Science.
Applied to Life.™

3M™ Scotchbond™ Universal Adhesive

Clinical Booklet

Letter from the inventor

Dear Dental Professional,

Throughout the world, 3M is known and trusted for its adhesive technology platform, providing innovative solutions that range from the aerospace industry to consumer products like Post-It® Notes or Scotch® Tape.

Since its first introduction in the early 1980s, the Scotchbond™ brand has been bringing the science of 3M adhesives to the dental community. While the first generations of Scotchbond products focused on high bond strength and ease of use, our goals for developing 3M™ Scotchbond™ Universal Adhesive went beyond. We wanted to provide a truly universal adhesive meeting these requirements:

- Works with all etching techniques – total etch, self-etch, and selective enamel etch
- Can be used for direct and indirect indications
- Bonds to all dental surfaces without the need for separate primers
- Virtually eliminates post-operative sensitivity

After designing and thoroughly testing over 400 experimental formulations, Scotchbond Universal was launched in 2011 and laid the foundation for the new generation of universal adhesives. Its revolutionary concept quickly became very popular among dental professionals and researchers around the world. The vast and growing amount of in-vitro and in-vivo studies that have been published since reflects this popularity, making Scotchbond Universal Adhesive the universal adhesive with most peer-reviewed scientific evidence. A recent literature search found over 300 publications in peer-reviewed journals on Scotchbond Universal, while the nearest competitor has less than 100 studies.* A small selection of updated scientific evidence is compiled in this brochure.

Enjoy reading!

Dr. Christoph Thalacker,
Senior Specialist Product Development, 3M Oral Care

* Scopus database search, Sep 25, 2018

Introduction

To predict how a dental adhesive will perform in the future, it may be useful to take look at its past. The availability of detailed scientific documentation, positive experience reports and – most importantly – long-term clinical studies is a good indicator of how a product may perform over the years.

In this respect, 3M™ Scotchbond™ Universal Adhesive – the industry's first universal adhesive – is a good choice. Since its introduction in October 2011, the product has been tried, tested and trusted by more dental practitioners than any other universal dental adhesive. More than 300 published reviews, laboratory investigations and clinical study results are available. Moreover, Scotchbond Universal Adhesive it is the first universal adhesive with published five-year findings from clinical studies.

These findings, many of which are summarized in this booklet, confirm the product's simplicity, versatility and reliability in the clinical environment. These findings are enriched with essential scientific background information and useful clinical tips for all those who might like to start using Scotchbond Universal Adhesive in their own dental office.

Andrew Milder

Global Business Team Leader
Direct Solutions Business Team
3M Oral Care

Marlyn Nelson

Global Category Manager
Direct Solutions Business Team
3M Oral Care

Dr. Miryam Schuckar

Global Scientific Affairs Manager
Direct Solutions Business Team
3M Oral Care

In-vitro studies: A truly universal adhesive

Moisture tolerance

Bonding to enamel and dentin

Bonding to restorative materials

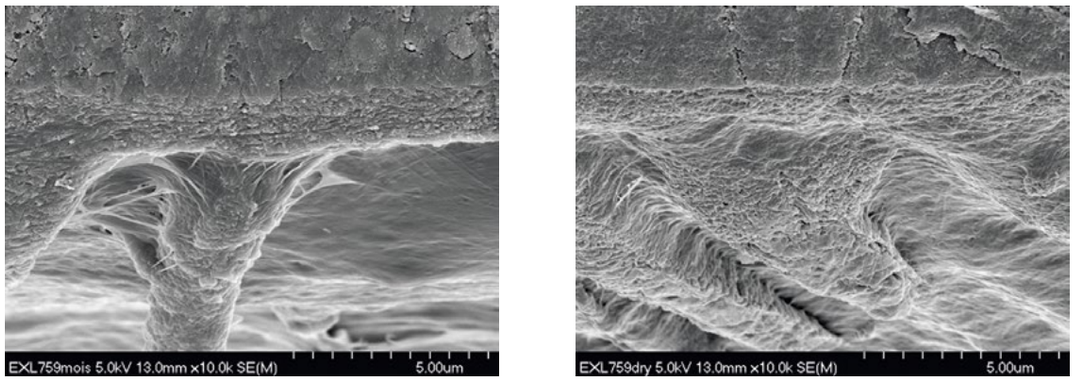
Moisture tolerance

It is sometimes difficult to create an ideal surface moisture level for bonding in the oral cavity. Challenges involve the establishing and maintenance of the required clean, isolated working field and proper air-drying of the dentin after etching.

Most adhesives require a clean, moist, but not wet and certainly not overdried dentin surface as they are unable to fully penetrate collapsed collagen.

Results of different in-vitro studies confirm that 3M™ Scotchbond™ Universal Adhesive is highly moisture as well as saliva tolerant and therefore able to perform reliably in many clinical situations.

The fact that the bonding performance of Scotchbond Universal Adhesive is similar on dry and moist dentin with and without a separate etching step was confirmed in two studies[1,2]. Perdigao et al.[2] also visualized the hybrid layer formed after total-etch application of Scotchbond Universal Adhesive on etched moist and dry dentin in an ultramorphological evaluation. Saliva contamination tolerance was tested by Pitta et al.[3] and Santschi et al.[4] in different settings. Both concluded the presence of saliva did not have a significant negative effect on the bonding performance of Scotchbond Universal Adhesive. Finally, phase separation is successfully prevented by HEMA contained in the adhesive.[5]



Distinct hybrid layers formed for etched moist (left) and dry (right) dentin[2].
SEM Images Courtesy of Dr. Jorge Perdigao, University of Minnesota.

References

Moisture tolerance

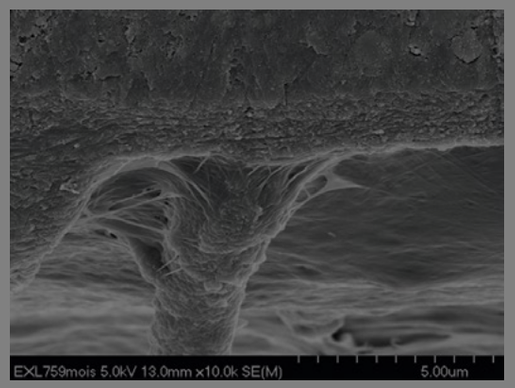
It is sometimes difficult to create an ideal surface moisture level for bonding in the oral cavity. Challenges involve the establishing and maintenance of the required clean, isolated working field and proper air-drying of the dentin after etching.

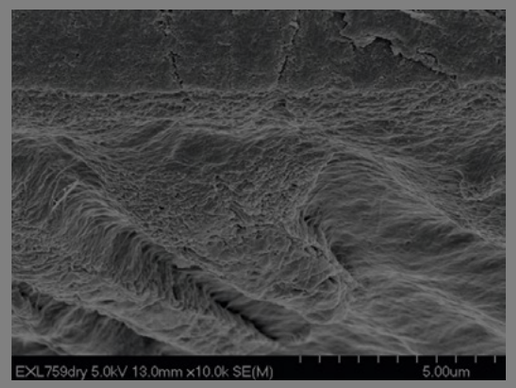
Most adhesives rec
dentin surface as th

Results of different
Adhesive is highly r
reliably in many clin

The fact that the bo
on dry and moist d
in two studies[1,2]. Pe
etch application of
in an ultramorpholo
Pitta et al.[3] and San
of saliva did not ha
Scotchbond Univer
by HEMA contained in the adhesive.[5]

[1] Fox L, Harsono M, Towers J, Perry RD, Kugel G: Shear Bond Strength of Different Products on Etched Dentin. IADR 2011, Abstract #3183
[2] Perdigão J, Sezinando A, Monteiro PC. Laboratory bonding ability of a multi-purpose dentin adhesive. Am J Dent. 2012, 25(3):153-8.
[3] Pitta J, Branco TC, Portugal J. Effect of saliva contamination and artificial aging on different primer/cement systems bonded to zirconia. J Prosthet Dent. 2018, 119(5):833-839.
[4] Santschi K, Peutzfeldt A, Lussi A, Flury S. Effect of salivary contamination and decontamination on bond strength of two one-step self-etching adhesives to dentin of primary and permanent teeth. J Adhes Dent. 2015, 17(1):51-7.
[5] Saikaew P, Chowdhury AFMA, Fukuyama M, Kakuda S, Carvalho RM, Sano H. The effect of dentine surface preparation and reduced application time of adhesive on bonding strength. J Dent. 2016, 47:63-70.





Distinct hybrid layers formed for etched moist (left) and dry (right) dentin[2].
SEM Images Courtesy of Dr. Jorge Perdigao, University of Minnesota.

Previous Home Next

References

Bonding to enamel and dentin

Bond strength testing is a very popular method used to predict the clinical performance of an adhesive. The tests are particularly useful for an assessment of the impact different factors like moisture and the surface structure may have on a product's bonding performance.

Consequently, a number of tests have been carried out to assess the bond strength of 3M™ Scotchbond™ Universal Adhesive to enamel and dentin in different settings[1-7]. Their results confirm that the universal adhesive may be expected to perform reliably under various circumstances, hence offering the desired versatility.

According to the study results, a high bond strength is obtained

- regardless of the application mode (with and without etching)[1,2]
- on moist and on dry dentin[3,4]
- on sound cervical and abrasion-lesion dentin[5]
- on primary dentin (total-etch and self-etch mode)[6]
- on cut and uncut enamel after etching[7]
- on dentin and enamel after artificial aging[2,8,9]

Meanwhile, long-term clinical data is available to support these findings. They show that users can trust Scotchbond Universal Adhesive in virtually any clinical situation.

Bonding to enamel and dentin

Bond strength testi
performance of an
the impact differen
product's bonding

Consequently, a nu
of 3M™ Scotchbon
Their results confir
under various circu

According to th

- regardless of th
- on moist and o
- on sound cervic
- on primary den
- on cut and uncu
- on dentin and e

Meanwhile, long-te
that users can trust

[1] Shinohara MS, Azevedo C, De Goes M: Pre-Etching Dentin Effects on Morphology and Bond Strength of Self-Etching Adhesives. IADR 2012, Abstract #1659.
[2] Wagner A, Wendler M, Petschelt A, Belli R, Lohbauer U. Bonding performance of universal adhesives in different etching modes. J Dent. 2014, 42(7):800-7.
[3] Perdigão J, Sezinando A, Monteiro PC. Laboratory bonding ability of a multi-purpose dentin adhesive. Am J Dent. 2012 Jun;25(3):153-8.
[4] Fox L, Harsono M, Towers J, Perry RD, Kugel G: Shear Bond Strength of Different Products on Etched Dentin. IADR 2011, Abstract #3183
[5] Maeno M, Akiyama S, Ogawa S, Hara M, Maseki T, Nara Y. Bonding Performance of Recent All-in-one Adhesive Systems to Sound Cervical Dentin and Enamel and Abrasion-lesion Dentin. AADR 2012, Tampa Bay, USA, Abstract No. 1307.
[6] Memarpour M, Shafiei F, Razmjouei F, Soltani M. Shear bond strength and scanning electron microscopy characteristics of universal adhesive in primary tooth dentin: An in vitro study. Dent Res J (Isfahan). 2018, 15(4):264-270.
[7] Fox L, Harsono M, Perry RD, Kugel G: Shear Bond Strength of Adhesives on Cut/Uncut Enamel. AADR 2012, Abstract #797
[8] Burgess J, Shah S, Cakir D, Bekc P, Ramp L: Shear bond strength to restorative materials and tooth structure [AADR abstract 636]. J Dent Res. 2012;91(spec iss B):636.
[9] Nara Y, Akiyama S, Maeno M, Hara M, Yamada Y, Maseki T, Dogon IL: Bonding Durability of Recent All-in-one Adhesive Systems under Thermocycled Repeated Load. AADR 2012, Abstract #1306.

Bonding to restorative materials

Nowadays, there are a great number of indirect restorative materials used in dentistry. A universally applicable adhesive should be able to establish chemical adhesion to all of them. Originally required separate application of primers should no longer be necessary.

3M™ Scotchbond™ Universal Adhesive, used in combination with 3M™ RelyX™ Ultimate Adhesive Resin Cement, offers the desired versatility. It contains active and stable silane, which chemically bonds to glass particles in silicate ceramics and composites. It also contains MDP, which has the ability to establish a chemical bond with metal oxides in oxide ceramics and metal alloys. Thus, there is no need for a separate use of priming agents.

The available in-vitro studies confirm that a reliable bond is obtained with

- oxide ceramics like zirconia and alumina[1,2]
- silicate ceramics and hybrid ceramics[3-5]
- (repaired) composite[3,6]
- precious metal[3]
- non-precious metal[7]

Zirconia, different silicate ceramics, a gold and a base metal alloy also passed bond strength testing successfully after artificial aging[7]. These results, together with clinical data available, show that Scotchbond Universal Adhesive may be expected to form a strong and long-lasting bond to virtually every restorative material.

Bonding to restorative materials

Nowadays, there a
A universally applic
all of them. Origina
be necessary.

3M™ Scotchbond™
Adhesive Resin Ce
silane, which chem
It also contains MD
oxides in oxide cer
use of priming age

The available in-vit

- oxide ceramics
- silicate ceramic
- (repaired) com
- precious metal
- non-precious metal

Zirconia, different silicate ceramics, a gold and a base metal alloy also passed bond strength testing successfully after artificial aging[7]. These results, together with clinical data available, show that Scotchbond Universal Adhesive may be expected to form a strong and long-lasting bond to virtually every restorative material.

[1] Blatz MB, Zbaeren C, Mante F. Bond of a New Self-etch Adhesive to Alumina and Zirconia. AADR 2012, Abstract # 710.
[2] Amaral M, Belli R, Cesar PF, Valandro LF, Petschelt A, Lohbauer U. The potential of novel primers and universal adhesives to bond to zirconia. J Dent. 2014 Jan;42(1):90-8.
[3] Kleverlaan CJ. Shear Bond Strength of Various Bonding Systems to Various Substrates. Results presented at a symposium of the Academic Center for Dentistry Amsterdam (ACTA), September 2012.
[4] Rosentritt M. Shear bond strengths of RelyX Ultimate to etchable ceramics - before and after aging. Unpublished results.
[5] Johnson GH, Lepe X, Patterson A, Schäfer O. Simplified cementation of lithium disilicate crowns: Retention with various adhesive resin cement combinations. J Prosthet Dent. 2018, 119(5):826-832.
[6] Staxrud F, Dahl JE. Silanising agents promote resin-composite repair. Int Dent J. 2015 Dec;65(6):311-5.
[7] Burgess J, Shah S, Cakir D, Bekc P, Ramp L: Shear bond strength to restorative materials and tooth structure [AADR abstract 636]. J Dent Res. 2012;91(spec iss B): 636.

Clinical studies: Proven to be reliable

Direct procedure

- Low incidence of post-operative sensitivity
- Technique-independent clinical performance after three years
- Similar performance as two-bottle system after five years
- Good marginal quality revealed by OCT
- Similar performance as a three-step adhesive after six months
- Reliable performance in a practice-based evaluation
- Self-etch mode beneficial in primary teeth

Indirect procedure

- Reliable system for luting glass and hybrid ceramic restorations
- High reliability independent of the adhesive application mode
- Great retention and resistance to marginal staining at five years

Low incidence of post-operative sensitivity

Authors	Guggenberger R, Cerny B, Thalacker C, Wiggins K, Soares AB
Title	Postoperative sensitivity with a new universal adhesive.
Presented at	IADR General Session; June 20, 2012; Iguaçu Falls, Brazil. Abstract # 186.
Disclosure	This study was directed by 3M.

Description

Shortly after the launch of 3M™ Scotchbond™ Universal Adhesive, a non-interventional study was conducted. In order to obtain information about the occurrence of initial post-operative sensitivity in different etching modes self-etch (SE), selective enamel etch (SEE) and total etch (TE), 120 dental practitioners in Europe used the product in their preferred technique. The number of cases treated and the number of teeth with post-operative sensitivity was reported.

Results

In all three etching modes, initial post-operative sensitivity occurred in less than one percent of the cases. The highest incidence rate – 0.4 percent – was reported for the total-etch technique. With 0.1 and 0.0 percent, respectively, the incidence listed in the self-etch and selective etch modes was significantly lower.

Application Mode	Number of Cases	Number of POS Cases	Percentage of POS Cases (%)
TE	3467	14[A]	0.4[A]
SE	3495	2[B]	0.1[B]
SEE	1544	0[B]	0.0[B]

Overview of the study results. Values with the same letters show no statistically significant differences.

Take-home message

For anyone who cares about post-operative sensitivity, the use of 3M Scotchbond Universal Adhesive is a good option. The incidence achieved with the universal adhesive is less than one percent independent of the adhesive technique used.

Technique-independent clinical performance after three years

Authors	Loguercio AD, de Paula EA, Hass V, Luque-Martinez I, Reis A, Perdigão J
Title	A new universal simplified adhesive: 36-Month randomized double-blind clinical trial
Published in	J Dent. 2015, 43(9):1083-1092.
Disclosure	Materials used in this study have been provided by 3M.

Description

Which application mode is best suited for 3M™ Scotchbond™ Universal Adhesive? In order to find out, a randomized double-blind clinical trial was initiated. The adhesive's performance was tested in four different settings in the context of restoring non-carious cervical lesions: It was applied after total etching on moist and on dry dentin, after selective enamel etching and in the self-etch mode in 50 teeth each. The restorations were evaluated using United States Public Health Service (USPHS) and World Dental Federation (FDI) criteria after 6, 18 and 36 months.

Results

After 36 months, the universal adhesive performed well independent of the selected application technique. There were no statistically significant differences. However, the authors found signs of a slightly better marginal quality of the restorations placed after adhesive use in the total-etch and selective enamel etch modes.

Take-home message

Clinicians who would like to start using 3M Scotchbond Universal Adhesive in their dental office do not need to worry about required changes regarding their application mode: They are likely to achieve good results with their preferred bonding strategy if they adhere to the recommended protocols.

Similar performance as two-bottle system after five years

Authors	Robles A, Lawson N, Fu CC, Givan D, Burgess J
Title	Clinical Evaluation of Universal and Two Bottle Total Etch Adhesives at 5 Years
Presented at	AADR Annual Meeting, March 24, 2018; Fort Lauderdale, Florida, US. Abstract # 1491
Disclosure	This study is based on research that was sponsored by 3M.

Description

This study was conducted to investigate whether 3M™ Scotchbond™ Universal Adhesive is able to match up to a proven two-bottle total-etch adhesive. The researchers recruited 37 patients with either three or six non-carious cervical lesions. Every patient with three lesions received one, those with six lesions two restorations per adhesive material / application mode: Scotchbond Universal self-etch, Scotchbond Universal total-etch, and 3M™ Adper™ Scotchbond™ Multi-Purpose Adhesive. Evaluations of marginal integrity were carried out at baseline and after 6, 12, 24, 36, and 60 months using modified USPHS criteria.

Results

At the five-year recall, ten of the 126 restorations were missing: six in the Adper Scotchbond Multi-Purpose group, three in the Scotchbond Universal self-etch group and one in the Scotchbond Universal total-etch group. Scotchbond Universal Adhesive also achieved the best results with regard to marginal adaptation and marginal discoloration. Secondary caries did not occur.

Take-home message

No matter whether applied in the self-etch or the total-etch mode, Scotchbond Universal Adhesive may be expected to offer a reliable clinical performance, which is similar to or even better than that of a proven classical adhesive system.

Good marginal quality revealed by OCT

Authors	Schneider H, Schmidt P, Hähnel M, Krause F, Haak R
Title	Assessment of a Universal Adhesive: 24-Months Clinical Results vs. OCT
Presented at	IADR General Session, July 27, 2018; London, UK. Abstract # 2447
Disclosure	This study is based on research that was sponsored by 3M.

Description

The clinical performance of adhesives is typically assessed in clinical examinations. In this study, optical coherence tomography (OCT) was used as an additional technique to detect and monitor marginal defects of fillings. The study involved 22 patients with three or more non-carious cervical lesions to be restored with composite. The adhesives / application modes used were 3M™ Scotchbond™ Universal Adhesive in the total-etch, self-etch and selective enamel etch modes and OptiBond FL. Clinical evaluation using FDI criteria and OCT analysis were carried out after 6, 12 and 24 months.

Results

After 24 months, the failure rate was lower and the defects at the dentin-/cement-composite interface revealed with OCT were less for Scotchbond Universal Adhesive compared to OptiBond FL irrespective of the application mode. At the enamel-composite interface, the least defects (OCT) were produced with the total-etch and selective enamel etch techniques. Adhesive defects detected in OCT analysis from previous recalls tended to increase prior to adhesive failure.

Take-home message

Scotchbond Universal Adhesive performs reliably after two years. As fewer enamel defects were detected in OCT when using the selective enamel etch or total-etch technique, etching of the enamel may be advisable for anyone who wants extra confidence in the marginal integrity of their restorations.

Similar performance as a three-step adhesive after six months

Authors	Han J, Kim D, Park SH
Title	Universal Adhesives in Non-carious Cervical Lesions: 6-month Randomized Clinical Trial
Presented at	IADR General Session, July 27, 2018; London, UK. Abstract # 2464
Disclosure	This study is based on research that was sponsored by 3M.

Description

Is there a difference in the performance of universal adhesives and a three-bottle total-etch system? Researchers of the Yonsei University College of Dentistry addressed this matter in a clinical study involving patients with at least two non-carious cervical lesions. The patients received pairs of composite restorations bonded either with 3M™ Scotchbond™ Universal Adhesive versus OptiBond FL (Kerr) or with Tetric N-Bond Universal (Ivoclar Vivadent) versus OptiBond FL. Evaluation using simplified FDI criteria was carried out after six months.

Results

Per material combination, 50 pairs were available at recall. For all adhesives, the retention rates were between 98 and 100 percent. This means that the two universal adhesives and the three-step total-etch adhesive used in this study performed similarly well after six months.

Take-home message

During the first months in clinical service, the bond quality of fillings placed with Scotchbond Universal Adhesive may be expected to be high. In this study, the universal adhesive performed on an equal level with a proven total-etch system while involving fewer steps.

Reliable performance in a practice-based evaluation

Authors	Burke FJT, Crisp RJ, Cowan AJ, Raybould L, Redfearn P, Sands P, Thompson O, Ravaghi V
Title	A Randomised Controlled Trial of a Universal Bonding Agent at Three Years: Self Etch vs Total Etch
Published in	Eur J Prosthodont Restor Dent. 2017, 25(4):220-227.
Disclosure	This study is based on research that was sponsored by 3M.

Description

How does 3M™ Scotchbond™ Universal Adhesive perform in a busy practice environment? This is what members of the PREP Panel investigated in their clinical evaluation. The universal adhesive was used by five dental practitioners in their practices either with the self-etch or the total-etch technique (split mouth design) for the placement of 64 composite restorations in load-bearing cavities. Clinical evaluation using modified USPHS criteria was carried out after one, two and three years.

Results

At the three-year recall, 45 restorations were available for the evaluation. Due to the split-mouth design, the number of restorations per application mode was almost identical (22 pairs). All restorations obtained acceptable (A or B) scores in all categories. None of the restorations developed secondary caries or post-operative sensitivity and the fillings performed equally well independent of the selected application mode.

Take-home message

The results of this study suggest that even without etching of the enamel, Scotchbond Universal Adhesive will deliver satisfactory results when used in a standard dental office over a period of three years.

Self-etch mode beneficial in primary teeth

Authors	Lenzi TL, Pires CW, Soares FZM, Raggio DP, Ardenghi TM, de Oliveira Rocha R.
Title	Performance of Universal Adhesive in Primary Molars After Selective Removal of Carious Tissue: An 18-Month Randomized Clinical Trial.
Published in	Pediatr Dent. 2017, 39(5):371-376.

Description

Is a specific application mode – self-etch or total-etch – of 3M™ Scotchbond™ Universal Adhesive preferable for use in primary teeth after selective caries removal? This question was addressed in a study with 44 children aged between five and ten. In this group, 90 primary molars with carious lesions were restored with composite after application of the universal adhesive in the self-etch or total-etch mode. Clinical assessment using USPHS criteria followed after one, 6, 12 and 18 months.

Results

Both application modes produced similar results at the 18-month recall. The examiners reported a tendency for better clinical performance of those restorations placed using the self-etch mode of the adhesive. These differences, however, were not statistically significant.

Take-home message

Given that the outcome is comparable independent of the selected application mode, dental practitioners using Scotchbond Universal Adhesive in primary teeth should prefer the self-etch approach. This technique involved fewer steps and is therefore less susceptible to errors and more time-efficient, which is particularly advantageous in pediatric patients.

Reliable system for luting glass and hybrid ceramic restorations

Authors	Fasbinder DJ, Neiva GF, Dennison JB, Heys D, Heys R
Title	Clinical Evaluation of CAD/CAM resin nano ceramic and leucite-reinforced glass-ceramic onlays
Presented at	AADR Annual Meeting 2016, Los Angeles, Abstract No. 254.
Disclosure	This study is based on research that was sponsored by 3M.

Description

Is the cementation system comprised of 3M™ Scotchbond Universal Adhesive and 3M™ RelyX™ Ultimate Adhesive Resin cement as reliable in the clinical environment as systems involving multi-step adhesives when used to cement glass ceramic and hybrid ceramic restorations? A team at the University of Michigan conducted a clinical study with 86 patients to find out. The 3M system and the Variolink system (Ivoclar Vivadent) were employed to cement 30 leucite-reinforced glass ceramic onlays and 30 resin nano ceramic onlays each. Evaluations were carried out after three years using USPHS criteria.

Results

At the recall after three years, 117 onlays were available for evaluation. The survival rate was 98 percent. Comparable results were obtained for the different adhesive systems and techniques as well as restorative materials placed. No incidence of debonding was reported.

% Alpha Rating – 3 Year Recall				
Onlay Material	**Lava Ultimate**		**IPS Empress CAD**	
Adhesive Cement	**Variolink®**	**RelyX™ Ultimate**	**Variolink®**	**RelyX™ Ultimate**
Color Match	100	100	100	100
Margin Discoloration	96	97	97	96
Surface Finish	100	100	100	100
Anatomic Form	100	100	100	100
Tooth / Cusp Fracture	93	100	100	100
Onlay Fracture	96	97	100	96
Caries	100	100	100	100
Margin Adaption	100	100	100	100
Surface Gloss	100	100	100	100

Three-year results: the table presents the % Alpha scores for each USPHS criteria evaluated. For any scores less than 100%, the remainder are % Bravo.

Take-home message

The cementation system from 3M involving Scotchbond Universal Adhesive may be expected to perform very well when placing indirect restorations made of different materials.

High reliability independent of the adhesive application mode

Authors	Vogl V, Hiller KA, Buchalla W, Federlin M, Schmalz G
Title	Controlled, prospective, randomized, clinical split-mouth evaluation of partial ceramic crowns luted with a new, universal adhesive system/resin cement: results after 18 months.
Published in	Clin Oral Investig. 2016, 20(9):2481-2492
Disclosure	This study was partially sponsored by 3M.

Description

This study provides insight into whether the application mode of 3M™ Scotchbond™ Universal Adhesive matters in the context of indirect restorative treatment. The 50 patients involved in this study received three partial crowns made of feldspathic porcelain each. Two of the three restorations in each patient were cemented with Scotchbond Universal Adhesive and 3M™ RelyX™ Ultimate Adhesive Resin Cement, one using the self-etch technique, the other using selective enamel etching. The third crown was placed with a self-adhesive resin cement.

Results

At the 18-month recall, 44 patients and 144 restorations were available for the clinical evaluation using FDI criteria. The restorations placed with Scotchbond Universal Adhesive and RelyX Ultimate performed very well, independent of the adhesive technique used.

Take-home message

The product combination is well-suited for the cementation of feldspathic porcelain restorations using the preferred adhesive application mode. While the self-adhesive resin cement was applied after the use of silane, Scotchbond Universal Adhesive functioned as silane in the RelyX Ultimate cement groups, both leading to similar results.

Great retention and resistance to marginal staining at five years

Title	3M RelyX Ultimate Adhesive Resin Cement: 5-year clinical performance.
Published in	THE DENTAL ADVISOR, Volume 34, Number 2, March-April 2017.
Disclosure	This study is based on research that was sponsored by 3M.

Description

This clinical evaluation published in THE DENTAL ADVISOR gives dental practitioners an idea of the overall clinical performance of 3M™ Scotchbond™ Universal Adhesive and 3M™ RelyX Ultimate Adhesive Resin Cement. The material combination was used in a practice-based investigation to cement crowns, bridges, inlays, onlays and veneers made of zirconia, silicate ceramics or metal ceramics. At five years, 1,532 restorations were evaluated with regard to retention and resistance to marginal discoloration.

Results

Of the 1,532 restorations available for evaluation at five years, 99 percent received the highest possible rating for resistance to marginal discoloration, and the retention rate was 98 percent. Only 17 out of 26 bond failures were related to the cement. This resulted in a 99 percent clinical performance rating.

Take-home message

The investigated cement system is perfectly suitable for luting of various types of restorations made of different restorative materials.

Tips
for clinical application

All application modes producing good results

According to the in-vitro and in-vivo study results available so far, 3M™ Scotchbond™ Universal Adhesive works well in the self-etch and total-etch modes as well as with selective enamel etching. Hence, the application mode may be selected according to individual preferences.

However, some study results as well as data from a systematic review and meta-analysis suggest that the durability of the enamel bond and the enamel margin quality may be improved by etching with phosphoric acid[1-3]. Consequently, selective enamel etching might be the best possible option in the long term.

Image courtesy of Dr. Gunnar Reich

Image courtesy of Style Italiano

Image courtesy of Dr. Marcos Vargas

All application modes producing good results

According to the in-v
Universal Adhesive w
selective enamel etc
individual preference

However, some stud
suggest that the dura
improved by etching
might be the best po

[1] Schneider H, Schmidt P, Hähnel M, Krause F, Haak R. Assessment of a Universal Adhesive: 24-Months Clinical Results vs. OCT. IADR General Session, July 27, 2018; London, UK. Abstract # 2447.
[2] Loguercio AD, de Paula EA, Hass V, Luque-Martinez I, Reis A, Perdigão J. A new universal simplified adhesive: 36-Month randomized double-blind clinical trial. J Dent. 2015, 43(9):1083-1092.
[3] Rosa WL, Piva E, Silva AF. Bond strength of universal adhesives: A systematic review and meta-analysis. J Dent. 2015, 43(7):765-76.

Image courtesy of Dr. Gunnar Reich

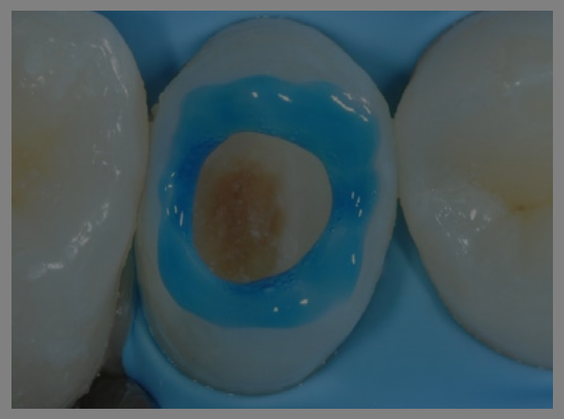


Image courtesy of Style Italiano

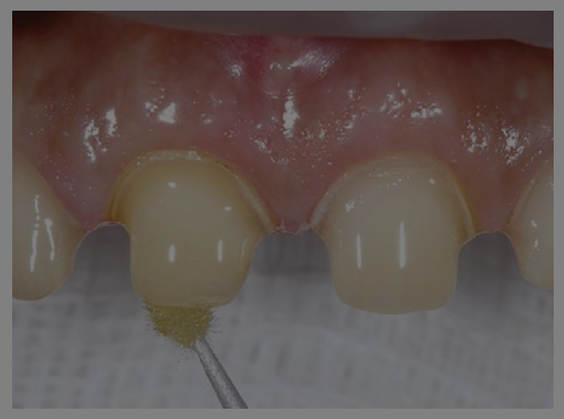


Image courtesy of Dr. Marcos Vargas

Separate silane application possible

Does separate silane application lead to a better bonding performance of 3M™ Scotchbond™ Universal Adhesive when bonding to glass ceramic or composite materials with glass fillers? As the universal adhesive contains stable, pre-hydrolyzed silane, a strong chemical bond is usually established.

In a study where the product and a conventional silane were applied to polished laboratory glass, a higher bond strength was determined for the silane samples[1]. However, if Scotchbond Universal Adhesive is applied to etched dental ceramic surfaces, a similar bond strength is obtained no matter whether used with or without a separate primer[2-4]. Clinically, the application of Scotchbond Universal Adhesive in the function of a silane for 3M™ RelyX™ Ultimate Adhesive Resin Cement has already been shown to work well[5,6].

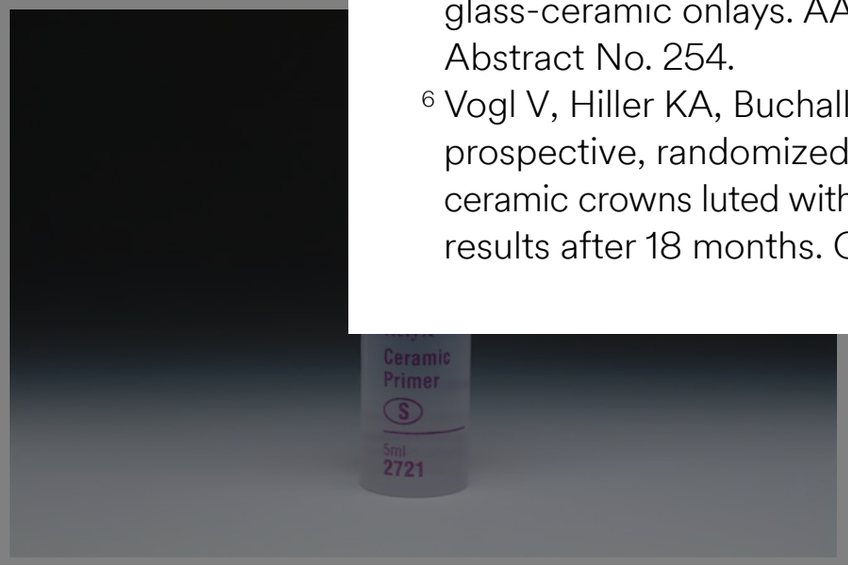
One of the laboratory investigations revealed that the use of Scotchbond Universal Adhesive for repair of lithium disilicate restorations resulted in similar bond strengths as other adhesives plus silane, while an additional silane application led to a further increase of the values[3]. This leads to the conclusion that the additional use of silane is possible, but not necessary for reliable results.

Separate silane application possible

Does separate silane
Universal Adhesive w
universal adhesive co

In a study where the
a higher bond streng
Adhesive is applied t
matter whether used
Universal Adhesive ir
already been shown

One of the laboratory
repair of lithium disili
silane, while an addit
the conclusion that t



[1] Yoshihara K, Nagaoka N, Sonoda A, Maruo Y, Makita Y, Okihara T, Irie M, Yoshida Y, Van Meerbeek B. Effectiveness and stability of silane coupling agent incorporated in 'universal' adhesives. Dent Mater. 2016, 32(10):1218-1225.

[2] Isolan CP, Valente LL, Münchow EA, Basso GR, Pimentel AH, Schwantz JK, da Silva AV, Moraes RR. Bond strength of a universal bonding agent and other contemporary dental adhesives applied on enamel, dentin, composite, and porcelain. Applied Adhesion Science 2014, 2:25.

[3] Brandt PD. Lithium Disilicate Glass-Ceramic Repair Using Bonded Composite. IADR 2014, Abstract #1467.

[4] Johnson GH, Lepe X, Patterson A, Schäfer O. Simplified cementation of lithium disilicate crowns: Retention with various adhesive resin cement combinations. J Prosthet Dent. 2018, 119(5):826-832.

[5] Fasbinder DJ, Neiva GF, Dennison JB, Heys D, Heys R. Clinical Evaluation of CAD/CAM resin nano ceramic and leucite-reinforced glass-ceramic onlays. AADR Annual Meeting 2016, Los Angeles, Abstract No. 254.

[6] Vogl V, Hiller KA, Buchalla W, Federlin M, Schmalz G. Controlled, prospective, randomized, clinical split-mouth evaluation of partial ceramic crowns luted with a new, universal adhesive system/resin cement: results after 18 months. Clin Oral Investig. 2016, 20(9):2481-2492.

The benefit of active application

In the instructions for use of 3M™ Scotchbond™ Universal Adhesive, it is described that the adhesive should be applied to the entire tooth structure and rubbed in for 20 seconds. According to in-vitro studies, this active application does indeed improve the performance of universal adhesives[1,2].

Loguercio et al.[1] tested seven different universal adhesives, five of which (including Scotchbond Universal Adhesive) showed increased enamel microshear bond strengths and degrees of conversion after active as opposed to passive application in the self-etch mode. A similarly good effect was found on dentin independent of the etching technique[2]. Three universal adhesives used in the total-etch and self-etch modes achieved higher dentin shear bond strengths after active than after passive application – before and after thermocycling. Hence, an active application is strongly recommended, as is may be expected to produce better results than just painting the adhesive onto the substrate, followed by a waiting period.

Image courtesy of Dr. Giuseppe Marchetti

The benefit of active application

In the instructions fo
the adhesive should
According to in-vitro
universal adhesives[1,2]

Loguercio et al.[1] teste
Scotchbond Universal
degrees of conversio
A similarly good effect was found on dentin independent of the etching technique[2]. Three universal adhesives used in the total-etch and self-etch modes achieved higher dentin shear bond strengths after active than after passive application – before and after thermocycling. Hence, an active application is strongly recommended, as is may be expected to produce better results than just painting the adhesive onto the substrate, followed by a waiting period.

[1] Loguercio AD, Muñoz MA, Luque-Martinez I, Hass V, Reis A, Perdigão J. Does active application of universal adhesives to enamel in self-etch mode improve their performance? DJ Dent. 2015 Sep;43(9):1060-1070.
[2] Moritake N, Takamizawa T, Ishii R, Tsujimoto A, Barkmeier WW, Latta MA, Miyazaki M. Effect of Active Application on Bond Durability of Universal Adhesives. Oper Dent. 2019 Mar/Apr;44(2):188-199.

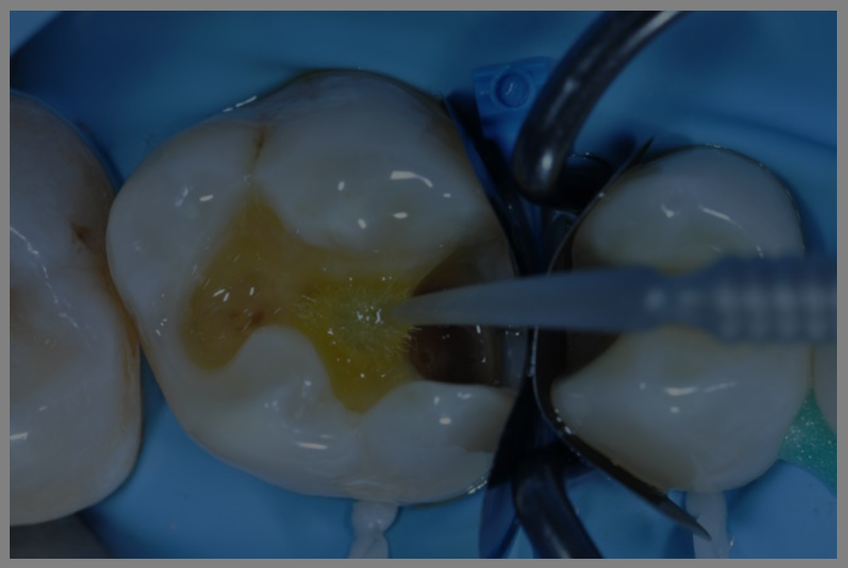


Image courtesy of Dr. Giuseppe Marchetti

Avoid shortening the application time

In the busy practice environment, the idea of shortening the recommended application time (20 seconds) for 3M™ Scotchbond™ Universal Adhesive may be tempting. This however, may have a negative effect on the long-term performance of universal adhesives.

The impact of a shortened application time on the microtensile bond strength of universal adhesives to bur-cut dentin before and after water storage was determined for three different universal adhesives including Scotchbond Universal Adhesive[1]. Two of the three products tested showed a decreased bond strength after one year of water storage when the application time was shorter than recommended by the manufacturer. Shortened or even zero application time as claimed for some recently introduced adhesives may therefore not be a good idea. In order to avoid a compromised performance, users should adhere to the application times stated in the instructions for use.

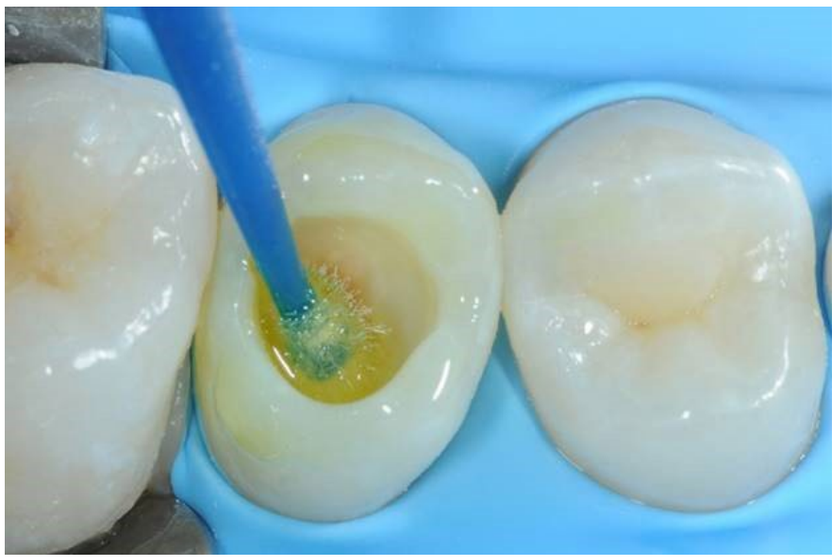


Image courtesy of Style Italiano

Avoid shortening the application time

In the busy practice e
(20 seconds) for 3M
may have a negative

The impact of a shor
adhesives to bur-cut dentin before and after water storage was determined for three different universal adhesives including Scotchbond Universal Adhesive[1]. Two of the three products tested showed a decreased bond strength after one year of water storage when the application time was shorter than recommended by the manufacturer. Shortened or even zero application time as claimed for some recently introduced adhesives may therefore not be a good idea. In order to avoid a compromised performance, users should adhere to the application times stated in the instructions for use.

[1] Saikaew P, Matsumoto M, Chowdhury A, Carvalho RM, Sano H. Does Shortened Application Time Affect Long-Term Bond Strength of Universal Adhesives to Dentin? Oper Dent. 2018 Sep/Oct;43(5):549-558.

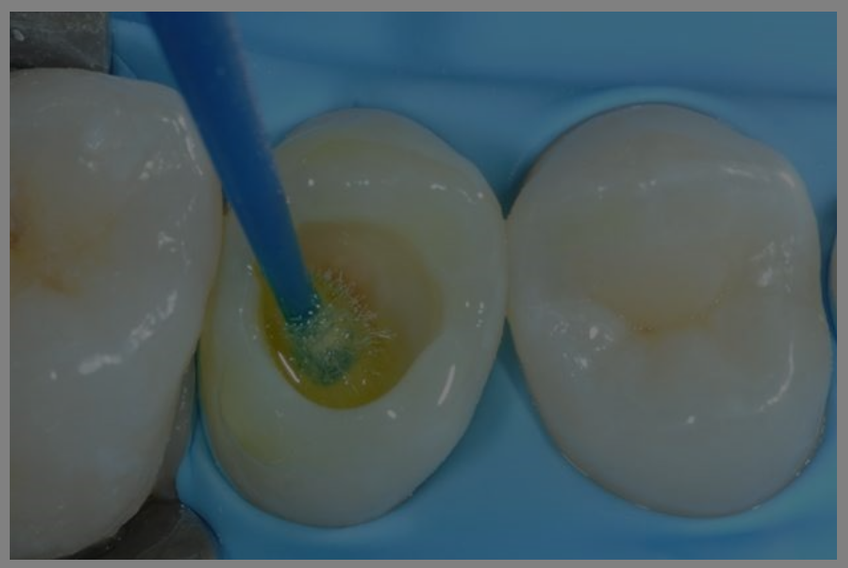


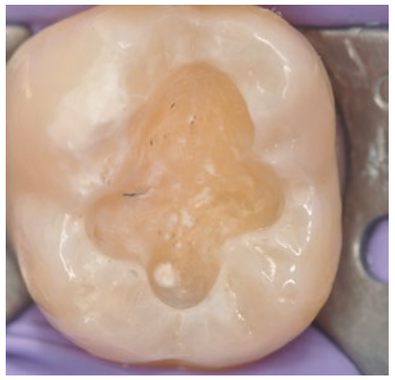
Image courtesy of Style Italiano

Clinical use of 3M™ Scotchbond™ Universal Adhesive

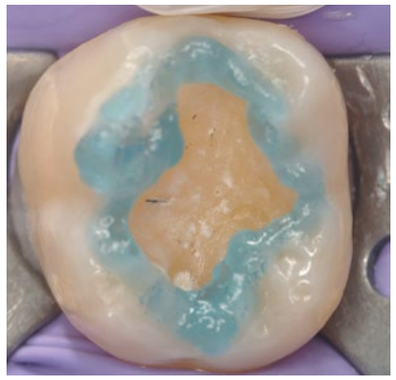
Replacement of an amalgam restoration with composite

The amalgam restoration in a mandibular second molar needed to be replaced. It was decided to place a Class-I composite restoration using 3M™ Filtek™ Supreme XTE Universal Restorative. For bonding, 3M™ Scotchbond™ Universal Adhesive was used after selective etching of the enamel.

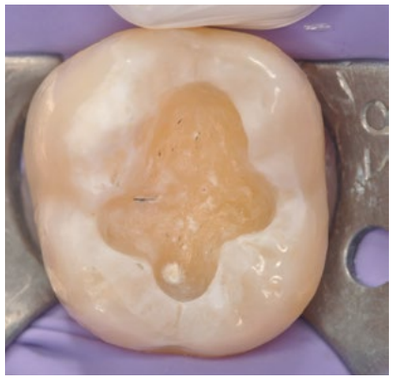
Initial clinical situation with an amalgam restoration to be replaced.



Working field isolated with rubber dam, tooth ready for the bonding procedure.



Selective etching: the etchant is applied to the enamel for 15 seconds.



Appearance after rinsing of the etchant and careful drying of the cavity.

Rubbing of the adhesive into the tooth structure for 20 seconds. Subsequently, the adhesive needs to be air-dried (5 seconds) and light-cured (10 seconds).

Composite restoration after contouring and finishing.

Photos courtesy of Dr. Mario deGoes

Conclusion

3M™ Scotchbond™ Universal Adhesive was introduced as the industry's first truly universal adhesive in 2011, and has become increasingly popular over the years.

While early in-vitro test results have raised high expectations with regard to the product's clinical performance, the clinical data available today confirms what has been predicted. Clinical study outcomes focusing on the use of Scotchbond Universal Adhesive in direct and indirect applications after up to five years show that the product performs equally or better compared to gold standards, while providing faster and easier handling and higher versatility.

The studies summarized in this booklet demonstrate that Scotchbond Universal has rightfully earned its popularity. There is overwhelming evidence that it can not only be safely and reliably used for its indications, but that it might well become one of the new gold standards in dentistry.

Science.
Applied to Life.™

3M™ Scotchbond™ Universal Adhesive

Previous

Home

3M Deutschland GmbH
ESPE Platz · 82229 Seefeld
Germany
info3mespe@mmm.com
www.3M.com