

Prosthodontics

NEWSLETTER

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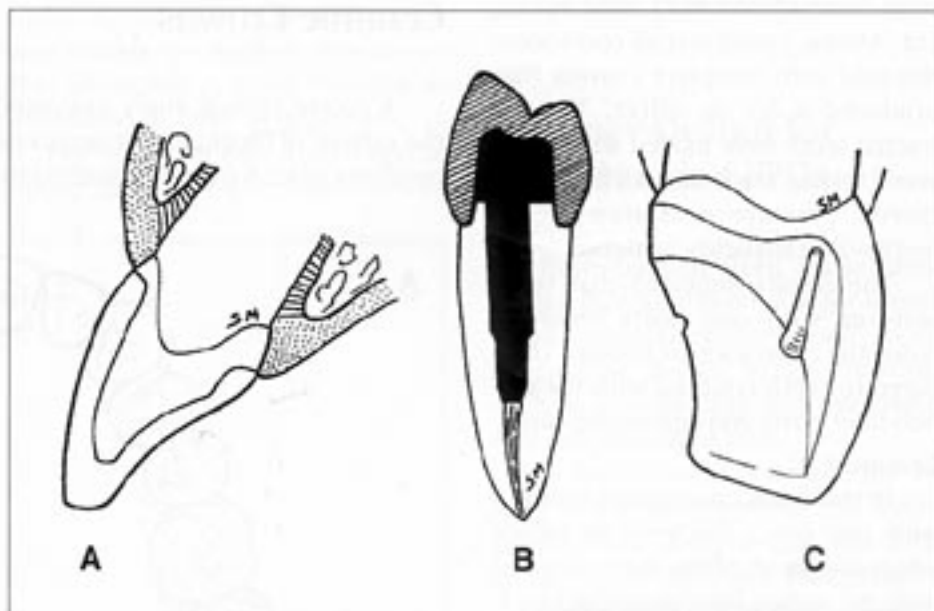
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- Analyzing Strength Of Carbon-fiber Posts
- Success of Glass-ceramic Crowns
- Retainer Design for Resin-bonded FPDs
- Role of Beryllium in Nickel-Chromium Alloys



Research reports reviewed in this issue include survival of all-ceramic crowns (A), strength of a new carbon-fiber post (B) and influence of retainer design for resin-bonded restorations on the thickness of the resin lute (C).

Research in Fixed Prosthodontics

New materials and restorative methods are introduced on a regular basis to the dental profession. However, in a clinical setting "new" may not always be "better."

This issue of *Prosthodontics Newsletter* is devoted to recently-published research in fixed prosthodontics. Both clinical and laboratory studies of contemporary restorative materials and techniques are reviewed and summarized to provide an update on these topics.

Analyzing Strength of Carbon-fiber Posts

A recent *in vitro* study compared the fracture resistance of extracted teeth restored with cast posts and cores to the strength of teeth restored with carbon-fiber reinforced epoxy resin posts and composite resin cores.

All posts were cemented with a resin cement (Panavia 21, Kuraray Co., Ltd., Osaka, Japan) and all cores were restored with complete crowns that produced a ferrule effect. The extracted teeth were loaded with a universal testing machine until failure occurred. Fracture resistance of the teeth was statistically analyzed.

The results indicated that teeth restored with cast posts recorded twice the resistance to fracture compared to teeth restored with the carbon-fiber posts and composite cores.

Comment

In this study, most teeth restored with cast posts fractured at failure whereas only 5% of the teeth restored with the carbon-fiber posts fractured. The forces required to cause failure of teeth with cast posts were extremely high and unlikely to occur in the mouth. Significantly lower forces, which may occur *in vivo*, resulted in failure of the restorations supported by carbon-fiber posts.

Results suggest a higher potential for failure with the new carbon-fiber post. However, if failure does occur, there is less chance of irreversible damage to the tooth. Additional research, including clinical studies, is necessary before recommendations can be made regarding universal application of these new posts.

Perhaps the lower strength values recorded for these posts will limit their use to single-unit restorations only. These posts may not be strong

enough to restore teeth that must serve as abutments to fixed or removable partial dentures.

Martinez-Insua A, Da Silva L, Rilo B, et al. Comparison of the fracture resistances of pulpless teeth restored with a cast post and core or carbon-fiber post with a composite core. *J Prosthet Dent* 1998;80:527-32.

Success of Glass-Ceramic Crowns

A recent clinical study evaluated the survival of Dicor glass-ceramic restorations placed by one prosthodon-

tist over a 14-year period. The study included 417 patients treated with 1444 Dicor restorations. There were 180 failures during the entire study period, and the authors statistically evaluated parameters that influenced survival.

Some restorations were acid etched on the fitted surfaces and some were not. Dicor crowns that were not acid etched recorded a risk of failure more than twice that of acid-etched crowns.

Failure also varied depending on the location of the restoration in the dental arch and gender of the patient (Figures 1 and 2). The age of the patient also influenced the risk of failure.

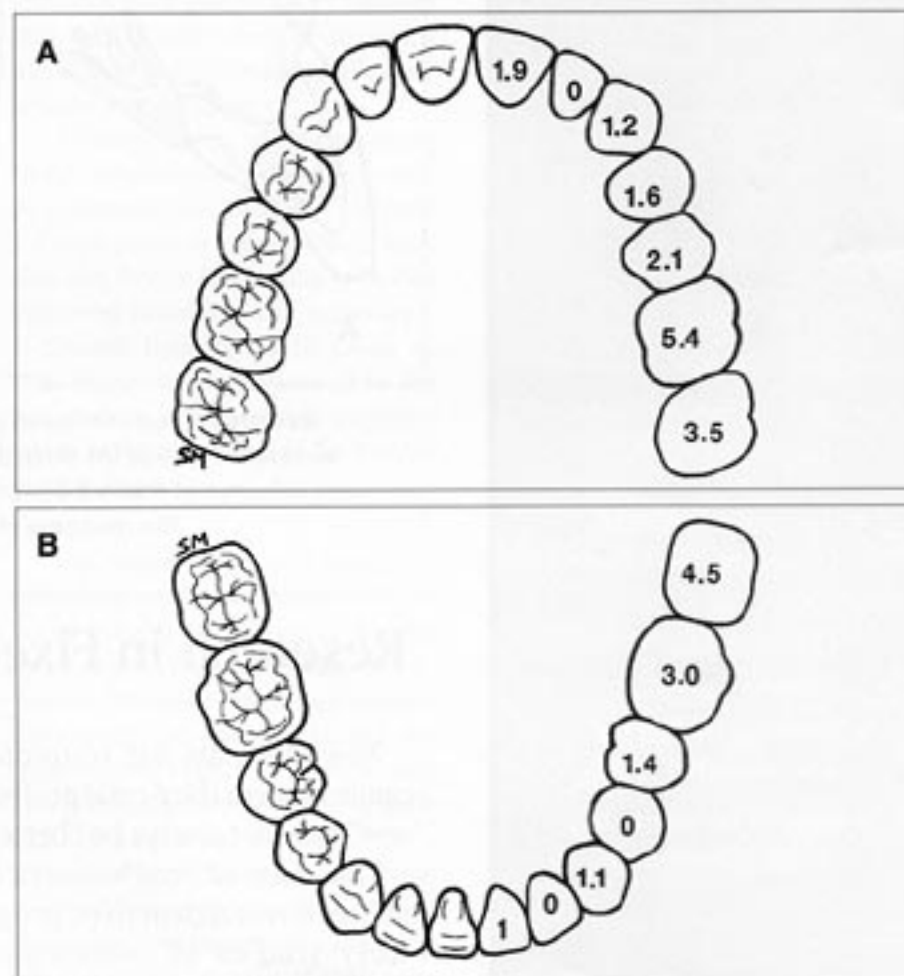


Figure 1. Relative risk of failure of acid-etched Dicor crowns in males (compared with mandibular central incisor) for the maxillary arch (A) and the mandibular arch (B).

Patients between the ages of 33 and 52 had a higher risk of failure than younger or older patients.

Comment

All-ceramic restorations continue to attract the attention of dentists and patients because of their superior esthetics. Nonetheless, their lack of inherent strength compared to metal-ceramic restorations continues to be a concern.

This study represented the largest clinical data set on glass-ceramic restorations in the dental literature. Based on *in vitro* data, the authors initially assumed that Dicor crowns could be placed on any teeth without

restrictions. However, initial evaluation of the data by the authors suggested that tooth position played an important role in predicting success. The use of Dicor crowns on molars was abandoned by the authors because of the observed unacceptable failure rate.

There are several all-ceramic systems commonly in use today, and the Dicor system is no longer commercially available. Although the specific results of this study of Dicor restorations cannot be applied directly to other all-ceramic systems, they can be generalized to serve as guidelines.

The results of this study suggest limiting the use of all-ceramic crowns

to situations where esthetic demands are extremely high, such as the restoration of incisors. Where strength is important, traditional metal-ceramic restorations will offer acceptable esthetics with a better long-term prognosis.

Molament KA, Socransky SS. Survival of Dicor glass-ceramic dental restorations over 14 years: Part I. Survival of Dicor complete coverage restorations and effect of internal surface acid etching, tooth position, gender, and age. *J Prosthet Dent* 1999;81:23-32.

Retainer Design for Resin-bonded FPDs

Resin-bonded fixed partial dentures (FPDs) have been used for almost two decades. The contemporary tooth preparation design includes features such as grooves that improve retentive and resistance form.

A recent study evaluated the effects of the complexity of the tooth-preparation designs and the final thickness of the resin luting agent. Five different styles of tooth preparation were studied, and Panavia Ex resin cement (Cavex Holland BV, Haarlem, Holland) was used to bond the retainers.

No significant differences were noted among the film-thickness means recorded for each of the five preparation designs. The overall mean for the resin lute was $75\mu\text{m}$.

Comment

The mean bucco-lingual thickness of the resin lute for the retainer that resembled a three-quarter crown was highest at the cervical margin ($83\mu\text{m}$) when compared to the other types of designs. This was the only measurement with any statistical significance. Nevertheless, the measurement compares favorably to the overall mean of

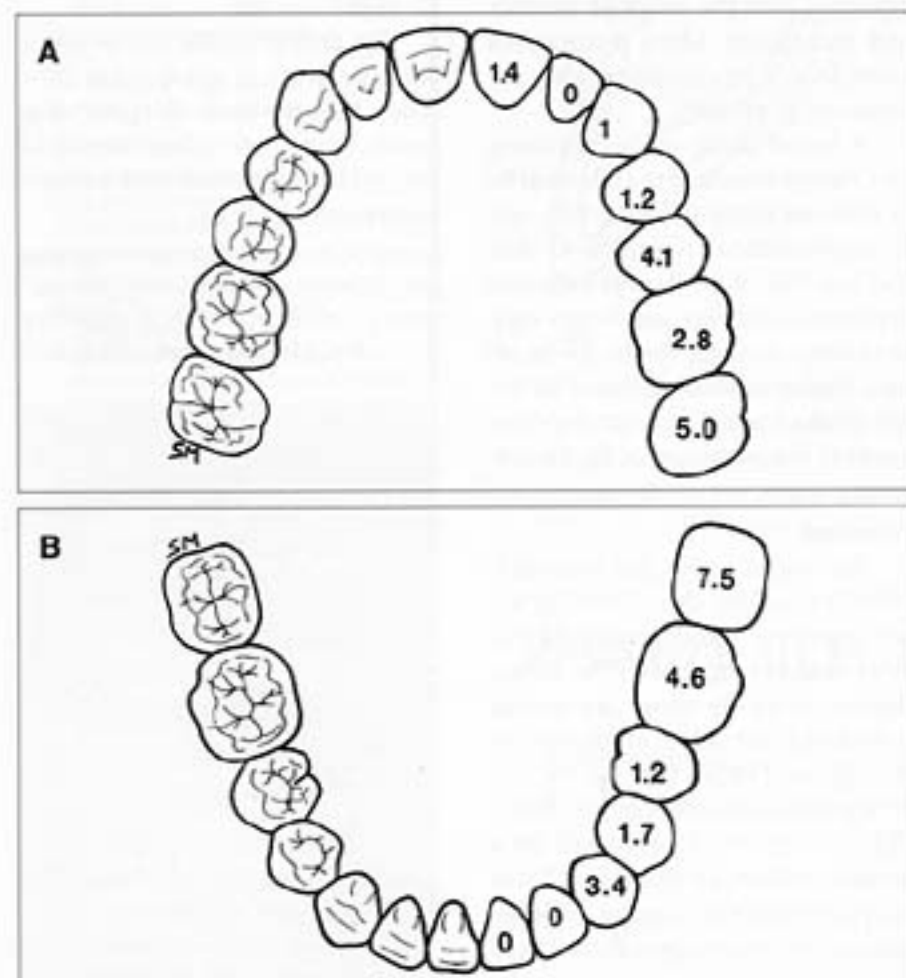


Figure 2. Relative risk of failure of acid-etched Dicor crowns in females (compared with maxillary canine) for the maxillary arch (A) and the mandibular arch (B).

Next:

- Strength of glass-infiltrated ceramics
- Effects of cyclic loading on dental ceramics
- Bond strength of etched ceramics

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

75 μ m, and is clinically acceptable for a resin-bonded restoration.

Inordinate thickness to the resin lute would be undesirable and would suggest incomplete seating of the restoration. The use of retentive features such as grooves has been shown to improve the prognosis of the restoration and will not significantly affect the thickness of the luting agent when Panavia Ex resin is used. The results of this study strongly suggest the use of retentive preparation designs for resin-bonded FPDs.

Wassell RW, Gagliano G. Effects of adhesive fixed prosthesis retainer design on resultant resin luting agent thickness. J Prosthet Dent 1998;80:479-84.

Role of Beryllium in Nickel-Chromium Alloys

Nickel-chromium (Ni-Cr) alloys are attractive alternatives to conventional gold alloys for metal-ceramic restorations because of their relatively low cost. These base-metal alloys are also highly resistant to corrosion in the mouth and are extremely rigid.

Trace amounts of beryllium (Be) have been reported to improve the castability of these alloys and to enhance the quality of the oxide layer on

the surface of the casting improving the strength of the ceramic bond.

Although Be can improve the properties of the alloy, its presence may pose a health hazard for the technician and dentist. Be is potentially aspirated into the lungs of dentists and technicians when restorations made from a Be-containing alloy are reshaped by grinding.

A recent study of Be-containing Ni-Cr alloys evaluated the effects of Be in concentrations of 0.9%, 1.0% and 1.1% compared to a control Ni-Cr alloy that was free of Be. Results indicated improved castability and better metal-ceramic bonding for Ni-Cr-Be alloys. Higher concentrations of Be did not produce any significant improvements in the properties of the Be-containing alloys.

Comment

Base-metal alloys are extremely difficult to solder; therefore, they are not commonly recommended for use in extensive, long-span FPDs. Nevertheless, Ni-Cr-Be alloys are usually considered the alloy of choice for resin-bonded FPDs. They can be cast in very thin segments because of their rigidity and bond very well to a number of resin luting agents. These alloys are also very popular in developing countries for conventional fixed prosthodontics because of their relatively low cost.

Results of this study suggest that concentrations of Be as low as 0.9% will produce physical properties that are comparable to alloys with higher concentrations. It is best to keep the concentration of Be as low as possible for health reasons.

The dentist should also be aware of the presence of nickel (Ni) in these alloys. Ni is the most allergenic of all metals, and these alloys should be avoided for any patients with a known hypersensitivity to Ni.

Bezzon OL, de Mattos MGC, Ribeiro RF, et al. Effect of beryllium on the castability and resistance of ceramometal bonds in nickel-chromium alloys. J Prosthet Dent 1998;80:570-74.

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.