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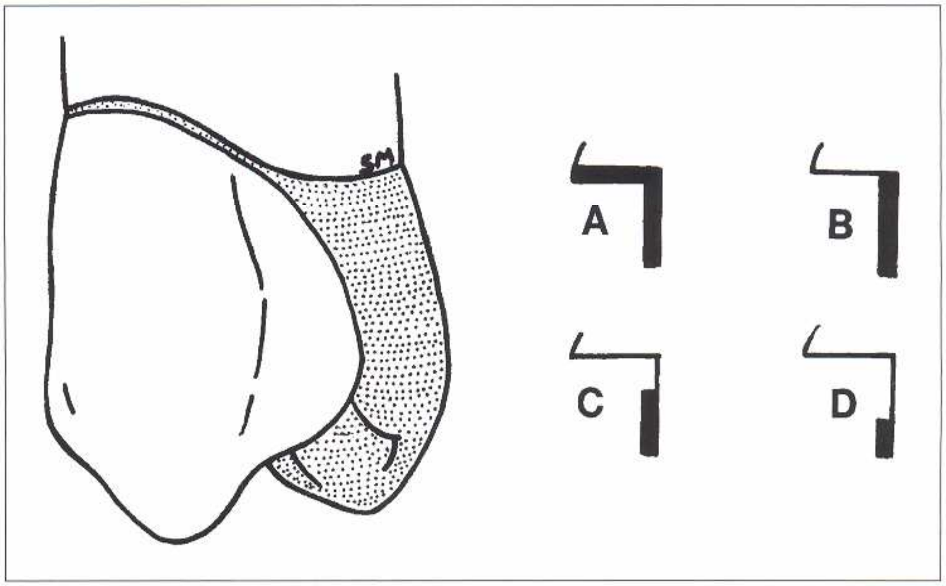
PROSTHODONTICS™ NEWSLETTER

AUTUMN 2008

IN THIS ISSUE:

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.



A recent study investigated the optical effects of a metal–ceramic crown with 4 different marginal designs: A, metal collar; B, 0-mm cutback; C, 1-mm cutback; and D, 2-mm cutback. See *Framework Design of Metal–Ceramic Restorations*, inside.

Contemporary Fixed Prosthodontics

Fixed prosthodontics represents a major aspect of the specialty, and there have been many advances in this area of dental practice. New knowledge, materials and methods can enhance the quality of care provided to patients. However, new materials and methods should be validated by studies published in peer-reviewed journals to ensure expected outcomes. This issue of *Prosthodontics Newsletter* reviews a series of journal articles devoted to research on materials and techniques used in fixed prosthodontics.

Framework Design of Metal-ceramic Restorations

Metal-ceramic crowns are com- monly used to restore natural teeth. The traditional framework design for a metal-ceramic restoration included a thin metal collar at the finish line on the facial surface of the crown. Contemporary designs of metal-ceramic frameworks com- monly use shoulder porcelain, with elimination of the metal collar for improved esthetics.

However, even with this shoul- der porcelain, some investigators have suggested that the underlying metal coping alters light transmis- sion and can result in darkening of the tooth structure and gingival tis- sues apical to the crown's margin. Trimming the metal substructure back from the shoulder has been suggested as a method to improve the optical qualities of collarless metal-ceramic crowns, avoiding cervical discoloration.

An in vitro study by Swain et al from the University of Manitoba, Canada, inveStigated the effects of various metal-ceramic framework designs on the color changes *(l1£s)* that occur apical to the margin of metal-ceramic restorations. Four framework designs were used in the study (see cover illustration):

. traditional metal collar with a height of 1 mm on the facial surface;
. porcelain facial margin without metal cutback;
. porcelain facial margin with a I-mm metal cutback; and
. porcelain facial margin with a 2-mm metal cutback.

Using a colorimeter and a com- puter-imaqinq system developed at

the Minnesota Dental Research Center for Biomaterials and Biomechanics, ~Es relative to the unprepared tooth were mea- sured with the metal coping alone and with the completed metal-ceramic restoration. Also, the ~Es were measured at 2 loca- tions apical to the crown margin, above and below the cemento- enamel junction (CEJ).

The differences in ~E depended on the framework design and the location of the measurement. The area between the crown margin and the CEJ showed a significantly higher ~E compared with the area below the CEJ for all 4 framework types. The differences between the 2 locations were greatest for the crown with a collar and decreased as the amount of cutback increased. The ~Es below the CEJ did not differ with the different framework types.

Comment The design of the metal sub- structu!e influenced the optical effect of the restoration on the tooth structure apical to the crown mar- gin. Best results were obtained with a 2-mm cutback. However, this amount of cutback could reduce the fracture resistance of the restora- tion, increasing the potential for mechanical failure in service. Also, measurements were made without any cement between the crown and the tooth. The presence of cement between the crown and the pre- pared tooth structure would likely alter the optical effect. An opaque cement could potentially eliminate the advantage of the 2-mm cutback.

Swain VL, Pesun II, Hodges IS. The
effect of *metal ceramic restoration framework design* on *tooth color.* T Prosthet Dent *2008;99:468-476.*

Clinical Performance of lithia Disilicate Core Ceramics for Posterior Fixed Partial Dentures

All-ceramic fixed partial den- tures (FPOs) can produce excellent esthetic results; however, fracture of the restoration in service is a con- cern, especially in the posterior regions of the mouth. A study con- ducted by Esquivel-Upshaw et al from the University of Florida prospectively evaluated 30 all- ceramic posterior FPOs made from a moderately high-strength, lithia dis- ilicate-based core ceramic material (e.Max Press, Ivoclar Vivadent).

The FPOs were fabricated using the lost wax technique. The wax pat- terns for the FPOs were invested and burned out in a special furnace. The precerammed ceramic material was plasticized at ll00°C and pressed under vacuum and pressure into the mold. Connector height and width were measured, with dimensions of 4 x 4 mm considered ideal for premo- lars and 4 x 5 mm considered ideal for molars. Veneering ceramic mate- rial was not used.

The FPOs were stained, and an overglaze was applied. The EPOs were cemented with either resin- modified glass-ionomer cement (Protec CEM, Ivoclar Vivadent) or a dual-polymerized resin cement (Variolink II, Ivoclar Vivadent), selected randomly.

Patients were recalled annually for 4 years to evaluate the prosthe- ses according to 11 clinical criteria. The fracture rate was approxi- mately 3% per year, with 4 prosthe- ses fracturing over the 4-year period. Overall ratings of good-to-excellent for nonfractured FPOs decreased by approximately 4% per year. Fractures occurred only With molar abutments and were associ- ated with connector heights of ~4 mm. The type of cement used did not influence the fracture rate.

Comment This study confirms the recom- mendation to use a moderately high-strength, lithia disilicate- based core ceramic material for anterior and premolar restorations only (not for molars), because fr~ct~~~d ~~! occur_Wi!h p~o- lar restorations.

Esquivel-Upshaw IF, Young H, *lones " et al. Four-year clinical per- formance* of a *lithia disilicate-based core ceramic for posterior fIXed par- tial dentures.* Int J Prosthodont *2008;21:155-160.*

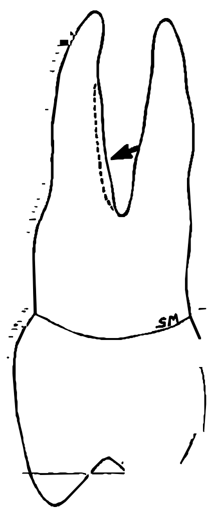
Post Space Preparation For Maxillary First Premolars

Usually, a maxillary premolar has 2 roots, but the location of the bifurcation of the roots varies. The point of bifurcation can be at the junction of the coronal and middle thirds or in the apical third.

An -invagination- on the palatal aspect of the buccal root has been reported to occur in 80-100% of dual-rooted maxillary first premo- lars. This palatal invagination on the buccal root results in limited residual dentin thickness in that area, and there is a risk of excessive thinning of the dentin with post space preparation after endodontic therapy (Figure 1).

Pilo et al from Tel Aviv University, Israel, evaluated the amount of residual dentin thick- ness in dual-rooted maxillary pre-

B



p

Figure 1. With dual-rooted maxillary premolars, an invagination (arrow) on the palatal (P) surface of the buccal (8) root can result in dentin thickness that is <1 mm after post space preparation.

molars at baseline, after endodontic preparation and after post space preparation. Thirteen premolars with bifurcations at the junction of the cervical and middle thirds of the roots were selected for post space preparation.

The teeth were embedded in a special muffle device and sec- tioned horizontally 2, 4 and 6 mm apical to the cementoenamel junc- tion. Residual dentin thickness was measured from the root-canal lum~to the root'-s- outer syrfac~ at the buccal, lingual, mesial and distal aspects of each root apical to the bifurcation.

Residual dentin thickness was also measured coronal to the bifur- cation, either to the buccal or lin- gual surface, as well as to the mesial and distal surfaces. After baseline measurements, the teeth were reassembled in the muffle device.

Endodontic instrumentation was performed, and each canal was enlarged to a K-40-size file, fol- lowed by irrigation with 5.25% sodium hypochlorite (NaOCI). The canals were dried, and the tooth sections were disassembled. The residual dentin thickness was again measured.

Then the coronal 7 mm of the root-canal space was prepared with Gates-Glidden drills (#2 and #3), followed by ParaPost drills (#3 and #4). After each step, the teeth were disassembled, and the residual dentin thickness was remeasured.
Results indicated that after post space preparation, the thick-
ne5s---of restduat-dentin-~t -the-s~
faces of the roots facing the bifur- cation (palatal surface for buccal roots and buccal surface for palatal roots) was <1 mm for:
. 77% of the buccal roots and . 61% of the palatal roots.
Comment To reduce the potential for root fracture during service, the recom- mended thickness of residual dentin surrounding an intraradicu- lar post is 1 mm. Although this rec- ommendation is based on conjec- ture, not research, it appears to be logical.
Because of the palatal invagina- tion on the buccal root, this surface of the buccal root of a maxillary first premolar is more likely to be <1 mm in thickness -after post space ~ ration. Based on the results of this study, when a post is placed in a maxillary dual-rooted premolar, the post should be as narrow as practi- cal and should be placed in the palatal root, rather than in the buc- cal root.
It should be noted that Parapost drills are parallel-sided. Because the roots and the root canals are tapered, a custom-made cast post that follows the natural taper of the root canal would be a more conser- vative choice, with less potential to

reduce the dentin below the rec- ommended 1 mm in thickness.
Pilo R, Shapenco E, Lewinstein [. *Residual dentin thickness* in *bifurcated maxillary first premolars after root canal and post space preparation with parallel-sided drills*. J Prosthet Dent
2008;99:267-273.

Accuracy of Impression Techniques For Fixed Prosthodontics

There are many approaches to making impressions for fixed prosthodontics. Caputi and Varvara from University G. 0' Annunzio, Italy, evaluated in vitro the accuracy of 4 different impression methods:
. monophasei . I-step putty/light-bodYi . 2-step putty/light-bodYi and . 2-step injection technique.
A stainless-steel model contain- ing 2 complete-crown, tapered abut- ment preparations was fabricated. The abutments were made with ref- erence cross grooves on the occlusal and proximal surfaces. All impres- sions were made with an addition-reaction silicone impres- sion material (Aquasili Dentsply International), with 15 impressions made for each technique.
The monophase impressions were made with regular body impression material. The I-step putty/light-body impressions were made with the simultaneous use of

the Aquasil putty and light-body material. With the 2-step putty/light- body method, acrylic resin copings 2 mm in thickness were placed on the abutment preparations when the putty impression was made. After setting of the putty impression, the acrylic resin copings were r~moved, and the light-body material was inserted into the putty impression. The impression was then reseated.
With the 2-step injection impres- sions, the putty and light-body material were seated simultane- ously, as with the I-step putty/light- body method. After polymerization, the impression was removed, and a hole was drilled in the impression at the occlusal surface of each abut- ment with a carbide bur. A thin layer of axial impression material was then removed from the impres- sion with the same carbide bur. Extra-light-body material was placed in the impression, and the impression was reseated on the abutments. Additional extra-light- body material was also injected through the holes in the impression.
Stone casts were poured in type IV stone (GC Fugirock EPi GC Europe NV). The accuracy of the 4 different impression techniques was assessed by taking measure- ments on the stainless steel model and comparing them with mea- surements on the stone casts.
All impression techniques pro- duced stone casts and dies with dimensions that were larger than those measured on the stainless- steel model. The order of highest to lowest increase from the stainless- steel model was:
. monophase; . I-step putty/light-body; . 2-step putty/light-body; and . 2-$tep injection technique.
Comment The investigators reported increases in the dimensions of the stone casts from those of the stain- less-steel model that ranged from 0.15-3.09%. Some of this dimen- sional increase was undoubtedly the result of expansion of the stone itself, and some of it was related to dimensional changes in the impres- sion. Although the

differences were statistically significant, the clinical relevance is unknown. An oversized die is desirable when fabricating fixed prostheses.

Caputi 5, *Varvara* G. *Dimensional accuracy* of *resultant casts made by* a *monophase, one-step and two-step, and* a *novel two-step putty/light-body*
impression technique: an in *vitro study.*
J Prosthet Dent *2008;99:274-281.*

NEXT:

- Clinical outcome of zirconia-based fixed partial dentures
- Fracture strength of bilayered zirconia restorations
- Fracture strength of all-ceramic CAD/CAM crowns

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.

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