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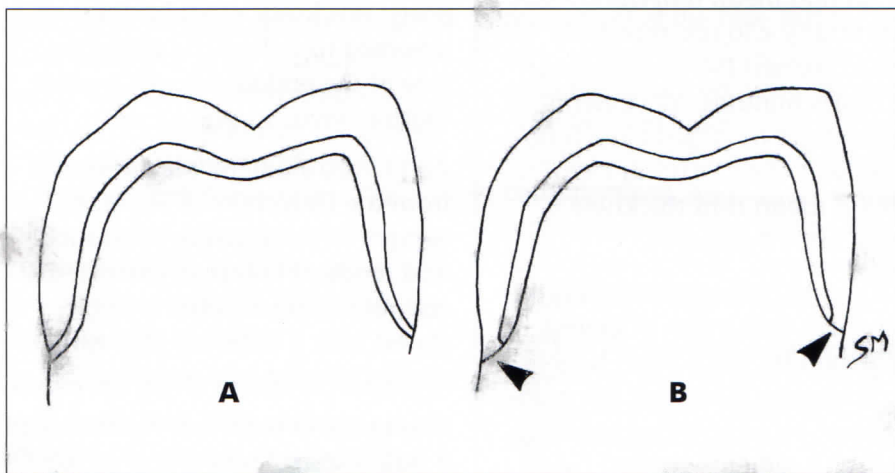
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A recent study evaluated the marginal fit of 2 different styles of all-ceramic crowns. One group had crowns with alumina copings as sent from the manufacturer that were veneered with porcelain (A). In the other group, the margin of the alumina copings was cut back, and the veneering porcelain was adapted to the die margins (arrows; B). See MARGINAL FIT OF ALL-CERAMIC CROWNS, inside.

Contemporary Fixed Prosthodontic Materials and Techniques

One of the 4 branches of the specialty of prosthodontics, fixed prosthodontics is devoted to restoring damaged teeth and replacing missing teeth, with artificial substitutes that are not removable by the patient. Conventional fixed prosthodontics involve artificial crowns and fixed partial dentures cemented to prepared natural teeth, and represent a major component of a contemporary prosthodontic practice. This issue of *Prosthodontics Newsletter* reviews several recently published articles related to conventional fixed prosthodontic materials and techniques.

Film Thickness of Recently Introduced Luting Agents

Luting agents are used to attach fixed prosthodontic restorations to their prepared teeth. Three relatively recently introduced classes of luting agents include

- resin-modified glass ionomer cement
- composite resin cement
- self-etching resin cement

When a crown or fixed partial denture (FPD) is cemented, a thin cement

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Film Thickness of Recently Introduced Luting Agents

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film is desirable to ensure complete seating of the restoration.

A study by Kious et al from the Medical College of Georgia reviewed the film thickness of 6 contemporary luting agents:

- ▶ 2 resin-modified glass ionomer cements (Fuji CEM; GC America, Alsip, Ill., and RelyX Luting Plus; 3M ESPE, St. Paul, Minn.)
- ▶ 2 composite resin cements (RelyX ARC; 3M ESPE, and Panavia 21; Kuraray America, New York, N.Y.)
- ▶ 2 self-adhesive, dual-polymerized resin cements (Maxcem; Kerr Corp., Orange, Calif., and RelyX Unicem; 3M ESPE)

All cements were mixed according to the manufacturers' instructions. The film thickness of each cement was evaluated by using the method described in International Organization for Standardization (ISO) 9917.

The mixed cement was pressed between 2 precisely parallel, cylindrical glass slabs with a load of 150 N. Cements were pressed 1, 2 and 3 minutes after the initiation of the mixing process.

The film thickness of each cement specimen was measured by a micrometer, accurate to $\pm 1 \mu\text{m}$. Testing was performed at room temperature without using polymerization lights.

Mean film thickness values for all cements were $\leq 25 \mu\text{m}$ after the 2-minute time interval. After 3 minutes, all resin-based cements produced mean film thickness values $< 27 \mu\text{m}$. Except for the RelyX Luting

Plus cement, all cements produced mean film thickness values $< 29 \mu\text{m}$ at 3 minutes.

Comment

Traditional resin-based cements have tended to result in a higher film thickness after crown cementation when compared with water-based cements. ISO standards for cement film thickness are $\leq 25 \mu\text{m}$ for water-based cements and $\leq 50 \mu\text{m}$ for resin-based cements.

The resin-based cements used in this study performed remarkably well. All had mean film thicknesses substantially $< 50 \mu\text{m}$ threshold found in current ISO standards after 2 and 3 minutes. All cements, except 1 resin-modified glass ionomer cement (RelyX Luting Plus), recorded a mean film thickness $< 29 \mu\text{m}$ after 3 minutes.

RelyX Luting Plus cement had a relatively high mean film thickness after 3 minutes ($53.6 \mu\text{m}$). However, 3 minutes is beyond the manufacturers' recommended working time for all cements studied (with the exception of Panavia 21 cement). Therefore, if manufacturer-recommended working times are followed, all 6 cements studied should produce film thicknesses well within current ISO standards.

It is also important to note that the micrometer used in the study was accurate within $\pm 1 \mu\text{m}$, so very small differences in the means among groups might be beyond the accuracy of the measuring device used in the study.

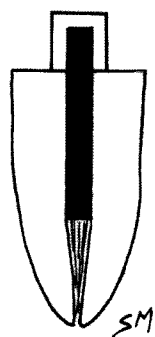
Kious AR, Roberts HW, Brackett WW. Film thicknesses of recently introduced luting cements. *J Prosthet Dent* 2009; 101:189-192.

Effect of Post Type And Length on Fracture Resistance Of Endodontically Treated Teeth

Many factors can affect the prognosis of a pulpless tooth restored with a prefabricated post, including the length of the post and the material from which the post is made. Fiber-reinforced resin posts have a lower modulus of elasticity than do metal posts; this lower modulus has been assumed to reduce the risk of fracture of the endodontically treated tooth in vivo.

An in vitro study by McLaren et al from the University of Michigan compared the fracture resistance and mode of failure of extracted endodontically treated teeth restored with 3 different post systems and 2 different post lengths.

One group of teeth was restored with a stainless steel post (ParaPost XP #42024; Coltène/Whaledent, Inc., Cuyahoga Falls, Ohio; positive control). A second group was restored with a quartz-fiber-reinforced post (Light-Post, #0200005207; Bisco, Inc., Schaumburg, Ill.), and a third group was restored with a glass-fiber-reinforced post (Snowlight, #LB051; Abrasive Technology, Inc., Lewis Center, Ohio). For each type of post, 2 subgroups were formed ($n = 10$) whereby 1 had posts 10 mm long and 1 had posts 5 mm long. All specimens were restored with standardized cores (Figure 1). A negative control group ($n = 10$) had a core reconstruction only and no post.

Figure 1.

Specimens were loaded at 90° to their long axis until ultimate failure occurred. Mean initial failure loads were significantly higher for all specimens with 10-mm posts compared with those with 5-mm posts. The highest mean initial failure load was recorded for the ParaPost group with the 10-mm posts. The lowest was for the core-only group.

When the mode of ultimate failure was evaluated, 20% of the roots restored with 10-mm ParaPosts fractured and 30% of the roots restored with 5-mm ParaPosts fractured. None of the fiber-reinforced groups experienced root fracture at ultimate failure.

Comment

Results of this study suggest that a long metallic post is the method of choice when a prefabricated post with direct composite resin core is used. However, these results must be viewed with some degree of caution because of obvious limitations of the study design. The specimens used in this study were teeth with prefabricated posts and direct cores only. Crowns with a circumferential

ferrule were not placed. It is well known that cementing a crown with a 360° ferrule 1.5–2 mm in height can increase the fracture resistance of the tooth and improve the prognosis.

The investigators loaded the cores at a 90° angle, which would simulate a direct blow to the face, probably not the most likely type of load placed on a natural tooth in vivo. Teeth are subjected to dynamic loading from years of chewing and parafunction.

For all groups, initial failure involved movement of the core, but the restorative system remained intact until ultimate failure occurred. In vivo, once the core has moved, the cement seal of the overlying crown will be compromised, and failure is inevitable. Therefore, the mean initial failure load is most important when comparing failure loads.

McLaren JD, McLaren CI, Yaman P, et al. The effect of post type and length on the fracture resistance of endodontically treated teeth. J Prosthet Dent 2009;101:174-182.

Marginal Fit of All-ceramic Crowns

All-ceramic crowns have become more popular, and there are numerous commercially available systems for making these crowns. The Procera Alumina crown system (Nobel Biocare, Yorba Linda, Calif.) uses computer-assisted design/computer-assisted manufacture (CAD/CAM) to fabricate an alumina coping that is then veneered with porcelain by the dental laboratory technician to develop the final crown contours.

Because the effect of marginal design of Procera crowns on the fit of the final restoration is unknown, Limkangwalmongkol et al from the University of Maryland evaluated the precision fit of crowns made with the coping supporting the veneering porcelain (coping as milled) and with the coping cut back to develop porcelain-butt margins (see cover illustration).

Sixteen extracted teeth were prepared for complete crowns. The teeth were randomly divided to receive the 2 different marginal designs with the crowns. Stone dies were fabricated and scanned with the Procera Sandvik Scanner (MOD50:1732; Nobel Biocare). Copings 0.6 mm in thickness were returned from the manufacturer. In 1 group, porcelain was applied to the as-milled copings. In the other group, the margins of the copings were cut back to develop porcelain-butt margins.

Marginal gaps of the finished crowns placed on the teeth were measured with a profilometer. The mean marginal gap size for the conventionally fabricated crowns with the as-milled copings was $68.07 \pm 16.08 \mu\text{m}$; the mean marginal gap size for the porcelain-butt crowns was $101.29 \pm 43.71 \mu\text{m}$. This difference was not statistically significant ($p = .065$).

Comment

Although this study reported no statistically significant difference between the 2 groups, the p value was .065. Normally a p value of $<.05$ is considered significant, so the difference was almost at the level of significance. If the sample size had been larger, perhaps a



significant difference would have been found.

It is simpler and less time-consuming to fabricate crowns with copings that have not been cut back. The authors recommended the use of this technique rather than the porcelain-butt margin method unless there is an esthetic need for a porcelain-butt margin.

Limkangwalmongkol P, Kee E, Chiche GJ, Blatz MB. Comparison of marginal fit between all-porcelain margin versus alumina-supported margin on Procera® alumina crowns. J Prosthodont 2009;18:162-166.

Cutting Efficiency And Temperature Changes with Rotary Cutting Instruments

To collect objective data to support manufacturers' claims of superiority of rotary cutting instruments, Ercoli et al from the University of Rochester, New York, studied the cutting behavior of 10 different rotary cutting instruments used in crown preparation.

Macor, a nonporous porcelain-like material with properties similar to tooth enamel, was used as a substrate. A simulated pulpal chamber was filled with a thermo-conductive silicone material attached to a thermocouple. The following 9 diamond instruments (7 multiuse and 2 single-use) and 1 carbide bur were used:

- Brasseler #6856018 (Brasseler USA, Savannah, Ga.)
- Diamond (SS White Burs, Inc., Lakewood, N.J.)

- NTI (Axis Dental Corp., Coppell, Tex.)
- Premier 770.8C (Premier Dental Products Co., Plymouth Meeting, Pa.)
- Premier 2005.8 (Premier Dental Products)
- TDA coarse (SS White Burs, Inc.)
- TDA medium (SS White Burs, Inc.)
- Piranha (SS White Burs, Inc.)
- NEO (Dentalaire Products, Intl., Fountain Valley, Calif.)
- Great White Ultra (SS White Burs, Inc.)

Ten groups ($n = 30$) were formed. On 75 Macor blocks, a 2-mm-deep cut was made on each side, for a total of 300 cuts; each cut was made with a new rotary instrument. Cuts were performed with an air-turbine handpiece (Midwest Quiet Air; Dentsply Professional, Des Plaines, Ill.) and water coolant spray (40 L/minute), and were controlled with computer software. The following variables were studied: temperature, rate of advancement, applied load, rotations per minute (rpm), rate of advancement/load and energy needed to cut the substrate.

All rotary instruments produced a reduction in temperature in the simulated pulpal chamber. The carbide bur (Great White Ultra) produced the best cutting efficiency when rate of advancement, applied load and rpm were compared. There was no difference in the performance of the multiuse diamonds compared with the single-use disposable diamonds.

Comment

The use of abrasives and cutting instruments is fundamental to a den-

tal practice. Nevertheless, little is known about the elements that govern these grinding and cutting procedures. The diamond instruments tended to display similar performance regardless of their design (channeled vs conventional) or the grit (coarse vs medium).

An important observation of the study was the lack of heat buildup in the simulated dental pulp. However, the effect of prolonged use of these instruments necessary to complete a tooth preparation or multiple preparations on their efficiency and pulpal temperature is unknown.

Ercoli C, Rotella M, Funkenbusch PD, et al. In vitro comparison of the cutting efficiency and temperature production of 10 different rotary cutting instruments. Part I: turbine. J Prosthet Dent 2009;101: 248-261.

In the Next Issue

- Mandibular overdentures and immediate loading of implants
- Mandibular overdentures retained by 1 or 2 implants
- Platform switching and bone-level response

Our next report features a discussion of these issues and the studies that analyze them, as well as other articles exploring topics of vital interest to you as a practitioner.

Do you or your staff have any questions or comments about **Prosthodontics Newsletter**? Please write or call our office. We would be happy to hear from you.

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