



# ESTEC EM II

Tokuyama Dental Italy | Teknik Rapor





## ESTECEM II - TEKNİK RAPOR



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# 1 GİRİŞ

## 1.1 GELİŞTİRME GEÇMİŞİ

Son yıllarda, rezin sementlerinin ve birkaç firma tarafından piyasaya sunulan yapıştırma maddelerinde ön işlem gerektirmeyen kendinden yapışkanlı rezin sementlerinin (bundan sonra SA sementler olarak anılacaktır) kullanımı basitleştirilmiştir. Ancak, SA sementlerin yapışma mukavemeti ön işlem gerektiren rezin sementlere göre daha zayıftır. Üstelik, hidrofilik monomerler ve/veya asit monomerler içerdikleri için SA sementlerinin su emiliminin ve estetik özelliklerinin bozulduğu bildirilmiştir.<sup>1, 2</sup> Aynı zamanda, ön işlem gerektiren rezin sementlerin geliştirilmesinde sistemlerin basitleştirilmesi de desteklenmektedir ve ön işlem maddesine yönelik adımların sayısının düşürüldüğü veya iyileştirilmiş çok yönlülüğe sahip ön işlem maddesinin kullanıldığı ürünler piyasaya sunulmuştur. Bununla birlikte, hem basitleştirilmiş bir sürecin hem de yüksek yapışkanlığın eş zamanlı olarak sağlanması henüz yeterince tamamlanmamıştır. Özellikle, kimyasal polimerizasyon kullanırken rezin sementlerin yapışmasıyla ilgili sorunlar veya bir şişeli ön işlem ajanları kullanan ürünlerin silan kaplin ajanının bozulma riski nedeniyle silika seramiklere yapışmasıyla ilgili sorunlar vardır.<sup>3</sup>

Tokuyama Dental Corp., kolay ve güvenilir yapışma sağlayan bir rezin sement olan ve estetik restorasyonlara uygun "ESTECEM"i pazarlamaktadır. ESTECEM, önceki paragrafta açıklandığı üzere sorun olan, kimyasal polimerizasyon kullanırken yapışma mukavemeti ve silika seramiklere yapışması açısından oldukça kabul görmektedir. Bu, diş maddesi "ESTELINK" için iki şişeli ön işlem maddesinin ve "TOKUYAMA UNIVERSAL PRIMER" protez malzemeleri için iki şişeli ön işlem maddesinin kullanımıyla elde edilmiştir.<sup>4, 5, 6</sup> Ayrıca, çift kürlü pat "ESTECEM PAT", daha iyi estetik sonuçlar elde etmek için lekelenmeye neden olan asit monomerler olmadan formüle edilmiştir. Kürlenmiş rezinin mukavemeti ve lekelenme karşıtı özellikleri büyük ilgiyle karşılanmıştır.<sup>7, 8</sup> Ancak, diş yüzeyi işleme ve protez işleme süreçlerinin her biri için ikişer şişe, yani toplamda dört şişe kullandığı için ESTECEM'in çalışılabilirliğiyle (kullanım kolaylığı) ilgili hala bir sorun vardı.

Dolayısıyla, Tokuyama Dental Corp. ilk önce hem diş maddesine hem de çeşitli protez malzemelerine uygulanabilen "TOKUYAMA UNIVERSAL BOND" ürününü geliştirdi; ardından, TOKUYAMA UNIVERSAL BOND ile mükemmel estetik özellikleri bulunan ESTECEM PAT'ı birleştirerek mükemmel çalışılabilirlik (kullanım kolaylığı), yapışkanlık ve estetik özelliklere sahip "ESTECEM II"yi geliştirdi.

## 1.2 ÜRÜN AÇIKLAMASI

ESTECEM II, mükemmel kullanım, estetik ve dişlere ve tüm protez malzemelerine yapışma özelliklerine sahip, çift kürlü (ışık ve/veya kendi kendine kürlenme), radyoopak, yapışkan rezin sement sistemidir. ESTECEM II'nin ana bileşenleri ESTECEM II PAT (A/B) ve TOKUYAMA UNIVERSAL BOND'dur (A/B).

TOKUYAMA UNIVERSAL BOND, ESTECEM II PAT'ın diş yüzeyine yapışmasını destekler. TOKUYAMA UNIVERSAL BOND ayrıca, ESTECEM II PAT'ın ayrı astarlar kullanmadan tüm protez malzemelerine yapışmasını da iyileştirir.

ESTECEM II PAT, ESTECEM PAT ile aynı birleşime sahiptir. Dolayısıyla ESTECEM II, ESTECEM'in mukavemet ve estetik özelliklerini miras almıştır.

ESTECEM II'nin özellikleri şöyledir:

1. Yapışkanın basit kullanımı
2. Güvenilir yapışma
3. Mükemmel pat özellikleri (estetik özellikler, kullanım kolaylığı)

\*ESTECEM PAT'tan alınmıştır.

# 2 BİRLEŞİM VE TALİMATLAR

## 2.1 BİRLEŞİM

TOKUYAMA UNIVERSAL BOND şunları içerir:

- yapışkan monomer yeni 3D-SR monomer (fosforik asit monomer)
- 6-metakriloyloksiheksil 2-tiourasil-5-karboksilat (MTU-6)
- $\gamma$ -metakriloksipropil triethoksi silan ( $\gamma$ -MPTES)

bunlar diş ve çeşitli protezlere yapışacak yapışkan monomerlerdir; bağlama tabakası

oluşturmaya yönelik bazı monomerler (HEMA, Bis-GMA ve TEGDMA); çözücü olarak aseton, izopropil alkol ve su ve polimerizasyon başlatıcı olarak borat katalizör ve peroksit. [Tablo 1](#)

ESTECEM II PAT, ESTECEM PAT ile aynı birleşime sahiptir ve şunları içerir:

- matris monomerler olarak çok işlevli monomerler (Bis-GMA, TEGDMA ve Bis-MPEPP)
- dolgu maddesi olarak silika-zirkon dolgu maddesi (dolgu yükü: %74 ağırlık)
- polimerizasyon başlatıcı olarak kamforkinon ve peroksit

Uzun süreli estetik görünüm açısından renk solmasına neden olan asit monomerler olmadan tasarlanmıştır. [Tablo 2](#)

**Tablo 1** TOKUYAMA UNIVERSAL BOND'un birleşimi

A BAĞI	
temel bileşenler	işlev
Fosforik asit monomer (Yeni 3D-SR monomer)	Diş için yapıştırıcı Bağlama tabakasının oluşturulması Zirkon, alüminyum ve değerli olmayan metal için yapıştırıcı
MTU-6	Değerli metal için yapıştırıcı
HEMA	Diş maddesinin içine nüfuz etme, Bağlama tabakasının oluşumu
Bis-GMA	Bağlama tabakasının oluşumu
TEGDMA	Bağlama tabakasının oluşumu
Aseton	Çözücü

B BAĞI	
temel bileşenler	işlev
$\gamma$ -MPTES	Cam seramikler ve kompozit rezin için yapıştırma
Borat	Polimerizasyon katalizörü
Peroksit	Polimerizasyon katalizörü
Aseton, İzopropil alkol	Çözücü
Su	Çözücü

**Tablo 2** ESTECEM II PAT'in birleşimi

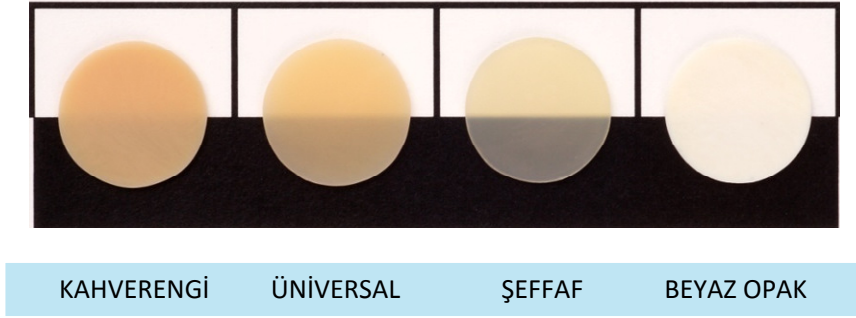
PAT A		PAT B	
temel bileşenler	işlev	temel bileşenler	işlev
Bis-GMA	Matris Monomer	Bis-GMA	Matris Monomer
TEGDMA	Matris Monomer	TEGDMA	Matris Monomer
Bis-MPEPP	Matris Monomer	Bis-MPEPP	Matris Monomer
Silika-Zirkon Dolgu Maddesi	Dolgu Maddesi (Dolgu Yükü: %74 ağırlık)	Silika-Zirkon Dolgu Maddesi	Dolgu Maddesi (Dolgu Yükü: %74 ağırlık)
		Kamforkinon	Polimerizasyon katalizörü
		Peroksit	Polimerizasyon katalizörü

## 2.2 ENDİKASYONLAR

- Cam/oksit seramikleri (porselen, zirkon ve alüminyum), metal/alaşımlar (değeri ve değerli olmayan) ve inorganik dolgu maddeleri de dahil resin malzemelerinden (kompozit malzemeler de dahil) yapılan kronların, köprülerin, inlay ve onlay dolguların sementasyonu
- Metal kronlara birleştirilen çatlak porselenin onarımı ve tüm seramik restorasyonlar
- Kaplamaların sementasyonu
- Yapıştırma köprülerin sementasyonu
- Metal ve resin çekirdeklerin, metal veya cam-fiber dayanakların sementasyonu

## 2.3 RENK TONLARI

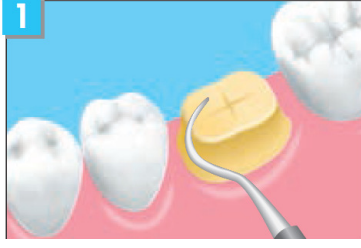
ESTECER II, aşağıda gösterilen dört renk tonunda mevcuttur. [Şekil 1](#)



[Şekil 1](#) 4 renk tonu vardır

- 1. Üniversal:**  
Diş rengine sahip renk tonu. Anterior Estetik Restorasyonlar ve genellikle çok çeşitli renk eşleştirme vakaları için idealdir. Üniversal renk Kit içine dahildir.
- 2. Şeffaf:**  
Renksiz ve şeffaf renk. Alttaki diş renginin renk ihtiyacının çoğunu karşıladığı Estetik Kron ve Kaplamalar için uygundur
- 3. Kahverengi:**  
Dentin rengine sahip renk tonu. Seramik veya kompozit resin kronlar için uygundur.
- 4. Beyaz-Opak:**  
Yüksek opasiteye sahip renk tonu. Kaplamalar ve alttaki rengin maskelenmesini gerektiren diğer vakalar için uygundur.

## 2.4 TALİMATLAR



### **Dişin Hazırlanması**

Plak, geçici sement kalıntısı, kron yerleşimini test etmek için kullanılan malzemelerden kalan yağ, el aletinden gelen yağ buharı, tükürük, kan ve eksüda sıvılarını gibi bulaşmaları ponza tozuyla fırçalayarak, ultrasonik temizlemeyle veya diş yüzeyini alkolle temizleyerek diş yüzeyinden temizleyin. Yüzeyi iyice yıkayın ve kurutun.

### **Diş yüzeyinin dağlanması (isteğe bağlı)**

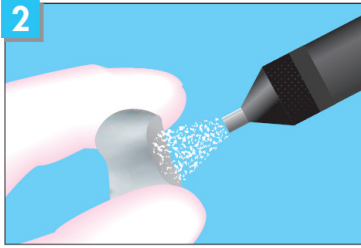
Klinik olarak yeterli yapışkan bağlar, yapıştırıcı maddenin uygulanmasıyla elde edilir. İsteğe bağlı olarak minenin dağlanması veya "total dağlama işleminin" kullanılması daha yüksek yapıştırma değerleri sağlayabilir.

#### *(a.) Selektif mine dağlama tekniği*

Fosforik asit jeli yalnızca hazırlanan kavitenin kenarını çevreleyen mineye uygulayın ve fosforik asit jeli 10-15 saniye boyunca bekletin. Dağlanan yüzeyi suyla iyice durulayın (en az 15 saniye) ve daha sonra ılık havayla kurutun.

#### *(b.) Total dağlama tekniği*

Fosforik asit jeli ilk önce hazırlanan mineye ve daha sonra dentine uygulayın. Dağlama maddesi reaksiyona girmesi için 10-15 saniye boyunca mine ve dentin üzerinde bırakılmalıdır. Suyla iyice durulayın (en az 15 saniye) ve ılık havayla veya pamuk toplarla kurutun; çok fazla kurutmayın.



### **Restorasyon Hazırlığı**

Restore edilecek malzemeye bağlı olarak aşağıda gösterilen prosedürü takip edin.

#### **1) Porselen dışındaki seramik ve kompozit malzemeler**

Yüzeyi yapışmaya hazırlamak için restorasyonun iç kısmını zımparalayarak (0,1 ila 0,2 MPa), havayla aşındırarak veya yavaş hızda elmas freze kullanarak zımparalayarak pürüzlü hale getirin.

#### **2) Porselen**

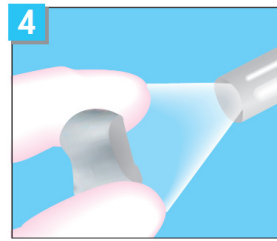
Yüzeyi pürüzlü hale getirmeyin; yapıştırma işlemi için temiz ve taze bir yüzey sağlayarak restorasyonun iç kısmını hazırlayın.

#### **3) Metal restorasyonlar**

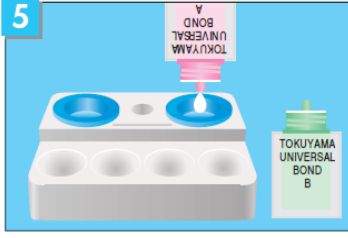
Yüzeyi yapışmaya hazırlamak için alanı zımparalayarak (0,3 ila 0,5 MPa), havayla aşındırarak veya yavaş hızda elmas freze kullanarak zımparalayarak pürüzlü hale getirin.



Yüzeyi iyice yıkayın.

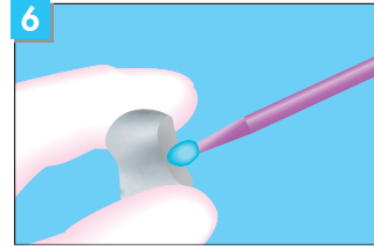


Yüzeyi kurutun.

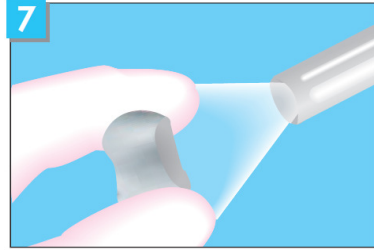


### Tokuyama Universal Bond ile restorasyon ve diş ön işlemi

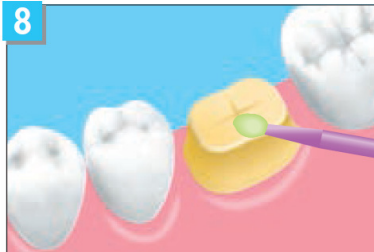
TOKUYAMA UNIVERSAL BOND A ve B'nin her birinden bir damla karıştırma kuyucuğuna veya tek kullanımlık karıştırma kuyucuğuna damlatın ve karıştırın.



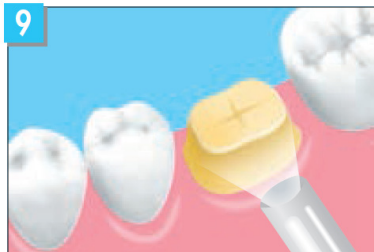
Karıştırılan bağlayıcıyı, yapıştırılacak restorasyonun yüzeyine uygulayın.



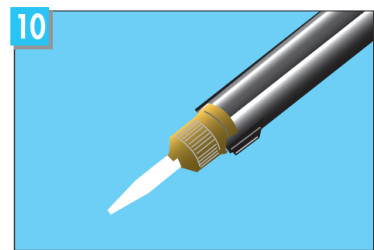
üzeye ılık hava uygulayın.



Karıştırılan bağlayıcıyı, yapıştırılacak dişin yüzeyine uygulayın.



Akışkan bağlayıcı hareket etmeden aynı konumda durana dek sürekli olarak zayıf hava uygulayın ve ardından yüzeye ılık hava uygulayın.



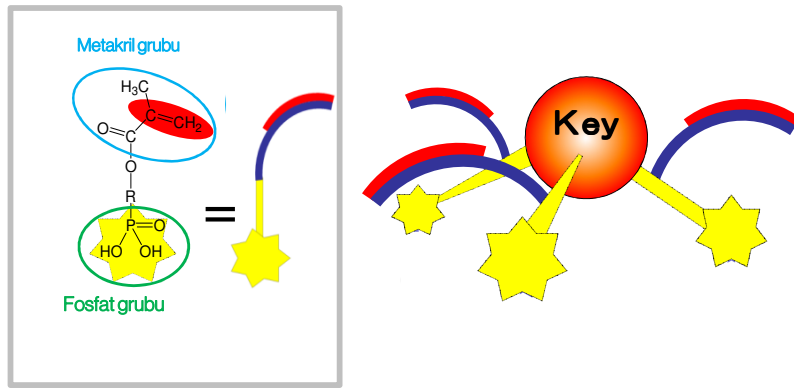
### Sementasyon ve Nihai Bağlama

"Karıştırma ucu nasıl takılır" bölümüne uygun olarak şırıngaya karıştırma ucu takın.

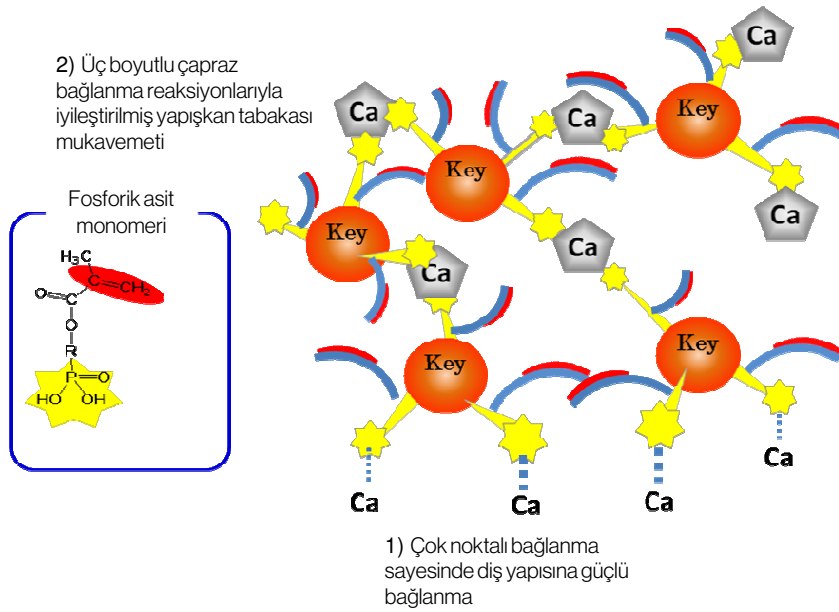


## 2.5.1 Diş maddesine yapışma mekanizması

Tokuyama Dental Corp., Tokuyama Bond Force bağlama maddesinin diş yüzeyine yapışkanlığını iyileştirmek için 3D-SR teknolojisini geliştirdi<sup>9, 10</sup>. Moleküle göre **Şekil 2** kalsiyum ve polimerleştirici gruplarla etkileşime girebilen birkaç işlevsel gruba sahip bu 3D-SR monomer (1. nesil) diş maddesindeki kalsiyumla birden çok noktada etkileşime girerek diş yapısı yüzeyinde güçlü bir yapışkanlık oluşturur. Üstelik, kalsiyum aracılığıyla üç boyutlu çapraz bağlanma ortaya çıkar ve yapışkan 3D-SR monomerleri ve diğer monomerler arasındaki eş polimerizasyon oldukça güçlü bir bağlanma tabakasının oluşmasına katkı sağlar. **Şekil 3**

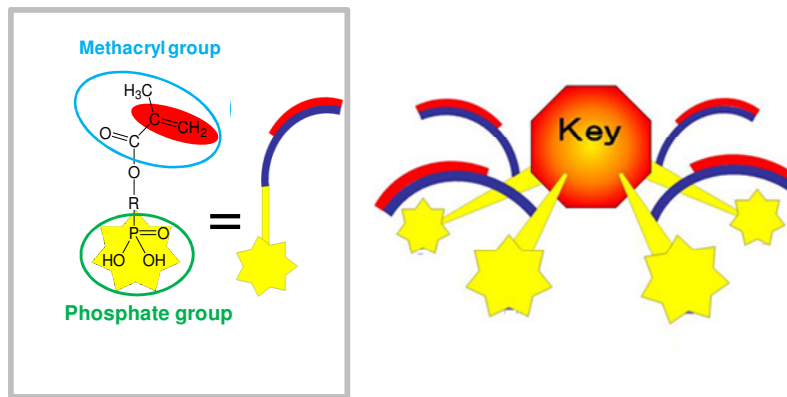


**Şekil 2** 1. Nesil 3D-SR Monomer



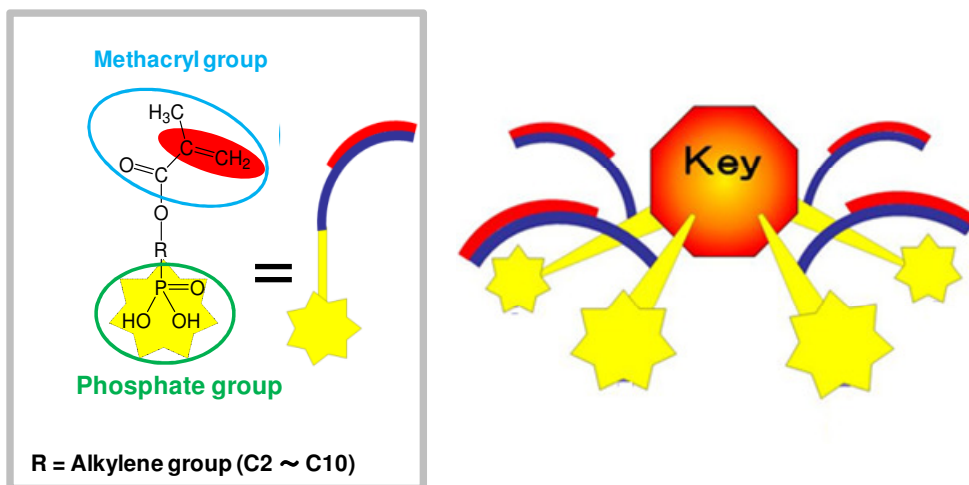
**Şekil 3** Yapışkan SR monomerlerinin ve kalsiyum iyonlarının üç boyutlu çapraz bağlanma reaksiyonları

To achieve the enhanced properties, our patented 3D-SR monomers were improved and the chemistry was optimized (2nd generation, [Figure 4](#)). In comparison to the previous Bond Force generation, the number of groups interacting with calcium groups and polymerizing groups per molecule of new 3D-SR monomer has been successfully increased. With the new and improved 3D-SR monomers providing a higher level of interaction with the calcium and enhanced three-dimensional cross-linking reactions, Tokuyama Bond Force II and ESTELINK provide decreased application time from the previous 20 seconds down to 10 seconds. Furthermore, the 2nd-generation 3D-SR monomer was adopted for TOKUYAMA UNIVERSAL PRIMER as a zirconia adhesive monomer.



**Figure 4** 2nd Generation 3D-SR Monomer

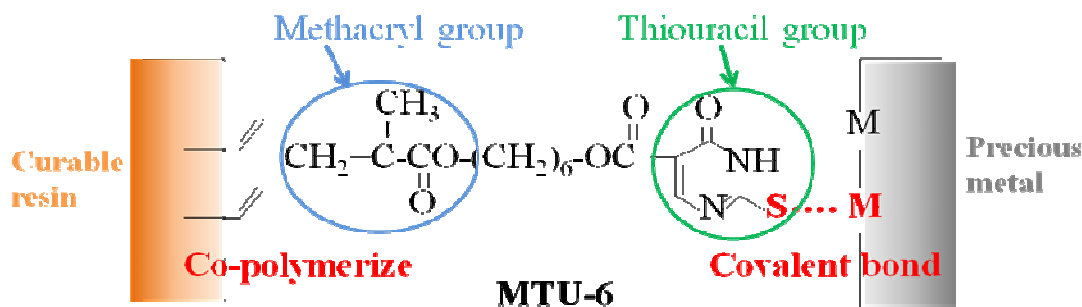
TOKUYAMA UNIVERSAL BOND has an enhanced response to tooth calcium and durability by combining several phosphoric acid monomers having different chain lengths of the main chain, the alkylene group (the 3rd-generation 3D-SR monomer, [Figure 5](#)). This could reduce the tooth application time from 10 to 0 seconds. Furthermore, this 3rd-generation 3D-SR monomer contributes to adhesion to non-precious metal as well as tooth, zirconia.



**Figure 5** 3rd Generation 3D-SR Monomer

## 2.5.2 Mechanism of adhesion to precious metal

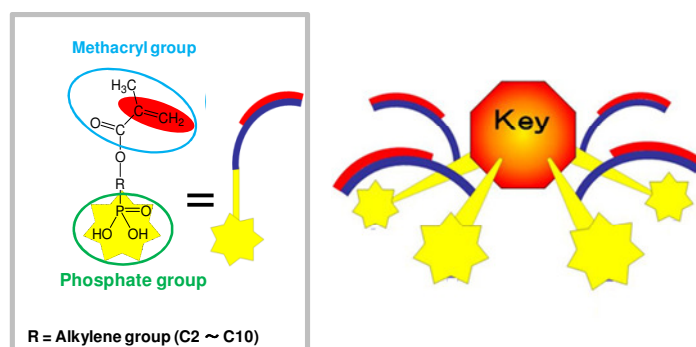
The adhesive monomer for precious metal is MTU-6. As shown in [Figure 6](#), the sulfur atom in the thiouracil group of MTU-6 interacts with precious metal (covalent bond) and additionally, the methacryl group co-polymerizes with monomers in dental-curable materials (resin cements, bonding agents, resin composites, etc.) for adhesion.



[Figure 6](#) Mechanism of adhesion to precious metal

## 2.5.3 Mechanism of adhesion to non-precious metal

The adhesive monomer for non-precious metal is new 3D-SR monomer. As shown in [Figure 7](#), the phosphate group of new 3D-SR monomer interacts with the oxygen atom of the passive layer of a nonprecious metal surface (hydrogen bond) and additionally, the methacryl group co-polymerizes with monomers in dental curable materials (resin cements, bonding agents, resin composites, etc.) for adhesion.



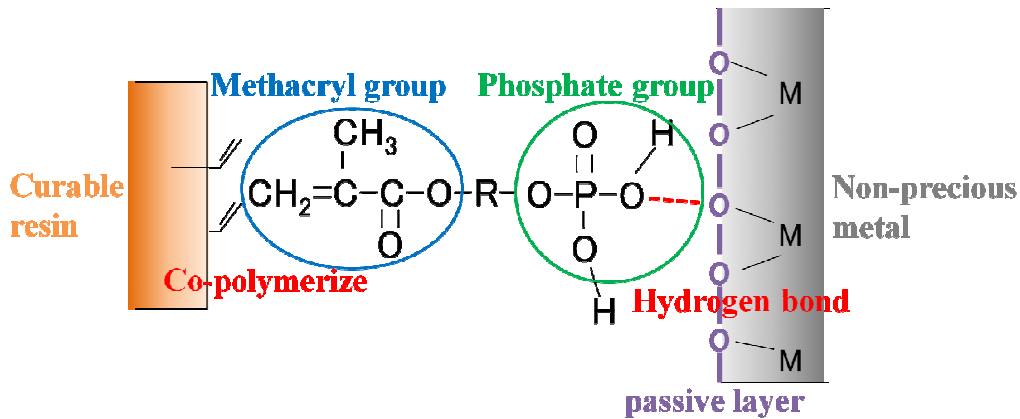


Figure 7 Mechanism of adhesion to non-precious metal

## 2.5.4 Mechanism of adhesion to glass-ceramics/resin

The adhesive monomer for glass-ceramics, porcelain and resin materials including inorganic filler is the new silane coupling agent,  $\gamma$ -MPTES. First, the alkoxy group in  $\gamma$ -MPTES reacts with water to form a silanol group [Figure 8](#) and next, a siloxane bond is formed by a dehydration and condensation reaction with the silanol group on the ceramic surface. Additionally, the methacryl group co-polymerizes with monomers in dental curable materials (resin cements, bonding agents, resin composites, etc.) for adhesion. [Figure 9](#)

TOKUYAMA UNIVERSAL BOND is a two bottle-type product, and stabilization of the silane coupling agent in bottles is excellent, and the risk of deterioration of the silane coupling agent that may occur in a one bottle-type product<sup>11</sup> is reduced. In addition, since the new silane coupling agent,  $\gamma$ -MPTES is more stable in the bottle than the conventional one ( $\gamma$ -MPS), the adhesion effect lasts for a long time.

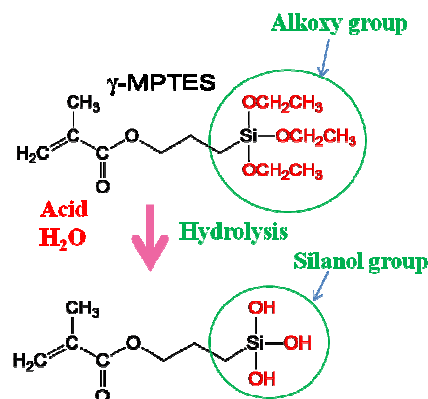


Figure 8 Hydrolysis of  $\gamma$ -MPTES

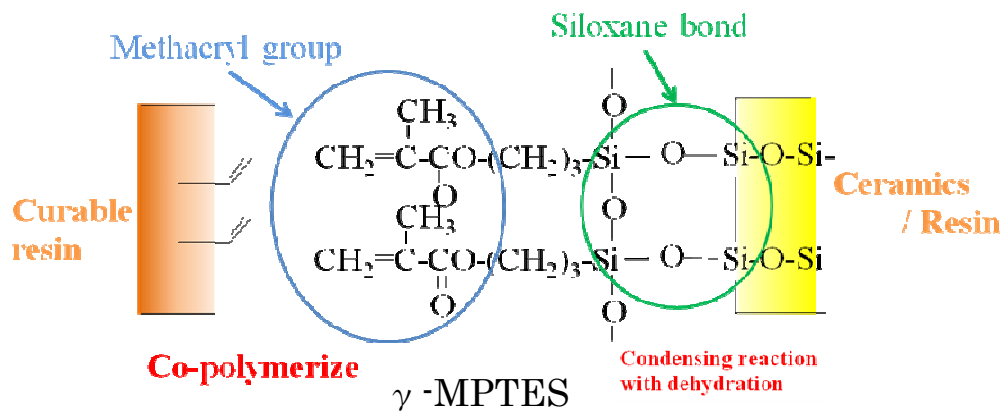


Figure 9 Mechanism of adhesion to glass-ceramics/resin

## 2.5.5 Mechanism of adhesion to zirconia/alumina

The adhesive monomer for zirconia/alumina is the new 3D-SR monomer (phosphoric acid monomer). It is believed that the phosphate group of new 3D-SR monomer forms chemical bonds with the zirconia/alumina surface for adhesion. [Figure 10](#)

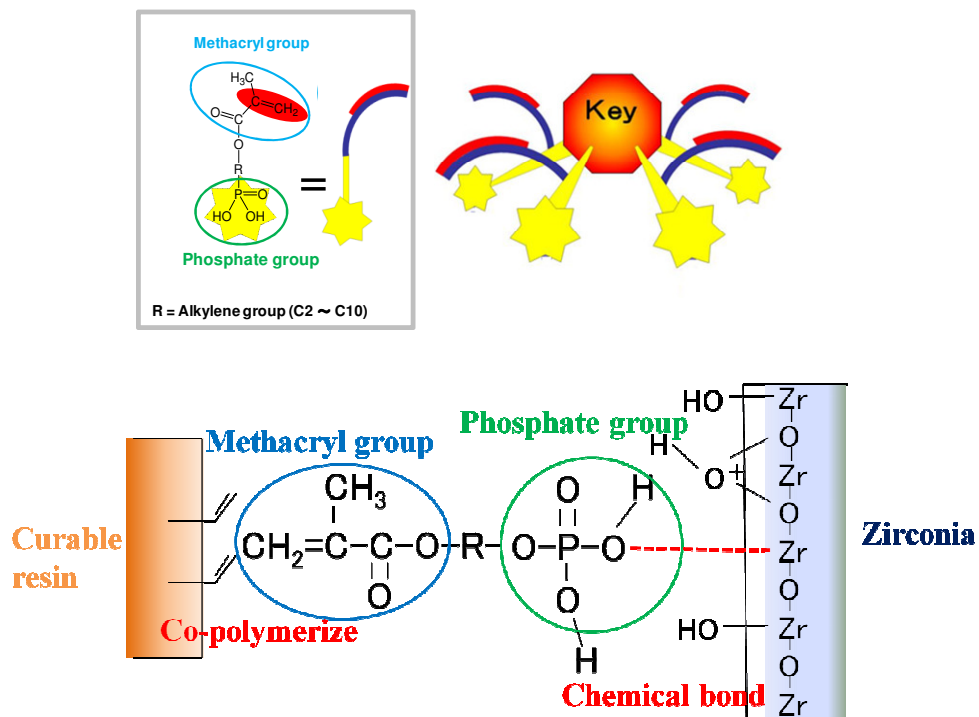
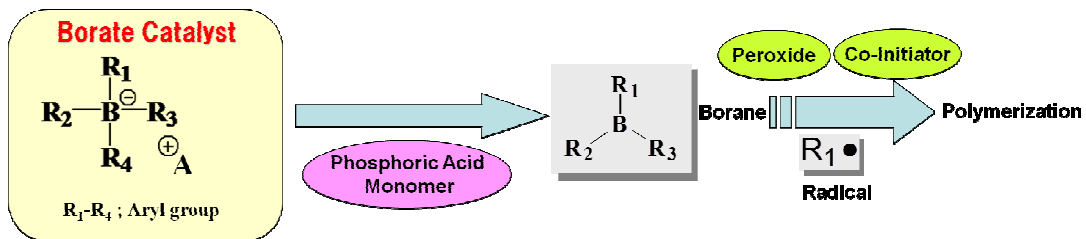


Figure 10 Mechanism of adhesion to zirconia

## 2.5.6 Mechanism of polymerization initiator "Contact Cure"

TOKUYAMA UNIVERSAL BOND employs our original BoSE technology with a borate initiator. The borate initiator is decomposed by acid (phosphoric acid monomer) and transformed into a borane compound which produces free radicals. In addition, TOKUYAMA UNIVERSAL BOND contains a peroxide that accelerates degradation of the borane compound and serves as a highly active chemical polymerization initiator *Figure 11*. BoSE technology is superior to the conventional chemical polymerization initiator, a benzoyl peroxide/amine system, because it exhibits high catalytic activity under strongly acidic conditions. A thin bonding layer formed after air blow becomes hard because of rapid progression of polymerization and curing on its adhesive interface (Contact Cure), when it comes into contact with resin materials such as composite resin. Excellent polymerization under acidic conditions made it possible to cover self-curing as well as light-curing and dual-curing type resin materials.



*Figure 11 Mechanism of polymerization initiator*


















# 3 FEATURES

## 3.1 SIMPLE HANDLING OF ADHESION

ESTEC EM II achieves adhesion to teeth and various prosthetic materials with the same treatment method, namely, through the use of TOKUYAMA UNIVERSAL BOND. Therefore, teeth and prosthetics can be treated using the same liquid when cementing prosthetics. Moreover, even in a

situation where the tooth substance and a resin core or metal core are mixed in the abutment tooth, there is no need to apply a dedicated primer for each material. ESTECER II is a very simple system compared to competing cement systems. In addition to the above-mentioned characteristics, TOKUYAMA UNIVERSAL BOND does not require any waiting time after application, which contributes to a reduction in total chair time. [Table 3](#)

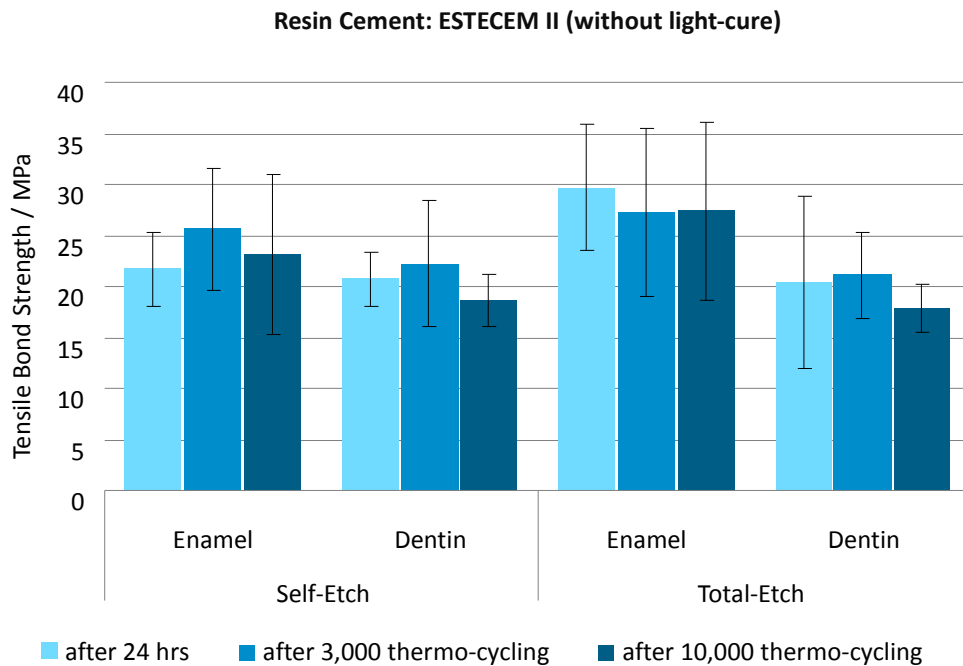
**Table 3** Comparison of pre-treatment agents bundled with the cement systems of different manufacturers

product	Estecem II	Estecem	Panavia V5	Panavia F2.0	RelyX Ultimate	NX3	Duo-Link Universal	Multilink Automixt	Variolink Esthetic DC
Teeth		 10 sec	 20 sec	 30 sec		 20 sec-15 sec	 10-15 sec	 30 sec	 20 sec
Precious metal									
Non-precious metal						No treatment			
Ceramics									
Indirect composite									
Zirconia		10 sec			20 sec		Note: ceramics primer is needed for ceramics	60 sec	60 sec

## 3.2 RELIABLE ADHESION

### 3.2.1 Adhesion of ESTECER II to tooth substance

The tensile bond strength of ESTECER II on enamel and dentin was measured in the self-etch and total-etch modes. The results are shown in [Figure 12](#). ESTECER II exhibited good bonding strength during the initial stage and after thermo-cycling in both modes.



**Figure 12** Tensile bond strength on enamel and dentin with varying waiting time when used with the self-etch and total-etch techniques

The tensile bond strength of ESTECM II and competitive products ([Table 4](#)) to the tooth substance was evaluated (initial bond strength and bond strength after durability test). The cement was cured by chemical polymerization, based on the assumption that it may be used under light-shielding conditions. As shown in [Figures 13-14](#), the results showed that ESTECM II had strong adhesion to both enamel and dentin. The results also demonstrated that ESTECM had superior durability.

**Table 4** Tested resin cement system

Resin Cement	Manufacturer	Abbreviation
ESTECM II	Tokuyama Dental	ES II
ESTECM	Tokuyama Dental	ES
Rely X Ultimate	3M ESPE	RU
NX3	Kerr	N3
Duo-Link	Bisco	DL
Multilink Automix	Ivoclar Vivadent	MA
Variolink Esthetic DC	Ivoclar Vivadent	VE
Panavia V5	Kuraray Noritake	PV
Panavia F 2.0	Kuraray Noritake	PF

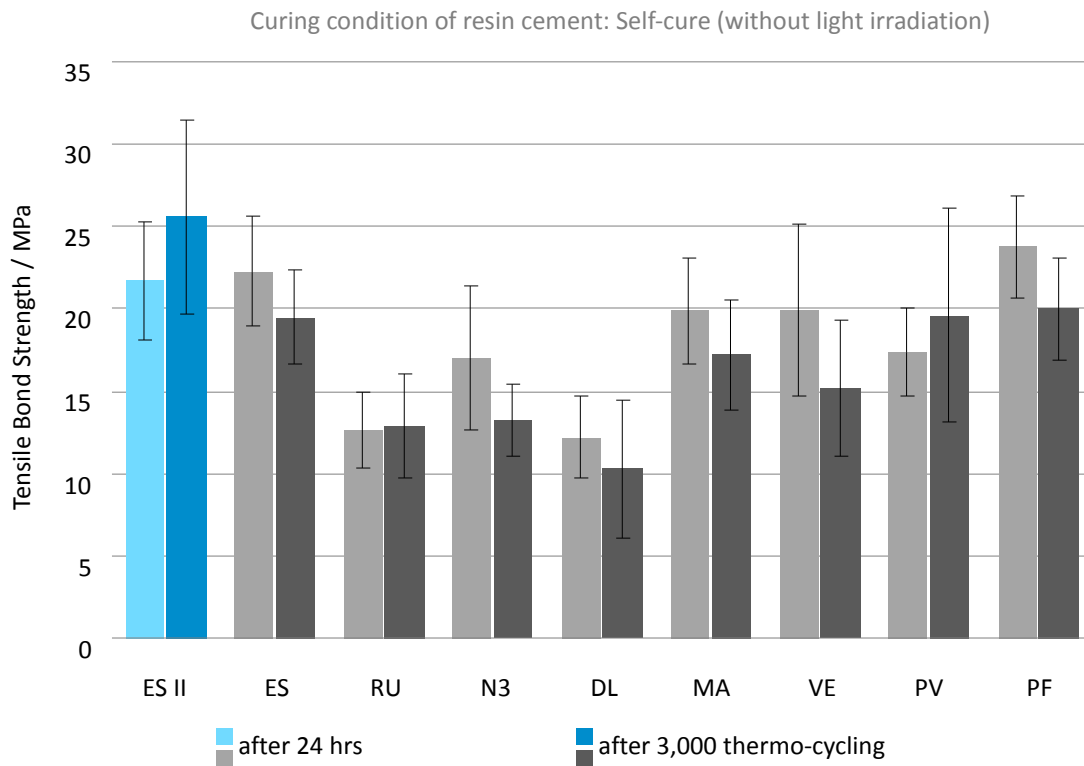


Figure 13 Tensile bond strength of resin cement systems on enamel, before and after thermo-cycling.

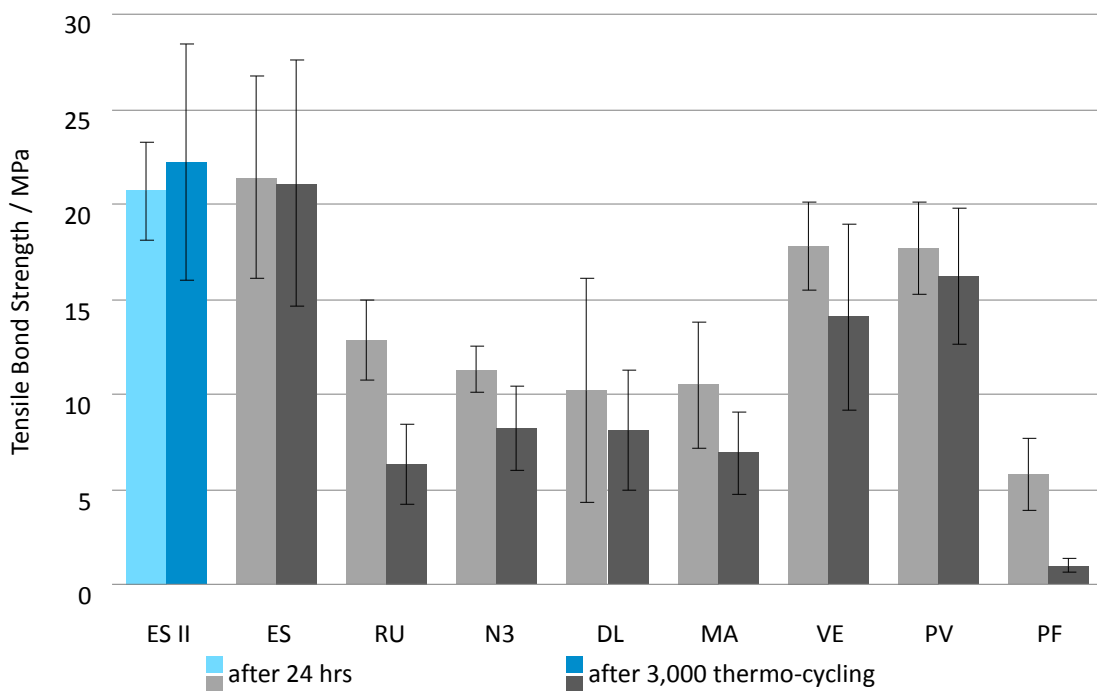


Figure 14 Tensile bond strength of resin cement systems on dentin, before and after thermo-cycling.

Figure 15 show data<sup>12</sup> generated by Dr. Miyazaki at Nihon University. The data show shear bond strength at 24hours. TOKUYAMA UNIVERSAL BOND / ESTECCEM II system was compared to Sctochbond universal Adhesive / RelyX Ultimate system in the self-etch mode and total-etch mode to dentin.

TOKUYAMA UNIVERSAL BOND / ESTECCEM II system exhibited good adhesion, regardless of whether phosphoric acid etching was used or light irradiation of the resin cement was performed.

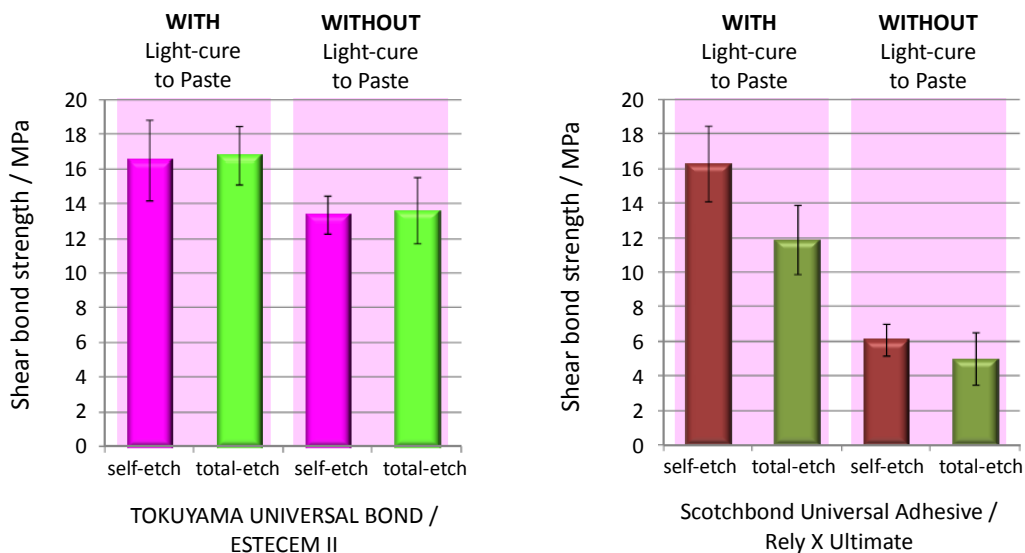


Figure 15 Shear bond strength to dentin in self-etch and total-etch technique w/w/o light-curing.

Figure 16 show data<sup>13</sup> generated by Dr. Sano at Hokkaido University. The data show micro-tensile bond strength at 24hours. TOKUYAMA UNIVERSAL BOND / ESTECCEM II system was compared to Scotchbond universal Adhesive / RelyX Ultimate system with/without right irradiation mode to dentin.

TOKUYAMA UNIVERSAL BOND/ESTECCEM II system demonstrated good adhesion to the tooth substance even without light irradiation of the resin cement.

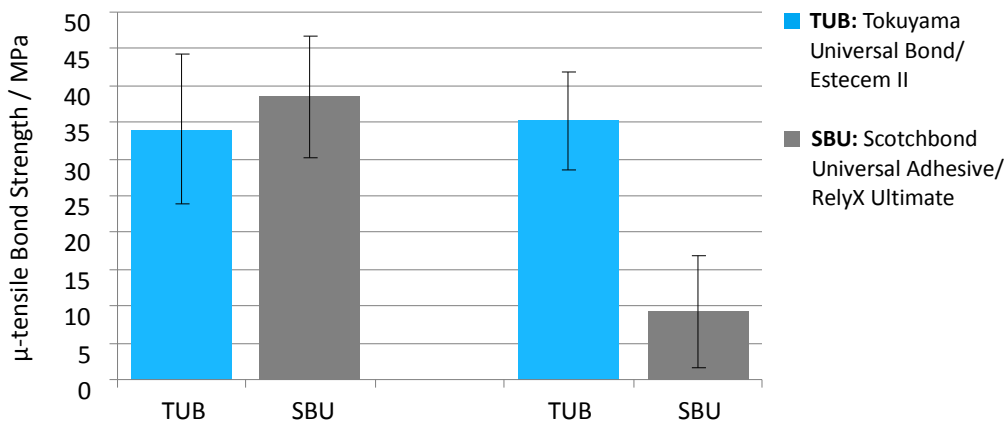


Figure 16 Micro-tensile bond strength on dentin with/without light-curing

### 3.2.2 Adhesion of ESTECM II to various indirect substrates

The tensile bond strength of ESTECM II on various prosthetic materials was evaluated. The bond strengths of the prosthetic materials listed in [Table 5](#) are shown in [Figures 17-18](#). The cement was cured through chemical polymerization, based on the assumption that it may be used under light-shielding conditions. The results showed that ESTECM II had strong adhesion to all prosthetic materials. These results are based on the reaction between the adhesive monomers (MTU-6, New 3D-SR monomer,  $\gamma$ -MPTES), which are the components of the pre-treatment agent TOKUYAMA UNIVERSAL BOND, and the prosthetics made of various materials.

Resin Cement: ESTECM II

Curing condition: Self-cure (without light irradiation)

**Table 5** Tested prosthetic materials and pre-treatment method

	Manufacturer	Product name (abbr.)	Composition	Pre-treatment
<b>Precious metal</b>	Tokuyama Dental	CASTMASTER12S (12S)	Au12/Pd20/Ag54/Cu12/other2	1) Grind with #1500 SiC
	GC	Casting Gold M.C. TYPE IV (CG4)	Au70/Pd3/Ag8/Cu16/Pt2/other1	2) Sandblast (50um of Al <sub>2</sub> O <sub>3</sub> )
		Casting Gold M.C. TYPE III (CG3)	Au75/Pd3/Ag5/Cu16/other1	
		Casting Gold M.C. TYPE II (CG2)	Au76/Pd2/Ag7/Cu14/other1	
	DENTSPLY SANKIN	MIRO BRIGHT (MB)	Ag72/Zn13/Sn9/In6	
SUNSILVER CB (SS)		Ag77/Zn10/In7/Cu5		
<b>Non-precious metal</b>	Tokuyama Dental	ICROME (IC)	Co57.8/Cr31.6/Mo5.6/other5	1) Grind with #1500 SiC
		TITADENT (TI)	Ti 99.5%	2) Sandblast (50um of Al <sub>2</sub> O <sub>3</sub> )
		TITADENT II (TI2)	Ti90/Al16/V4	
<b>Ceramics (Silica-base ceramics)</b>	Kuraray Noritake Dental	Super Porcelain AAA (SP)	—	1) Grind with #800 SiC
	Ivoclar vivadent	IPS Empress (IE)	—	
	Ivoclar vivadent	IPS e.max CAD (EC)	—	
<b>Indirect composite</b>	SHOHU	CERAMAGE (CE)	—	1)Grind with #1500 SiC
	Kuraray Noritake Dental	ESTENIA C&B (ES)	—	2)Sandblast (50um of Al <sub>2</sub> O <sub>3</sub> )
<b>CAD/CAM BLOCK</b>	VITA	Enamic (EM)	—	1) Grind with #1500 SiC
	DENTSPLY SANKIN	KZR-CAD HR2 (KH)	—	2) Sandblast (50um of Al <sub>2</sub> O <sub>3</sub> )
<b>Zirconia</b>	TOSO	TZ-3Y-E (TZ)	Yttria stabilized Zirconia (Yttria 3%)	1) Grind with #120 SiC
	3M ESPE	LAVA Zirconia (LZ)	—	2) Sandblast (50um of Al <sub>2</sub> O <sub>3</sub> )
	Kuraray Noritake Dental	KATANA Zirconia (KZ)	—	

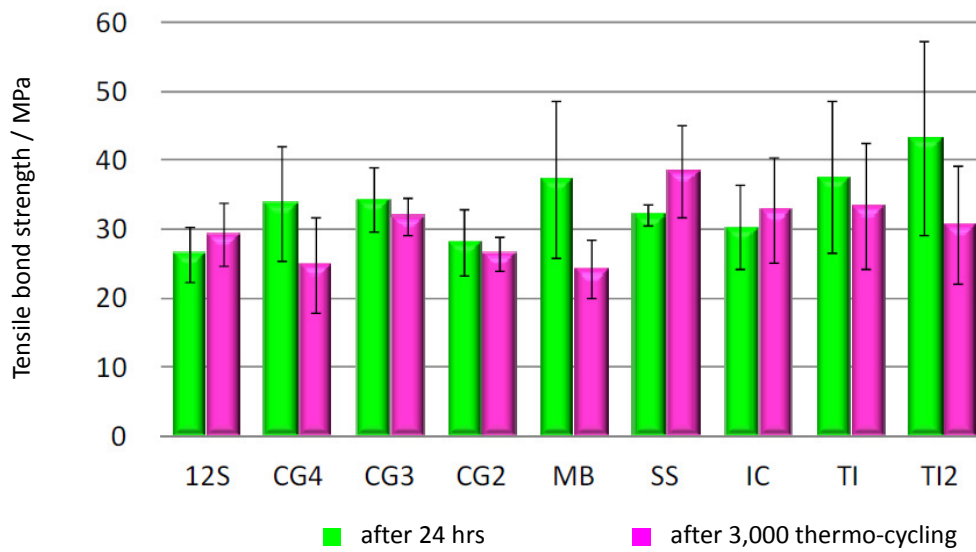


Figure 17 Tensile bond strength of ESTEC EM II on metal

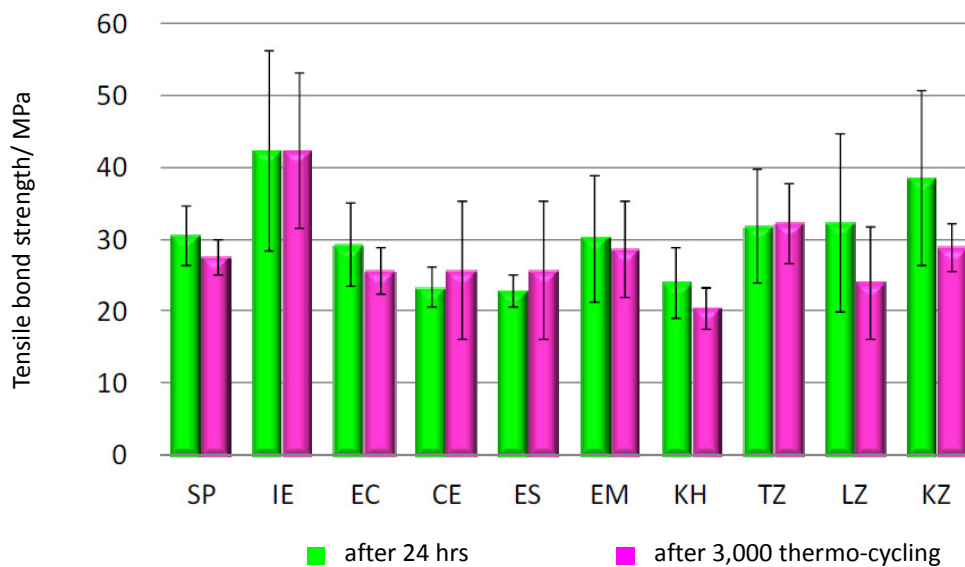


Figure 18 Tensile bond strength of ESTEC EM II on ceramics, indirect resin, CAD/CAM block and zirconia

The tensile bond strength of ESTEC EM II and competitive products (Table 7) to the prosthetic materials was evaluated (initial bond strength and bond strength after durability test). The cement was cured by chemical polymerization, based on the assumption that it may be used under light-shielding conditions. As shown in Figures 19-23, the results showed that ESTEC EM II had strong adhesion to all prosthetic materials. The results also demonstrated that ESTEC EM II had superior durability.

**Table 6** Tested prosthetic materials and pre-treatment method

	Manufacturer	Product name	Composition	Pre-treatment
<b>Precious metal</b>	Tokuyama Dental	CASTMASTER1 2S	Au12/Pd20/Ag54/Cu12/other2	1) Grind with #1500 SiC 2) Sandblast (50um of Al <sub>2</sub> O <sub>3</sub> )
<b>Non-precious metal</b>	Tokuyama Dental	ICROME	Co57.8/Cr31.6/Mo5.6/other5	1) Grind with #1500 SiC 2) Sandblast (50um of Al <sub>2</sub> O <sub>3</sub> )
<b>Ceramics (Silica-base ceramics)</b>	Kuraray Noritake Dental	Super Porcelain AAA	—	1) Grind with #800 SiC
<b>Indirect composite</b>	Tokuyama Dental	PEARLESTE	—	1) Grind with #1500 SiC 2) Sandblast (50um of Al <sub>2</sub> O <sub>3</sub> )
<b>Zirconia</b>	TOSO	TZ-3Y-E	Yttria stabilized Zirconia (Yttria 3%)	1) Grind with #120 SiC 2) Sandblast (50um of Al <sub>2</sub> O <sub>3</sub> )

**Table 7** Tested resin cement system for prosthetic materials

Resin Cement (Abbr.)	Prosthesis				
	Precious metal	Non-precious metal	Ceramics	Indirect composite	Zirconia / Alumina
<b>ESTECEM II (E II)</b>	TOKUYAMA UNIVERSAL BOND				
<b>ESTECEM (ES)</b>	TOKUYAMA UNIVERSAL PRIMER				
<b>RelyX Ultimate (RU)</b>	Scotchbond Universal Adhesive				
<b>Multilink Automix (MA)</b>	Monobond Plus				
<b>Variolink Esthetic DC (VE)</b>	Monobond Plus				
<b>NX3 (N3)</b>	-	Optibond XTR			
<b>Panavia V5 (PV)</b>	Clearfil Ceramic Primer Plus				
<b>Panavia F2.0 (PF)</b>	Alloy Primer	Clearfil SE Bond Primer + Clearfil Porcelain Bond Activator			
<b>DUO-LINK (DL)</b>	Z-Prime Plus	Porcelain primer	Z-Prime Plus		

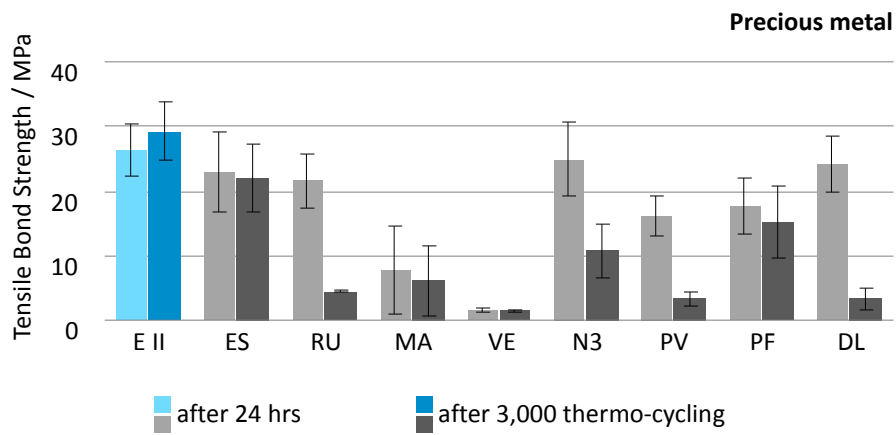


Figure 19 Tensile bond strength of resin cements on precious metal

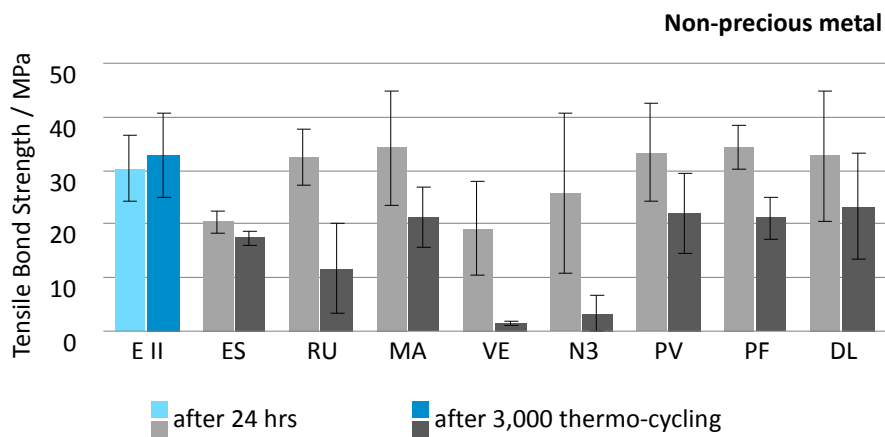


Figure 20 Tensile bond strength of resin cements on non-precious metal

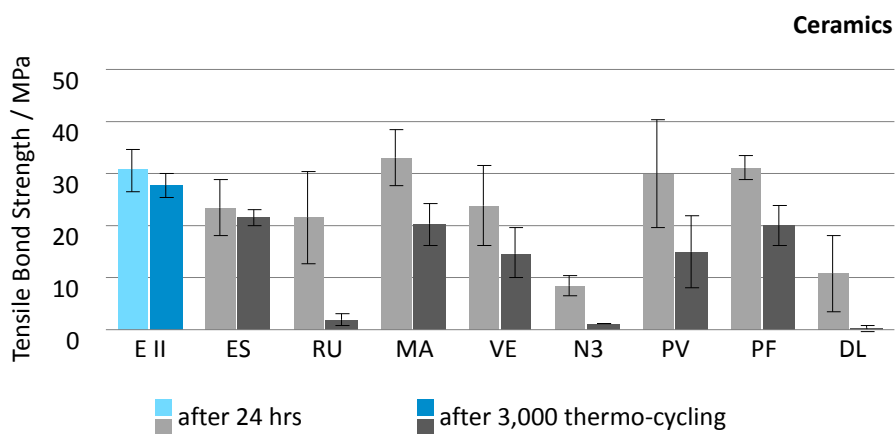


Figure 21 Tensile bond strength of resin cements on ceramics

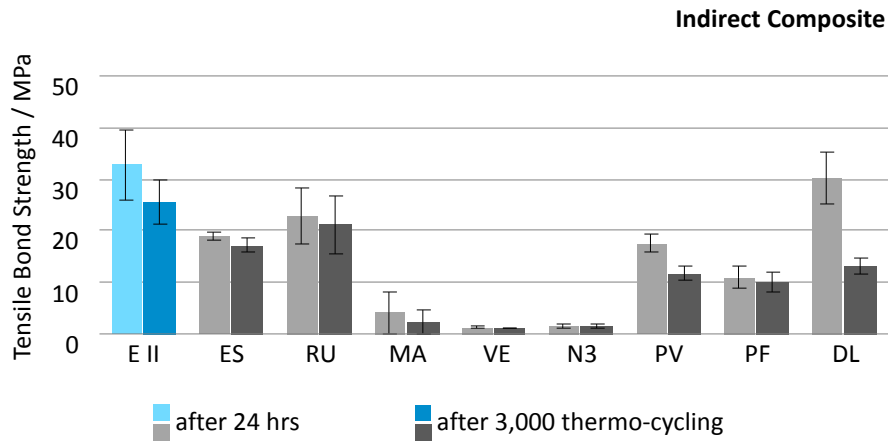


Figure 22 Tensile bond strength of resin cements on indirect composite

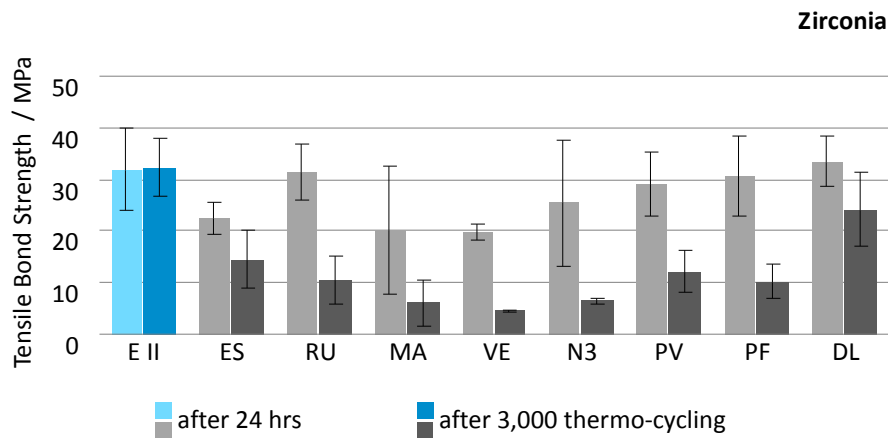


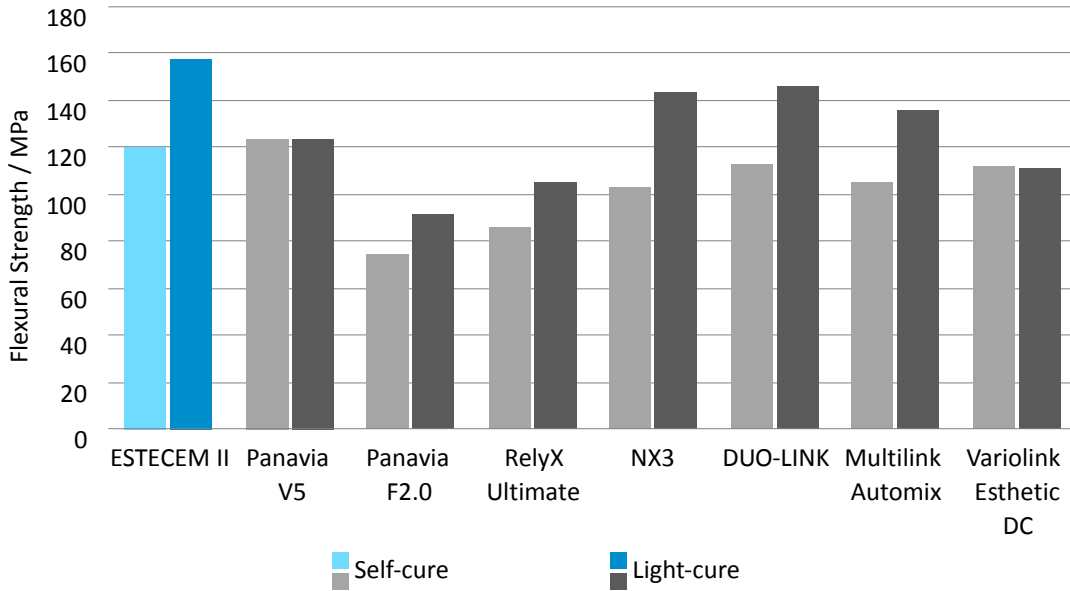
Figure 23 Tensile bond strength of resin cements on zirconia

### 3.3 SUPERIOR ESTHETICS

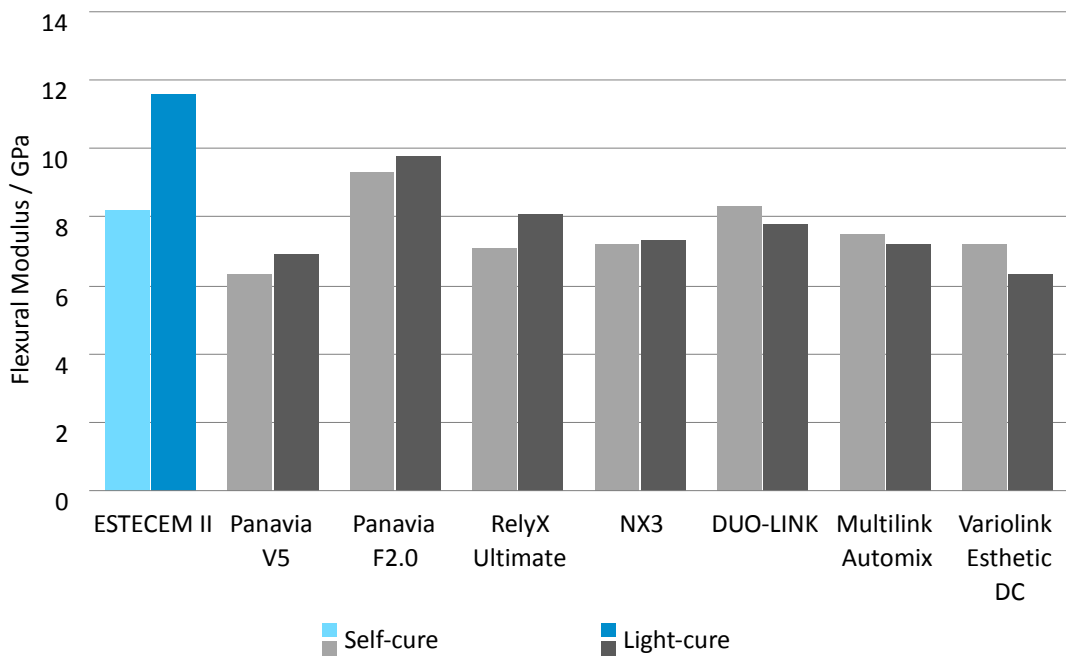
#### 3.3.1 Flexural strength and elastic modulus

ESTECM II PASTE has the same composition as ESTECM PASTE. Therefore, ESTECM II PASTE has inherited the excellent strength and esthetic properties of ESTECM PASTE<sup>7,8</sup>

The flexural strength and flexural modulus of cured ESTECCEM II PASTE were evaluated. [Figures 24-25](#) The evaluation method complied with ISO4049. The flexural strength and elastic modulus of ESTECCEM II were at least comparable or superior to those of other manufacturers. Increasing the strength of cured paste reduces abrasion at the margin and enables restoration to achieve better esthetic results.



**Figure 24** Flexural strength of ESTECCEM II and competitive products



**Figure 25** Flexural modulus of ESTECCEM II and competitive products

### 3.3.2 Water sorption and the solubility

The water sorption and the solubility of cured ESTECEM II PASTE were evaluated. *Figures 26-27* The evaluation method complied with ISO4049. The water sorption and the solubility of ESTECEM II were both lower than the resin cements of other manufacturers, resulting in good adhesion durability, and anti-staining properties. Therefore, ESTECEM II can be expected to demonstrate reliable adhesion and produce excellent esthetic results in long-term clinical use.

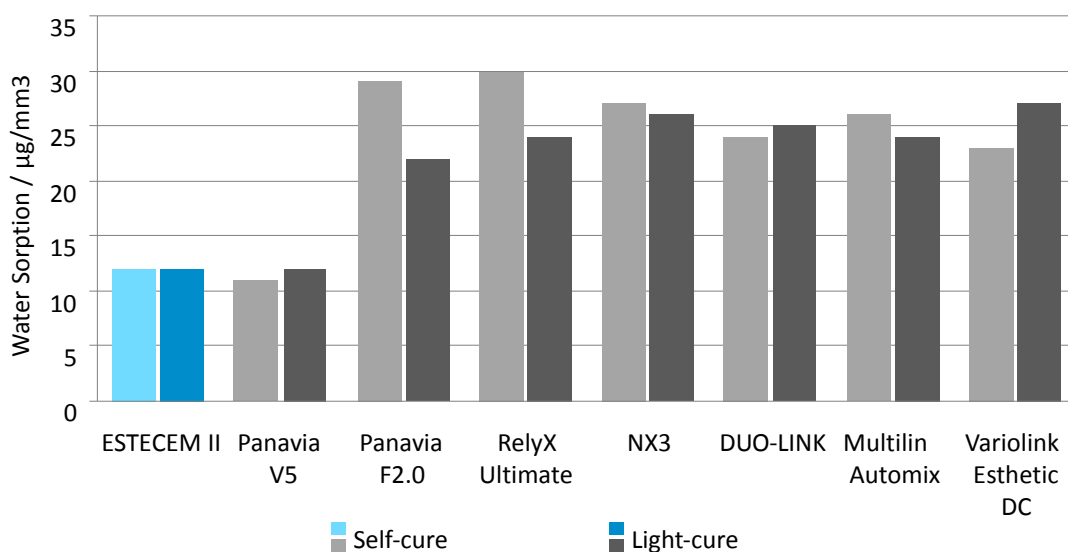


Figure 26 Water sorption of ESTECEM II and competitive products

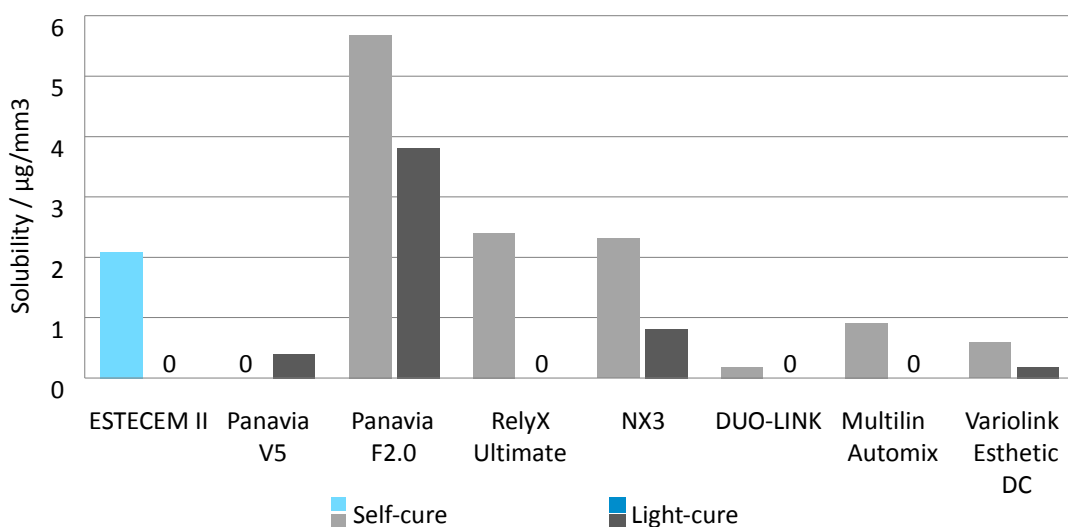


















Figure 27 Solubility of ESTECEM II and competitive products

















### 3.3.3 Color stability

Staining tests with coffee and curry were performed for cured ESTEC EM II PASTE. [Tables 8-9](#). The results show that ESTEC EM II has superior anti-staining properties compared with the resin cements of other manufacturers. Therefore, ESTEC EM II can be expected to produce excellent esthetic results in long-term clinical use.

**Table 8** Results of staining test with coffee

<b>COFFEE</b>								
	ESTEC EM II	Panavia V5	Panavia F2.0	RelyX Ultimate	NX3	DUO-LINK	Multilink Automix	Variolink Esthetic DC
Shade	UNIVERSAL	UNIVERSAL	LIGHT	A1	YELLOW	UNIVERSAL	YELLOW	LIGHT
Before test								
After test								
$\Delta E$	4,61	12,50	11,83	8,83	8,90	8,18	10,98	19,80

**Table 9** Results of staining test with curry

<b>CURRY</b>								
	ESTEC EM II	Panavia V5	Panavia F2.0	RelyX Ultimate	NX3	DUO-LINK	Multilink Automix	Variolink Esthetic DC
Shade	UNIVERSAL	UNIVERSAL	LIGHT	A1	YELLOW	UNIVERSAL	YELLOW	LIGHT
Before test								
After test								
$\Delta E$	6,55	8,87	8,40	9,48	9,70	9,56	8,94	12,80

## 3.4 EASE OF USE

### 3.4.1 Physical Properties Related to Cement Handling

The physical properties related to handling of ESTEC EM II PASTE and competitive products were summarized. [Table 10](#) The evaluation method complied with ISO4049.

**Table 10** Physical properties related to handling of resin cements

	ESTECEM II	Panavia V5	Panavia F2.0	RelyX Ultimate	NX3	DUO-LINK system	Multilink Automix	Variolink Esthetic DC
<b>Curing Time (37°C)</b>	4'30"	2'50"	6'30"	2'40"	2'00"	2'35"	5'30"	2'15"
<b>Working Time (25°C)</b>	2'40"	6'00"	10'30"	4'10"	2'10"	2'00"	3'30"	3'00"
<b>Radiopacity</b>	YES	YES	YES	YES	YES	YES	YES	YES
<b>Film Thickness /<math>\mu</math>m</b>	10	8	21	7	9	7	9	17
<b>Flowability (Vertical) /mm</b>	0	2	2	1	0	0.5	0	0

### 3.4.2 Removability of excess cement

ESTECEM II has been designed to provide "ample time for removal of excess cement." Regardless of the intensity of light used, excess cement can be removed over a prolonged period when using photopolymerization. [Table 11](#) It also gives sufficient time for removal with chemical polymerization. [Table 12](#).

Test procedure:

1. The labial side of an extracted bovine first front tooth was ground using silicon carbide paper (#600) to adjust the enamel.
2. The adjusted bovine tooth was then left to stand at 37°C under humid conditions for at least 1 hour.
3. Each cement paste (from different manufacturers) was mixed in accordance with the manufacturer's instructions, applied to the bovine tooth, and a piece of metal 1-mm square was pressed against the paste so that the paste protruded from the sides.
4. The tooth was shielded from light at 37°C under humid conditions for a preset period of time or irradiated with light to cure the cement.
5. Cement protruding from the sides of the metal piece was removed with an explorer.

○: excess cement can be removed easily

△: cement paste is soft/hard but can nevertheless be removed

x: cement paste is too soft/hard to be removed

**Table 11** Removability of excess cement (using photopolymerization)

	Light Intensity mW/cm2	Irradiation time / sec.												
		1	2	3	4	5	6	7	8	9	10	11	12	
ESTECCEM II	200	x	○							x				
	400	x	○						x					
	800	x	○						x					
Panavia V5	200	x	Δ	Δ	○								Δ	
	400	x	Δ	○							x			
	800	Δ	○			Δ		x			x			
Panavia F2.0	200	x	○									x		
	400	x	○								x			
	800	○								x				
RelyX Ultimate	200	○	x											
	400	Δ	x											
	800	x												
NX3	200	○								x				
	400	○		Δ						x				
	800	○	Δ	x										
DUO-LINK	200	○		Δ						x				
	400	○	Δ	x										
	800	Δ	x											
Multilink Automix	200	Δ	○	x										
	400	○		x										
	800	○	x											
Variolink Esthetic DC	200	x	○											
	400	○												
	800	○												

**Table 12** Removability of excess cement (using chemical polymerization)

	After placing the restoration / min.														
	0,5	1,0	1,5	2,0	2,5	3,0	3,5	4,0	4,5	5,0	5,5	6,0	7,0	8,0	
ESTECCEM II	x	○									x				
Panavia V5	x	Δ	○			Δ		x							
Panavia F2.0 with Oxygard	x	○									x				
RelyX Ultimate	x	Δ	○					Δ		x					
NX3	○	Δ	x												
DUO-LINK	Δ	○		x											
Multilink Automix	x	Δ	○			Δ		x							
Variolink Esthetic DC	x	Δ	○		Δ		x								

# 4

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## ESTECEM II packaging

### KIT

- Paste Universal A/B, 2.3+2.3 ml (4.7+4.7 g)
- Tokuyama Universal Bond A/B, 5+5 ml
- Accessories



### SPARE PARTS

- Paste A/B, 2.3+2.3 ml (4.7+4.7 g) on the following colors:  
Universal, Clear, Brown, White Opaque
- Tokuyama Universal Bond Refill:  
available bottles A and bottle B (5 ml each)
- Accessories

The simplicity  
of an unbreakable bond,  
even in extreme situations.