Dental Cements for Luting and Bonding Restorations

Self-Adhesive Resin Cements

Adriana P. Manso, DDS, MSc, PhD, Ricardo M. Carvalho, DDS, PhD*

KEYWORDS

• Self-adhesive resin cements • Dental cements • Luting cement • Cementation

KEY POINTS

- Self-adhesive resin cements are current popular luting materials with advantages over traditional luting cements: ease of use and improved properties.
- The chemistry of the materials dictates their behavior. Acidic monomers need to be neutralized during setting to prevent compromising curing, increased sorption and expansion and lowering overall properties.
- There is not enough clinical evidence to draw robust conclusions about its performance. Early, short-term studies suggest performance similar to conventional cements and traditional luting cements.

INTRODUCTION

In the last two decades, the increased demand for esthetics in dentistry has resulted in significant improvements in metal-free restorations, from indirect resin composites to various categories of ceramic materials. Nevertheless, the clinical performance of those esthetic restorative materials relies largely on the luting/bonding procedure. Among the desired features of a luting material for a metal-free restoration are optical characteristics similar to natural dentition, improved mechanical properties to strengthen the final restoration, and ability to bond to multiple substrates. The customarily used conventional luting cements, such as zinc phosphate and glass-ionomer, do not meet these expectations. With the introduction of metal-free indirect restorations, there was an imminent need to develop alternative luting materials. The first resin-based or conventional resin cements introduced to the market required the use of dental adhesives to promote bonding to enamel and dentin. Several studies

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Department of Oral Biological and Medical Sciences, Division of Biomaterials, Faculty of Dentistry, The University of British Columbia, 368-2199 Wesbrook Mall, Vancouver, British Columbia V6T 1Z3, Canada
* Corresponding author. Faculty of Dentistry, The University of British Columbia, 368-2199 Wesbrook Mall, Vancouver, British Columbia V6T 1Z3, Canada.
E-mail address: rickmc@dentistry.ubc.ca

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demonstrated that the use of conventional resin cements can improve mechanical properties of metal-free indirect restorations when compared with other luting cements,[1] and this has been directly related to long-term clinical success.[2] However, incompatibility issues between simplified adhesive systems having acidic and hydrophilic characteristics and self- and dual-cured resin cements were reported at the early stage of development of the new resin cements.[3–5] This incompatibility was responsible for directly compromising bond strengths, potentially reducing retention and support for the restorations.

Most clinical procedures involving resin-based luting materials occur under unfavorable circumstances, such as altered and/or deep dentin, subgingival preparations, and sometimes with challenging field isolation. Combined, all these limiting factors can have a significant impact on the adhesive application and subsequent performance when resin cements requiring prebonding are used. However, their use is justified if one considers all the benefits offered by a resin luting material, such as improved mechanical properties, lower solubility, and reinforcement of all-ceramic restorations in comparison with the traditional luting cements.[6,7] Commercially available self-adhesive resin cements (**Table 1**) combine the easy application of conventional luting materials with the improved mechanical properties and bonding capability of the conventional resin cements. The presence of functional acidic monomers, dual cure setting mechanism, and fillers capable of neutralizing the initial low pH of the cement are essential clinically relevant elements of the material that should be understood when selecting the ideal luting material for each particular clinical situation. This review addresses the most relevant aspects of self-adhesive resin cements and their potential impact on clinical performance. The article focuses only on self-adhesive resin cements as the "modern" luting material, because extensive information on traditional

Table 1
Self-adhesive resin cements listed by alphabetical order

Cement	Manufacturer
BeautiCem SA	Shofu Inc
Bifix SE	Voco
BisCem	Bisco Inc
Breeze	Pentron
Calibra Universal	Dentsply
Clearfil SA	Kuraray Noritake Dental
Embrace WetBond	Pulpdent Corporation
G-Cem	GC Corporation
G-Cem LinkAce	GC Corporation
iCem	Heraeus-Kulzer
Maxcem Elite	Kerr
Monocem	Shofu
Panavia SA	Kuraray Noritake Dental
RelyX Unicem	3M/ESPE
RelyX Unicem 2	3M/ESPE
SeT	SDI
Smart Cem 2	Dentsply
SpeedCEM Plus	Ivoclar Vivadent

The list is not intended to cover all products available. Any omission is unintentional.

luting cements and conventional resin cements are covered in several previous publications.[6–8] The clinical performance of self-adhesive resin cements has also been included in this review. Although a limited number of clinical studies are available to establish solid clinical evidence, the information presented aims to provide clinical guidance in the dynamic environment of material development.

CHEMISTRY AND CURING MECHANISM

In general terms, a self-adhesive resin cement is, by nature, a self-etching material during the initial stages of its chemical reaction. Its low pH and high hydrophilicity at early stages after mixing yields good wetting of tooth structure and promotes surface demineralization, similar to what occurs with self-etching adhesives.[9] As the reaction progresses, the acidity of the cement is gradually neutralized because of the reaction with the apatite from dental substrates[10,11] and with the metal oxides present in the basic, acid-soluble inorganic fillers.[9,12,13] In parallel, as the hydrophilic and acidic monomers are consumed by the chemical reactions in situ, the cement becomes more hydrophobic, which is highly desirable in a fully set resin cement to minimize water sorption, hygroscopic expansion, and hydrolytic degradation.[14] Self-adhesive resin cements demonstrate different levels of pH neutralization during their setting reaction. In general, the least pH-neutralization has been observed with the most hydrophilic cements. Additionally, unconsumed, residual acidic monomers can have an impact on the polymerization reaction of the cement, especially by inhibiting the action of the amine accelerator required for the camphor quinone–amine photo initiator system present in essentially all current cement systems[15] (**Fig. 1**).

Self-adhesive resin cements must be presented as two-part materials, usually in separate, individual syringes or in the more popular dual-barrel syringe dispensers. In either case, the components must be separated because of the possibility of premature acid-base interaction between acidic monomers and the ion-leachable glass fillers, the need to separate the self-curing chemical components, and the need to isolate the tertiary amine used in the photo curing mechanism from the acidic monomers.[9] The main constituents of any self-adhesive resin cement are the predominant functional acidic monomers (**Table 2**), conventional di-methacrylate monomers (eg, bis-GMA, UDMA, and TEGDMA), filler particles, and activator-initiator systems. The manufacturer's challenge is to create an adequate balance between the acidic/hydrophilic monomers and the conventional/hydrophobic monomers to promote the required initial self-adhesion from the former and ultimately the desired long-term stability for optimal clinical performance from the polymer produced by the latter.

Current self-adhesive resin cements are dual-cure resin materials that rely on light-cure and chemical-cure activation to convert monomers into polymers. However, the two curing mechanisms are not necessarily integrated and do not always follow the assumption that light-curing supplements self-curing or vice versa.[16] It has been suggested that the early vitrification (polymer network formation) induced by light activation could interfere with the self-polymerization, thus compromising the overall degree of conversion of dual-cure resin cements.[17] More recently, it has been confirmed that insufficient light exposure to self-adhesive resin cement could result in incomplete polymerization, to a level even lower than that of self-curing alone. The authors speculated that because the self-cure mechanism proceeds more slowly, the early vitrification brought on by the initial light activation minimizes the extent of the subsequent self-polymerization of the dual-cure resin cements because of restricted molecular mobility.[18] This has profound clinical implication because it suggests that some

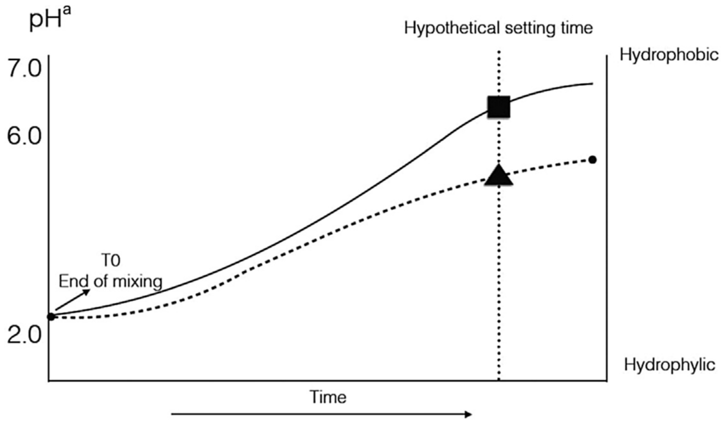

Fig. 1. Schematic representation of the neutralization reaction in self-adhesive resin cements. Under ideal conditions (*solid line*), when the cement is in contact with dentin and enamel, the neutralization reaction progresses as the acidic monomers are neutralized by the dental structures and the fillers, causing the pH to increase, thus turning the cement more hydrophobic and leaving no residual acidity. At the setting time for that particular cement (*square*), it cures to its maximum capacity and is hydrophobic, thus less prone to water sorption over time. Conversely, when conditions are not ideal (*dashed line*) for the neutralization to occur, such as when the cement is in contact with core build-up material, the pH rises more slowly because neutralization relies exclusively on the reaction with the fillers and it may never reach neutrality during the setting time and beyond (*triangle*). This leaves residual acidic monomers that can further compromise the curing, thus rendering a cement layer more prone to water sorption and its negative consequences on the properties of the cement.[a] The pH values are arbitrary and only show that neutralization of the acidic monomers raises the pH during the setting of the cement. Slight acidity may be expected even under ideal conditions after up to 24 hours for some cements.

materials may benefit from delayed light-activation, contrary to common belief and most manufacturer instructions.

Self-adhesive resin cements usually present a significant delayed initial polymerization rate because of the presence of acidic functional monomers, which can deactivate free radicals and compromise the curing reaction. This delayed polymerization can last from 24 hours to 7 days, depending on the product.[19] The amount/ratio of self-curing to light-curing components can vary considerably among different commercially available self-adhesive cements, and this may affect how well the material is expected to cure under conditions with less than ideal light exposure, such as under thick inlays or crowns. It is important, however, to highlight that the ability

Table 2
Functional acidic monomers commonly used in self-adhesive resin cements

Monomer Abbreviation	Complete Monomer Name
BMP	bis(2-methacryloxyethyl) acid phosphate
MDP	10-methacryloyloxydecyl dihydrogen phosphate
Penta-P	Dipentaerythritol penta-acrylate monophosphate
Phenyl-P	2-methacryl-oxyethyl phenyl hydrogen phosphate
PMGDM	Pyromellitic glycerol dimetracrylate
4-META	4-methacryloxyethyl trimellitic anhydride

of a self-adhesive resin cement to cure under clinical conditions depends on a multitude of factors. For instance, if the cementing substrate is mostly comprised of resin build-up material or amalgam or a metal casting, or any material other than dentin or enamel, the necessary neutralization of the acidic monomers can be significantly affected and, therefore, the amount of residual acidity may unbalance the setting reaction, likely reducing the curing rate, delaying final setting, and ultimately compromising the overall polymerization of the cement. These deleterious effects could result in a cement with increased water sorption. Unfortunately, most studies investigating bonding and curing of self-adhesive resin cements are conducted on dental substrates (mostly dentin), and the information on the behavior of the cements when in contact with other substrates is generally lacking.

Another aspect that directly affects the chemistry and curing of resin cements is storage temperature. Excessive (prolonged) heat during storage (>30°C) can have detrimental effects on the acidic monomers, and the components responsible for the self-curing reaction, and significantly alter working and setting time, either extending or reducing them depending on which component is more affected by heat.[20] It is recommended to store self-adhesive resin cements in a cool place (4°C–18°C) and to bring them to room temperature before using.

pH-NEUTRALIZATION, SORPTION, AND SOLUBILITY

Sorption of a resin cement has an important impact on the durability of the indirect restoration. Materials more prone to excessive water sorption are under increased risk of causing weakening and fracture of the indirect restoration.[21] In contrast, a slight water sorption may have a crucial role in compensating polymerization shrinkage, and possibly improving marginal seal.[22] Although sorption causes swelling and mass gain,[23] solubility reflects the released amount of unreacted monomers, and some filler particles and ions, resulting in loss of mass.[24,25] Different levels of sorption and solubility are observed in self-adhesive resin cements because of the differences in their chemical composition, mainly the organic matrices.[12,15,25] The amount of hydrophilic components,[25] cross-linking density and porosity,[26] and amount of acidic monomers or type of polar functional groups in the formulation have been shown to play an important role in these properties.[26–28] When self-adhesive resin cements are compared with conventional resin cements, the former are generally more prone to water sorption. The factor that determines the extent to which each material absorbs water is not the initial number of acidic groups, but the amount of remaining acidic groups that have not been neutralized during the setting reaction.[15] This supports the importance of neutralization of the acidic components to reduce water sorption and solubility, and further calls attention to situations when the prosthesis is cemented on materials other than dentin or enamel, when neutralization might be compromised.

It is clear that neutralization during setting plays a significant role in the performance of self-adhesive resin cements at multiple levels. Initially, a low pH and high hydrophilicity is desired in a self-adhesive resin cement to favor good wetting and bonding to the tooth substrate. During demineralization, functional acidic monomers are gradually neutralized by the reaction with the hydroxyapatite and fillers as previously described. Once adhesion is achieved, the pH would ideally increase,[10] and the material would turn more hydrophobic and, consequently, less susceptible to hydrolysis over time. Although the pH neutralization mechanism is considered a basic chemical setting process intrinsic to all self-adhesive resin cements, it varies significantly among available products.[29] A recent study found that self-adhesive resin cements with lower pH neutralization capacity displayed higher residual hydrophilicity and higher hygroscopic expansion.[14] Among the materials evaluated in the study, RelyX Unicem 2 (3M/ESPE, St. Paul, MN, USA), ICem (Heraeus-Kulzer, Hanau, Germany), and MaxCem Elite (Kerr, Orange, CA, USA) presented initial pHs of 3.8, 2.9, and 3.9, respectively. However, the pH increases over a period of 24 hours were significantly different, being 24.1% for RelyX Unicem 2, 11.7% for ICem, and 5.5% for MaxCem Elite, with the corresponding free expansion stresses observed as 14.5 MPa, 29.1 MPa, and 21.0 MPa, respectively. It is obvious that residual hydrophilicity can lead to water sorption and significant hygroscopic expansion stresses during and after the setting reaction. Thus, when a self-adhesive resin cement is the preferred clinical option, it is recommended to use cements with strong neutralization reactions, resulting in low hygroscopic expansion stresses.[14,30] One should keep in mind that these studies did not account for the additional neutralization that might occur when the cement is in contact with dentin or enamel. However, the results discussed previously provide an indication of what could happen when there is no dental substrate to help neutralization and the process relies exclusively on the intrinsic self-neutralization reaction of the cement.

MECHANICAL PROPERTIES

Improved properties is one of the reasons why clinicians have been shifting from conventional luting materials (zinc phosphate, zinc polycarboxylate, and glass-ionomer cements) to resin-based luting materials. Studies have demonstrated that self-adhesive resin cements are mechanically stronger than conventional, nonresin-based materials,[31] and some present flexural strength similar to conventional resin cements.[32] However, it has been observed that flexural properties and wear resistance can vary widely among commercial self-adhesive resin cements, and in general, self-adhesive cements have lower mechanical properties than conventional resin cements.[33] Nevertheless, self-adhesive resin cements are a viable clinical alternative concerning their mechanical properties, especially in cases when the benefits of a self-adhesive luting procedure surpass the need for maximum mechanical properties, such as cementation of fiber posts, monolithic zirconia crowns, and PFM crowns when moisture control is challenging for adhesive application.

BONDING TO RELEVANT SUBSTRATES

Self-adhesive resin cements do not require that a bonding agent or dental adhesive be placed before cementation. However, many self-adhesive resin cements can benefit from additional surface treatments before cementation to improve performance.[34–36] A complete understanding of how self-adhesive resin cements interact with the multiple bonding substrates present clinically can play a significant role in the decision-making process when selecting the best material for a particular clinical scenario. For a summary of clinical bonding protocols, please refer to **Table 3**.

Natural Dental Substrates: Enamel and Dentin

Self-adhesive resin cements are expected to simultaneously demineralize and infiltrate enamel and dentin. Even though micromechanical retention and chemical interaction between acidic groups and hydroxyapatite are expected, self-adhesive resin cements interact only superficially with dental hard tissues.[11,13,37]

Enamel bonding with self-adhesive resin cements can be compared with self-etching adhesive systems. The acidic monomers present in the composition of self-adhesive cements provide lower interprismatic hybridization and, consequently, weaker bond strengths compared with conventional hybridization techniques with

Table 3
Suggested surface treatment protocol before cementing with self-adhesive resin cements

Substrate	Suggested Procedures
Enamel	• Not suitable for direct bonding with self-adhesive resin cements • Phosphoric acid etch and bond of enamel is recommended if self-adhesive resin cements are used
Dentine	• Clean gross debris from temporary materials with hand instruments • Pumice the surface for complete surface cleaning; rinse well • Intraoral light sandblasting may be used to help cleaning • Polyacrylic acid (10%–25%) may also be used to clean and enhance bonding; do not use any chemical cleaning agent or strong acids • Do not overdry dentine before cementing
Core materials (resin build-up, metal cast, or amalgam core)	• Clean with hand instruments • Light intraoral sandblasting if available or slight bur roughening • Metal primers can be used as per manufacturer's instructions
Glass-matrix ceramics and lithium-disilicate ceramic	• Etch with hydrofluoric acid followed by silanization and bonding agent • Use proprietary, accompanying products of the cement brand if available • Follow respective manufacturer's instructions
Zirconia	• Light sandblasting followed by MDP-containing zirconia primer

the separate etching and bonding approach.[38] The functional acidic monomers are generally weaker when compared with traditional phosphoric acid etching and thus have reduced capacity to demineralize enamel. Bond strengths to enamel are usually low and make self-adhesive resin cements unsuitable for cementing veneers. For example, selective enamel etching is considered an alternative approach for creating increased bond strengths, producing results comparable with conventional resin cements.[36–38] Clinically, the selective enamel etch process has been proven to significantly increase retention and survival rate of partial ceramic crowns, particularly in complex restorations with extensive core build-ups or cavity linings, and reduced amount of exposed dentin and enamel available for bonding.[39]

Dentin bonding, conversely, does not benefit from phosphoric acid etching before self-adhesive resin cement application. Pre-etching has been shown to diminish the effectiveness of the bond, probably because of inadequate resin cement infiltration into the exposed collagen fibril network.[37,38] Some studies have demonstrated that the use of polyacrylic acid instead of phosphoric acid can have a positive impact on the bonding performance of self-adhesive resin cements to dentin,[35,40] but there are conflicting results. The optimal concentration of polyacrylic acid is not clearly established, but may vary from 10% up to 25%. It is assumed that there is a potential influence of the concentration of the polyacrylic acid and the respective acidity (pH). For instance, 20% polyacrylic acid has a reported pH of around 1.0,[41,42] whereas 10% polyacrylic acid is around 2.0.[43] These differences might account for rendering dentin surfaces more or less suitable for self-adhesive resin cements. More directed studies are required before the application of polyacrylic acid is routinely recommended before self-adhesive resin cements, and one should consider the benefit of the procedure against adding another step to the process.

In the clinical scenario, the presence of remnants of provisional cements can adversely affect the performance of self-adhesive resin cements. Application of different cleaning treatments to dentin before bonding can have effects ranging from simple removal of contaminants to total or partial removal of the smear layer.[44] A study found that the ideal cleaning treatment before bonding with RelyX Unicem was achieved by sandblasting the dentin surface. The same study demonstrated that either 0.12% chlorhexidine digluconate or 40% polyacrylic acid were not able to significantly increase shear bond strength when compared with a hand instrumentation cleaning protocol.[34] It is valid to highlight that the viscosity of some self-adhesive resin cements can also be partially responsible for a limited diffusion into the exposed dentinal tubules treated by the polyacrylic acid.[45] Cleaning the substrate before bonding with a self-adhesive resin cement seems a logical, required clinical procedure, but it is currently unclear as to the best approach to be used routinely. When additional retention to dentin is desirable, it seems that hand instrument cleaning followed by mild polyacrylic acid (ie, 10%–20%) or brief sandblasting are safe to use, but one should avoid strong acids (eg, phosphoric acid or highly concentrated polyacrylic acid) or other cleaning solutions with unknown interactions with the chemistry of self-adhesive resin cements.

Cementation of posts to radicular dentin is another clinical scenario that faces numerous challenges, especially when resinous materials are to be used. The main reason for failure of fiber posts is debonding of the resin cement from the radicular dentin.[46] Several aspects create challenges when using an adhesive system followed by conventional resin cements for luting posts, such as ideal moisture control, proper adhesive application, and subsequent light curing of the cement.[47] In this particular scenario, the use of self-adhesive resin cements seems to be a suitable and perhaps less technique-sensitive option than other luting strategies that may involve pretreating the difficult-to-access canals with adhesives.

A recent systematic review with meta-analysis of in vitro studies suggests that the use of self-adhesive resin cement could improve the retention of fiber posts into root canals.[48] Authors attributed the result to the bonding properties of self-adhesive resin cements, which create micromechanical retention and chemical bonding, greater moisture tolerance,[49] and lower polymerization stress compared with conventional resin cements.[50] Perhaps even more relevant clinically is the elimination of the technique sensitivity associated with intracanal bonding when conventional resin cements are used with separate adhesives.

Ceramic Substrates

Today, numerous ceramic products are available and a thorough understanding of the ideal luting material and surface treatment for each ceramic is crucial. More recently, new resin-matrix ceramic materials have been introduced, creating a new category of esthetic indirect restorative materials to which clinicians need to bond.[51] Even though dental ceramics are regarded as strong materials, it is well known that using a luting agent with bonding capability and enhanced mechanical properties is necessary for their durability because it significantly increases fracture resistance.[52] In general, resin cements meet those requirements and are the preferred choice as luting materials for all ceramic restorations.

Glass matrix ceramics are essentially nonmetallic inorganic ceramics containing a glass phase. They are represented by the traditional feldspathic ceramics; the synthetic ceramics, such as leucite, lithium disilicate, and fluorapatite ceramics; and the glass infiltrated ceramics, such as alumina (In-Ceram, Vita/Sirona, Bensheim, Germany). These ceramics allow for chemical treatment of the internal surface to improve retention, usually with hydrofluoric acid gels followed by silanization.[53] Recommended for all glass matrix ceramics, silanization has been shown to reduce the contact angle and increase the wettability of the ceramic surface,[54] making it a suitable substrate for resin cements. The combination of hydrofluoric acid etching and silanization is currently the standard, recommended procedure for bonding resin cements, including self-adhesive, to glass matrix ceramics.[55] Self-adhesive resin cements are not the best choice for cementing veneers. Although a good bond is accomplished to the veneer after hydrofluoric acid etching, silanization, and adhesive bonding, the bonding to the dental substrate (usually enamel) is weak and may result in early clinical dislodgment of the veneer. Light-cured-only cements remain the best option for cementing veneers. These cements do not contain certain amines required for the self-curing reaction that have been shown to discolor, and thus the light-cure-only cements are the most color stable.

Polycrystalline ceramics, which in general contain metal oxides, are represented by alumina ceramic (Procera All Ceram, Nobel Biocare Zurich, Switzerland) and stabilized zirconia (Procera Zr, Nobel Biocare; Lava Plus, 3M ESPE; In-Ceram Zr, Vita; IPS e-max ZirCad, Ivoclar Vivadent, Amherst, NY, USA).[51] It is known that the cement choice is less important to the clinical success when cementing zirconia prosthesis. The intaglio surface treatment, however, with light-pressure sandblasting combined with MDP-containing primers seems crucial for optimal long-term performance of conventional and self-adhesive resin cements.[56–59] In general, the application of universal primers (zirconia primers) alone, without prior airborne-particle abrasion (ie, light sandblasting), does not seem to improve adhesion of resin cements to zirconia.[60] The question, however, remains to be answered whether air-abrasion protocols exert detrimental effects on the fatigue strength of zirconia.[61] Recently, systematic reviews on adhesion to zirconia have demonstrated that the use of MDP-based self-adhesive cements after physicochemical conditioning of zirconia surface presented more favorable results.[56,58] Although water storage can affect the bond strength of resin cements to zirconia,[62] a meta-analysis found no difference among the cements for the aged-dataset, which may confirm that the cement choice is less essential to the durability of zirconia bonding, at least when resin cements are used.[58] The major reason for failures in porcelain-veneered zirconia crowns is chipping and fracture of the veneering ceramic.[61,63] As monolithic zirconia crowns become available and increasingly acceptable because of improvements in their optical appearance, chipping of the veneering ceramic may no longer be a clinical problem and, therefore, the clinical success of zirconia crowns will likely be more dependent on the retention capacity provided by the surface treatment and cement choice, leaving the clinician the responsibility of choosing the most appropriate, and evidence-based, cementation protocol.

Resin-matrix ceramics are essentially an organic matrix highly filled with ceramic particles (>50% by weight). Few studies have investigated the best resin cement and bonding protocol for this novel category of materials. The manufacturer's recommendations for each of these materials vary. Although hydrofluoric acid etching apparently is not the appropriate method for surface conditioning of resin-matrix ceramics, surface mechanical roughening followed by adhesive application seems promising.[64] A recent study found varied results for Vita Enamic (Vita Zahnfabrik, Langen, Germany) and Lava Ultimate (3M ESPE) resin-matrix ceramic blocks regarding optimal surface treatment and resin cement choice.[65] For Lava Ultimate, a composite formed of a resinous matrix highly filled with silica and zirconia particles, the most influential parameter was mechanical pretreatment; however, hydrofluoric acid (HF) acid etching had a significant positive effect on bond strength. Regarding the resin cement, the self-adhesive material presented significantly higher bond strengths to Lava Ultimate than the conventional resin cement.[65] Lava Ultimate is still indicated for inlays, onlays, and veneers; however, the manufacturer has removed the crown indication since June 2015 because of higher rates of premature debonding. In contrast, surface treatment had little impact when bonding to Vita Enamic, which is essentially a ceramic structure infiltrated with a resin. Optimal surface treatments were either silane application alone or HF followed by silane, as recommended by the manufacturer. However, the self-adhesive resin cement used presented overall lower bond strengths than the conventional resin cement within the same surface treatment group.[65] Because this category of indirect materials is new to the market, few studies are currently available to offer consistent guidance regarding the clinical protocol for bonding and cementing. Considering the studies available, it is clear that optimal cementation protocol (and consequently clinical retention) is material-dependent and closely following the respective manufacturer's instructions is warranted at this time.

CLINICAL PERFORMANCE OF SELF-ADHESIVE RESIN CEMENTS

RelyX Unicem is by far the most investigated product in clinical studies; however, long-term studies are still lacking.[66] Clinical studies have demonstrated that selective enamel etching before self-adhesive luting procedure with lithium disilicate inlays had no significant influence on marginal integrity when compared with the nonetched controls.[2,67] The authors, however, recognized that the findings were not conclusive and longer-term evaluation is still needed. A 12-month clinical evaluation of indirect resin composites luted with self-adhesive or conventional resin cements observed that both luting materials performed similarly, but this is not surprising because little or no difference between materials is what is usually expected at the early 1-year clinical evaluation.[68] When a self-adhesive resin cement was clinically compared with zinc phosphate for luting metal-based fixed partial dentures at a mean observation time of 3 years, none of the 49 prostheses was lost, regardless of the cement used,[69] suggesting that self-adhesive resin cements performed similarly to zinc phosphate luting materials within that 3-year time frame. Of clinical relevance was the finding that plaque accumulation and bleeding score were higher around prostheses cemented with the resin cement. Factors that possibly accounted for this finding were the content of resins and the resulting bacterial colonization on their surfaces; the bonding of the resin cement, which is not so easily removed from the sulcus; and the high solubility of zinc phosphate cement (ie, release of potentially antimicrobial zinc ions), which may be an advantage to repel microorganisms from the margins in the long term.[69] Conversely, other authors found less gingival inflammation around restorations cemented with self-adhesive resin cements.[70]

A recent review presented the current status of clinical studies on self-adhesive resin cements.[66] The review found only three studies comparing self-adhesive resin cements with traditional cements, none of them identifying retention loss either for self-adhesive resin cements or other traditional luting agents. Comparable clinical results were also found between conventional resin cements and self-adhesive resin cements as luting agent for inlays and onlays up to 4 years follow-up.[67,71] It is clear that more sophisticated clinical investigations of these new types of cements are required. The lack of consistent and relevant clinical studies on the performance of self-adhesive resin cements presents a limitation for a robust analysis of this category of resin cement. However, there is a good amount of sound laboratory investigations that can support clinicians in their decision.[66]

SUMMARY

Self-adhesive resin cements are considered as alternative luting cements with multiple applications in modern dentistry. However, one must consider the material's chemistry, bonding, and mechanical requirements for each particular clinical scenario, and the limitations that are intrinsic to the nature of the material. Clinical studies are still insufficient to completely understand the material clinical performance.

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