1</sup> on enamel. iBond SE<sup>1</sup> shows a significantly lower performance on both substrates.



<sup>1</sup> iBond SE and Scotchbond Universal are not registered trademarks of DENTSPLY International, Inc.

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# Dentin permeability in class V



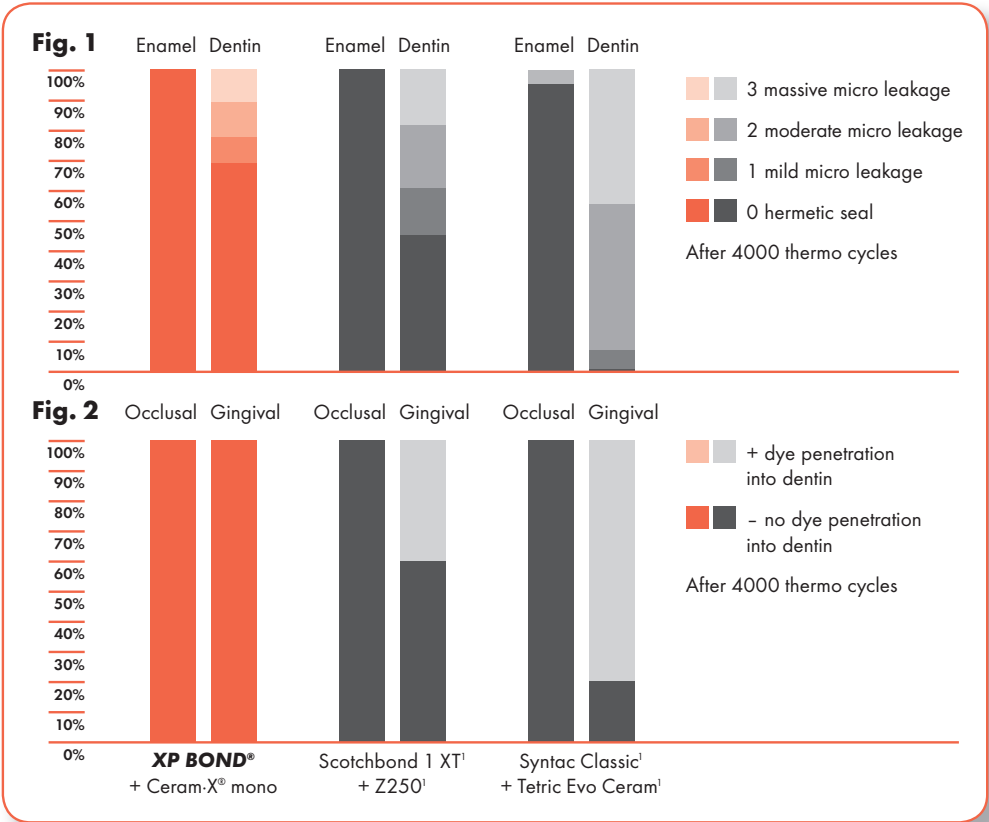
Rosales-Leal JJ, Granada

The clinical longterm success of composit restorations depends not only on bond strength but also on hermetical sealing. Microleakage of a restoration can lead to marginal discoloration and secondary caries.

To evaluate the sealing ability of different etch&rinse adhesives, microleakage and dentin permeability on occlusal and gingival walls were investigated an statistically analyzed.

Fig. 1 shows the extent of dye penetration along the restoration was ranked between 0 (hermetic seal), 1 (mild micro leakage), 2 (moderate micro leakage) and 3 (massive micro leakage).

Additionally, for those cases that showed micro leakage, it was investigated if the dye penetrated into the dentin (Fig. 2).



<sup>1</sup> Scotchbond 1 XT, Syntac, Tetric Evo Ceram and Z250 are not registered trademarks of DENTSPLY International, Inc.

Data on file.

# Microleakage in Class II Cavities after artificial aging



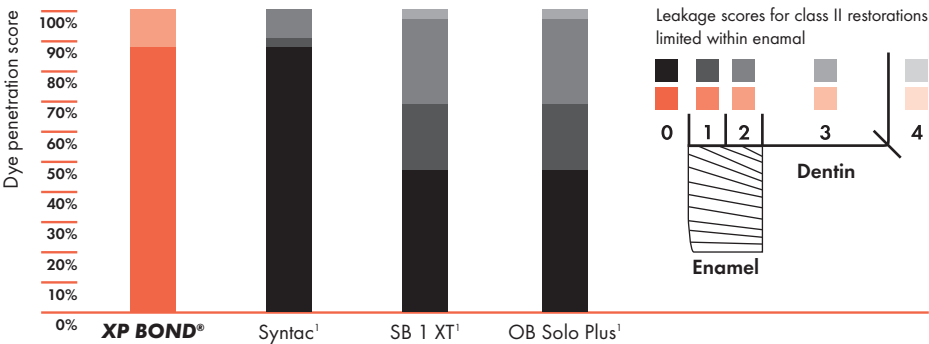
Manhart J, München

40 human molars were prepared with one proximal box limited within enamel and one proximal box extending into dentin. After restoring, the teeth were stressed in a chewing simulator by 2.000 thermo cycles between 5 °C and 55 °C and 50.000 chewing cycles using an artificial antagonist loaded with 50N (Manhart J et al. 1999).

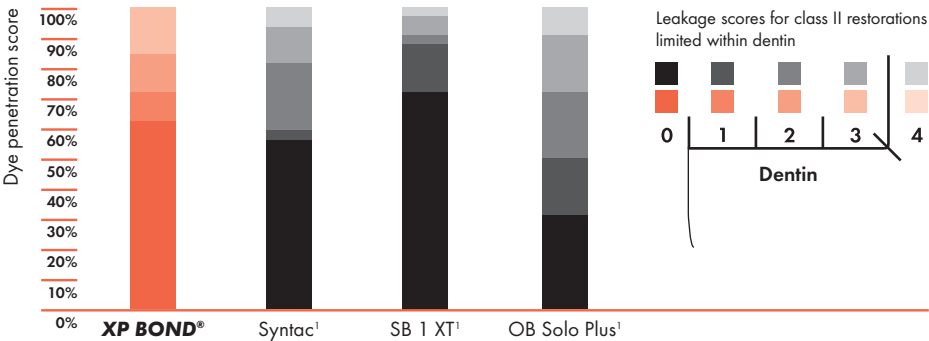
Micro leakage was tested using a standardized dye penetration method. Dye penetration was evaluated separately for enamel margins in the approximal box limited to enamel (Fig. 1) and dentin margins in the deeper approximal box (Fig. 2).

XP BOND® showed excellent micro leakage results in both, enamel and dentin. Micro leakage of XP BOND® is at the same level or even better than other etch&rinse adhesives.

**Fig.1: Micro leakage scores for enamel margins in class II**



**Fig.2: Micro leakage scores for dentin margins in class II**



¹ OptiBond Solo Plus, Scotchbond 1 XT, and Syntac are not registered trademarks of DENTSPLY International, Inc.






# Nanoleakage



Breschi L, Trieste

Small sticks prepared from bonded dentin specimens were immersed for 24 hours in 50 wt% ammoniacal AgNO3 solution. Thin undemineralized sections were gained using an ultra microtome. These sections were investigated under a light microscope and categorized according to their grade of nanoleakage.

XP BOND® showed the lowest degree of nanoleakage proving again its excellent ability to seal dentin.

Adhesive		Nanoleakage Grade
		1: < 25%; 2: 25-50% ; 3: 50 - 75% ; 4: > 75%
XP BOND®	grade 2	
OptiBond Solo Plus¹	grade 3	
Scotchbond 1 XT¹	grade 4	

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Data on file.

# Clinical Trial: Class V restorations after 4 years



Dondi G, Bologna

Clinical study according to the ADA Guidelines for Dentin and Enamel Adhesive Materials. Restorations were rated according to the clinical rating scale established by Gunnar RYGE (1980).

60 restorations were placed in 30 patients. Each patient received 1 restoration using Scotchbond 1 XT<sup>1</sup> and Ceram-X<sup>®</sup> and 1 restoration using XP BOND<sup>®</sup> and Ceram-X<sup>®</sup>.

Study design: Longitudinal, randomized, controlled, and single-blinded.

The investigator stated: "Safety and efficiency of XP BOND<sup>®</sup> were demonstrated."

**Number of recalled restorations after 4 years:**  
**XP BOND<sup>®</sup>: 30**  
**Scotchbond 1 XT<sup>1</sup>: 26 (4 failures after 24 months)**

Criteria and number of evaluated restorations	XP BOND <sup>®</sup> / Ceram-X <sup>®</sup> duo [%]					AP Scotchbond 1 XT <sup>1</sup> / Ceram-X <sup>®</sup> duo [%]				
	n	alpha	bravo	charl.	delta	n	alpha	bravo	charl.	delta
Retention	30	100	0	0	0	26	88.5	0	11.5	0
Post-op. sensitivity (Σ)	30	93.3	6.7	0	0	26	88.5	11.5	0	0
Marginal discoloration	30	93.3	6.7	0	0	26	88.5	0	11.5	0
Marginal integrity	30	100	0	0	0	26	88.5	0	11.5	0
Secondary caries	30	100	0	0	0	26	100	0	0	0
Restoration contour	30	93.3	6.7	0	0	26	88.5	0	11.5	0
Vitality test	30	100	0	0	0	26	100	0	0	0

<sup>1</sup> Scotchbond 1 XT is no registered trademark of DENTSPLY International, Inc.

Data on file.

# Clinical Trial: Indirect ceramic inlays and onlays after 4 years



Ferrari M, Livorno

The aim of this clinical study was to evaluate clinical parameters of Empress II restorations luted under clinical conditions with XP BOND® in combination with Self Cure Activator and Calibra™ cured in self-cure mode.

53 restorations were placed in 38 patients. No patient received more than 2 restorations. Luting procedures were performed following manufacturers' instructions. The restorations were evaluated for post-operative sensitivity, marginal discoloration, marginal integrity, secondary caries, maintenance of interproximal contact and fracture.

XP BOND® used with SCA and Calibra™ showed no residual postoperative sensitivity in 49 restorations after 4 years of placement. The results of this 4 years study reveal good clinical performance of XP BOND® in combination with SCA and Calibra™ in self-cure mode.

## Number of recalled restorations: 49

Criteria and number of evaluated restorations	XP BOND® / SCA / Calibra™ mix [n]				
	n	alpha	bravo	charl.	delta
Marginal discoloration & integrity	49	44	3	2	0
Secondary caries	49	49	0	0	0
Vitality test	49	48	1	0	0
Interproximal contacts	49	48	1	0	0
Retention	49	49	0	0	0
Fracture	49	49	0	0	0
	n	no	yes	mean	SD
Post-operative sensitivities	49	49	0	0	0

# Packaging Information



## **XP BOND® Refill**

- 1 x 5 ml XP BOND®
- 1 x 50 Applicator Tips
- 1 x CliXdish™
- 1 x Directions for use



**ReOrder 606.67.281**

## **XP BOND® Eco Refill**

- 3 x 5 ml XP BOND®
- 2 x 50 Applicator Tips
- 2 x CliXdish™
- 1 x Directions for use



**ReOrder 606.67.401**

## **Self Cure Activator**

- 1 x Self Cure Activator (4.5 ml)



**ReOrder 634354K**

## **Applicator Tips**

- 50 Applicator Tips



**ReOrder 658012**

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