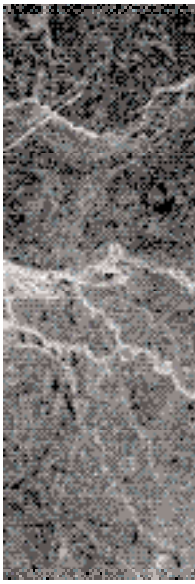

Critical Appraisal

DENTAL CEMENTS

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Selection of the appropriate dental cement when delivering an indirect restoration is vital to the success of the treatment. This task has become a challenge, considering the different types of luting agents available and the increasing number of different restorative options. This Critical Appraisal presents some of the choices of dental cements available for cementation of indirect restorations, with their respective clinical indications.

RETROSPECTIVE ASSESSMENT OF 546 ALL-CERAMIC ANTERIOR AND POSTERIOR CROWNS IN A GENERAL PRACTICE

B.S. Segal
The Journal of Prosthetic Dentistry 2001 (85:544–50)

ABSTRACT

Objective: This was a retrospective clinical study, conducted in a private dental practice setting, and was designed to evaluate the long-term success of all-ceramic In-Ceram (VITA, Bad Säckingen, Germany) alumina crowns placed with a resin-modified glass ionomer (RMGI) cement in both anterior and posterior areas.

Materials and Methods: Five hundred forty-seven In-Ceram anterior and posterior crowns were placed in 253 patients. After preparation, the prepared teeth were temporized with resin provisional crowns cemented with a eugenol-containing provisional cement (TempBond, Kerr Corporation, Orange, CA, USA). At the delivery appointment, the preparations were thoroughly cleaned and an RMGI cement,

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Vitremer (3M ESPE, St. Paul, MN, USA), was used as the definitive luting agent. A strict cementation protocol was followed in order to prevent initial moisture contamination. The treated teeth were evaluated at 6-month recalls, over 6 years, by the same dentist who provided the treatment.

Results: One intact anterior crown was deleted from the study because the tooth was traumatically avulsed during the follow-up period. Among the crowns cemented, 378 were placed on maxillary teeth and 168 on mandibular teeth. One hundred seventy-seven crowns were anterior and 369 posterior. Five crowns failed over the 6-year observational period. Two crowns failed because of core failure and three because of veneer fracture (with intact core). The reasons for the core failures seem to be related to inadequate reduction (on the anterior case) and bruxism (on the posterior case). Inadequate core support was the probable reason for the veneering failures. The overall failure rate was only 0.9%.

Conclusions: In-Ceram crowns cemented with RMGI appear to be an acceptable alternative for restoration of anterior and posterior damaged teeth in patients with high esthetic demands.

COMMENTARY

This study indicates no correlation between RMGI cementation and fracture of high-strength ceramic. However, one should be careful when interpreting the results of the study. Even though some of the crowns were followed for 6 years, approximately 67% were in function for less than 3 years. A longer observation period would be helpful.

High-strength ceramic crowns, ie, crowns with porcelain layered on alumina or zirconia cores, have high flexural strength and consequently are quite resistant to fracture. Even though all-ceramic crowns are usually not the first choice for restoration of posterior teeth, high-strength ceramics can be an acceptable choice. Because of their excellent inherent mechanical properties, there is typically no need to reinforce these restorations bonding them to the tooth structure. Instead, they can be cemented and, according to this study, RMGI cements seem to be a reasonable option for luting of these restorations to the tooth structure.

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LONG-TERM SURVIVAL ESTIMATES OF CAST GOLD INLAYS AND ONLAYS WITH THEIR ANALYSIS OF FAILURES

S.P. Studer, F. Wettstein, C. Lehner, T.G. Zullo, P. Schärer
Journal of Oral Rehabilitation 2000 (27:461–72)

ABSTRACT

Objective: The aim of this retrospective study was to assess the long-term clinical behavior of gold inlay and onlay restorations. A survival analysis was performed and the types of failures were reported.

Materials and Methods: Three hundred and three gold inlays/onlays placed in 50 patients since 1950 were included in this study. The cast gold restorations were placed by several different clinicians trained at the University

of Zürich. Subjects with moderate to high caries risk, poor periodontal health, poor oral hygiene, or temporomandibular disorders were excluded from the study.

Preparations were done according to published guidelines and cemented with either zinc phosphate (296 restorations) or glass ionomer (GI) cement (6 restorations). One restoration was cemented with a temporary cement.

The clinical reevaluation of the restorations took place in 1996–1997, using modified US Public Health Service (USPHS) criteria. Marginal adaptation, anatomic form, and surface texture were evaluated according to these criteria. Teeth also were assessed for presence of caries and the need for endodontic and/or periodontal treatment. Extracted teeth and teeth used for other prosthodontic work were recorded. A and B ratings were given to restorations that were deemed clinically acceptable. C and D ratings were assigned when the restoration required repair or replacement.

Results: Forty-two restorations received a C or D rating in at least one of the USPHS criteria and were considered failures. Statistical analysis revealed cumulative survival probability estimates of 96.1, 87.0, and 73.5% at 10, 20, and 30 years, respectively. The most common causes of failure, secondary caries and loss of retention, accounted for 40 and 30% of the total number of failures, respectively. Tooth fracture, need for endodontic treatment, primary caries, and extensive abrasion were some of the other failures observed. The type (inlay/onlay) and location of the restorations did not influence their longevity. Endodontic treatment was identified as a risk factor. Restorations on 12 out of 29 endodontically treated teeth failed over time. None of the restorations were replaced because of postoperative sensitivity.

Conclusions: Cast gold inlay and onlay restorations cemented with zinc phosphate are a clinically acceptable treatment option for restoration of damage teeth. Endodontic treatment might affect the survival of teeth restored with cast gold inlay/onlay restorations.

COMMENTARY

This study supports the use of nonadhesive cementation, especially with zinc phosphate, for delivery of indirect metal restorations. In recent years, the use of zinc phosphate cement has declined greatly, being superseded mostly by GI luting materials. Its relative poor mechanical properties when compared with other contemporary dental cements have led to limited indications of this material. However, the encouraging long-term clinical data on zinc phosphate cement raises questions about the relevance of in vitro data. Zinc phosphate has been used as dental cement for more than a century and proved to work properly when well indicated and an adequate tooth preparation is achieved, despite its relatively poor mechanical properties.

Well-designed retrospective studies can have great scientific value. However, some data can be difficult to obtain because flaws in the records are often present. In the present study, most of the subjects received the restorations in the Department of Fixed and Removable Prosthodontics and Dental Materials at the University of Zürich and were then referred to a private dentist for recalls. Even though most of the failures were noticed prior to the reevaluation appointment, meaning the appointment after the initiation of this study, 14% of the failed restorations were detected at the reevaluation only. Another potential limitation of this study relates to the exclusion criteria. Patients determined to have moderate to high risk of caries were excluded from the study. This is the probable reason for the low number (17 cases) of failures resulting from secondary caries. Lastly, sensitivity was apparently assessed at the reevaluation appointment only. It is probable that some patients would

not recall this event considering that over 30% of the restorations were in function for more than 20 years.

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THE STRENGTHENING MECHANISM OF RESIN CEMENTS ON PORCELAIN SURFACES

G.J. Fleming, F.R. Maguire, G. Bhamra, F.M. Burke, P.M. Marquis
Journal of Dental Research 2006 (85:272–6)

ABSTRACT

Objective: Two different mechanisms involving resin cements have been proposed as possible ways of strengthening all-ceramic crowns. These are (1) modification of the intaglio surface by crack healing and (2) strengthening of the ceramic by shrinkage of the resin cement, which would stress the molecules together after polymerization. This in vitro study tested the validity of these two proposed mechanisms.

Materials and Methods: Two hundred 12-mm-diameter by 2-mm-thick Vitadur Alpha disks (VITA)—an aluminous oxide layering porcelain—were fabricated. The disks were ground with silicon carbide abrasive papers and then allocated into groups of 20 specimens as follows:

1. No treatment was performed. Specimens were stored in a desiccator to serve as dry controls.
2. Specimens were indented to produce a 30- to 40-μm indentation. As in the first group, specimens were then stored in a desiccator to serve as dry controls.
3. No treatment was performed, and specimens were stored in a water bath at 37°C for 24 hours to serve as wet controls.
4. Specimens were stored in a water bath at 37°C for 24 hours to serve as wet controls. In contrast to the previous group, these specimens were indented.
5. Ground specimens were etched with Mirage Super Etch (Chameleon Dental Products Inc., Kansas City, KS, USA)—a 9.6% hydrofluoric acid gel—for 90 seconds. Monobond-S silane agent (Ivoclar Vivadent AG, Schaan, Liechtenstein) was applied to the acid-etched surface for 60 seconds and air-dried. The treated surface was then coated with Compolute Aplicap (3M ESPE)—a dual-cured resin cement—following the manufacturer's instruction. The cement was light-activated with an Optilux 501 unit (Demetron Kerr).
6. Specimens were treated as in the preceding group, but also were indented.
7. Specimens were treated as in the Compolute group except that RelyX Unicem Aplicap (3M ESPE) was the resin cement used.
8. RelyX Unicem Aplicap was the resin cement used, and specimens were indented.
9. Indented specimens were etched only to determine the effect of etching.
10. Indented specimens were etched and primed to determine the effect of these procedures.

All specimens except for those in the first two groups were kept in a water bath at 37°C for 24 hours until testing. Biaxial flexure strength testing was performed in all specimens. Profilometry evaluation was done to examine the surface roughness of the ground and indented control specimens.

Results: Both Compolute and RelyX Unicem significantly

increased the fracture strength of ground (20 and 42%, respectively) and indented specimens (28 and 48%, respectively) when compared with the respective wet controls. Dry controls had higher fracture strength than their respective wet controls. Etching and priming did not have any effect on fracture strength of the indented specimens.

Conclusions: The authors concluded that the strengthening of the porcelain occurs by shrinkage of the resin cement, and does not depend on the severity of defects.

COMMENTARY

Dental porcelains used as substrate for indirect restorations can be divided according to their strength. While high-strength porcelains do not need to be bonded to the tooth preparation, low-strength porcelains must be bonded to the tooth structure. The latter are not sufficiently strong to support physiological forces. Their resistance to fracture increases significantly when bonded with resin cements, as was nicely demonstrated in this study. At the bottom end of the strength scale are the feldspathic ceramics and the pressed ceramics such as IPS Empress (Ivoclar Vivadent).

This study is a great addition toward understanding the mechanism of strengthening of low-strength porcelains. However, laboratory data must be interpreted carefully before extrapolating the results to a clinical scenario. In this study, cements were applied to the porcelains but not were bonded to the tooth structure. Also, this was a short-term in vitro evaluation of one type of porcelain being reinforced with two resin cements. It is unknown whether this potential reinforcement would persist over a longer period of time or how other materials would behave in a similar situation.

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THE BOTTOM LINE

Indirect restorations have been used for restoration of extensively damaged teeth or for esthetic improvement for decades. Inlays, onlays, full gold and ceramometal crowns, and porcelain veneers are some of the indirect restorations available for restoration of the compromised dentition. To be successful, these restorations must be cemented or bonded to the prepared tooth structure. For most metal-based indirect restorations, a conventional tooth preparation is required and simple cementation of these restorations is indicated. Glass ionomers (eg, Fuji I, GC Corporation, Tokyo, Japan), resin-modified glass ionomers (eg, RelyX Luting Plus, 3M ESPE), and zinc phosphate cements have proved to be clinically successful and are recommended for cementation of metal-based restorations.

Also, various ceramics have been used for the fabrication of indirect restorations. Ceramic restorations can be zirconia or alumina cores (with layered porcelain), pressed porcelains, or layered porcelains. The strength of these ceramic restorations decreases from the former to the latter. High-strength core ceramics

cannot be etched and—as with metal-based restorations—can be cemented to the prepared tooth structure. The others, because of their relatively low strength, must be bonded to the tooth. Bonding is usually achieved by etching the ceramic substrate with hydrofluoric acid, applying a silane coupling agent and an adhesive system, and using resin cements. Numerous resin cements are currently available. As a rule, chemical- (eg, C&B Cement, Bisco, Schaumburg, IL, USA) and dual-cured resin cements (eg, RelyX ARC, 3M ESPE) are the cements of choice for bonding of low-strength porcelain restorations, with the exception of veneers. The need for an optimal esthetic result indicates the use of light-cured resin cements (eg, RelyX Veneer, 3M ESPE) for delivery of porcelain veneers. Light-cured resin cements have better color stability than other resin cements.

Recently, self-adhesive resin cements were introduced. Long-term clinical studies on these materials are yet to be seen, but some short-term studies have already shown promising results for some of the materials. RelyX Unicem, Maxcem (Kerr), BisCEM (Bisco), and MonoCem (Shofu Inc., Kyoto, Japan) are among the options available in this arena. Nevertheless, an adequate tooth preparation should always be advocated. The correct selection and the use of an appropriate cement, along with a satisfactory tooth preparation, help guarantee a successful restoration.

Editor's Note: We welcome readers' suggestions for topics and contributors to Critical Appraisal. Please address your suggestions to the section editor:

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