The "Point of Care" section answers everyday clinical questions by providing practical information that aims to be useful at the point of patient care. The responses reflect the opinions of the contributors and do not purport to set forth standards of care or clinical practice guidelines. This month's answers are provided by speakers at the Jasper Dental Congress, which will be held May 24-27, 2007, in Jasper, Alberta. The Congress is co-hosted by the Alberta Dental Association and College and the Canadian Dental Association.

QUESTION 1

How can I effectively drain an odontogenic abscess?

General Principles

Once the dental practitioner has determined that a patient has an odontogenic abscess, then the abscess must be drained. The essentials in the management of an odontogenic infection are maintenance of the airway and drainage of the abscess.[1]

There are several possible ways to drain an abscess, and the practitioner must choose the most appropriate method for the particular presentation. The choice is largely determined by the extent of the odontogenic infection. Infections that are accessible through the periodontal route (**Fig. 1**) or the endodontic route (**Fig. 2**) may be drained using these approaches. If the involved tooth is deemed nonsalvageable or nonstrategic, then the drainage may be established through the tooth extraction socket.

In some cases an abscess may be aspirated using a needle and a syringe. The needle is inserted into the area of maximal fluctuance, and suction is applied by drawing back on the plunger of the syringe (**Fig. 3**). This method, combined with image-guided techniques[2] such as computed tomography or ultrasonography, has rapidly gained popularity for many areas of the body where an abscess may be located far from the skin surface, especially if it is near vital structures, and where traditional cutaneous incision and drainage would cause excessive morbidity.

Even though image-guided drainage of certain deep neck infections may be helpful, most odontogenic infections do not require this approach. Such aspiration may yield a sample that is ideal for aerobic and anaerobic culture and sensitivity testing, but there are some potential disadvantages, the most important being the possibility of incomplete evacuation of the abscess. Another possible problem is that without a formal incision and placement of a drain, drainage may cease and the abscess may recur, with a requirement for repeated aspirations, or it may spread further.

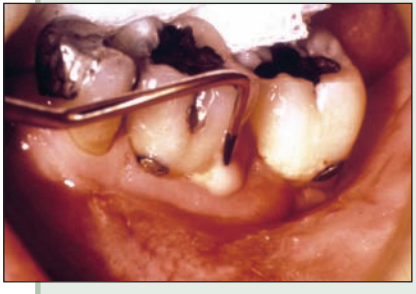

Figure 1: Some odontogenic infections can be drained by the periodontal route.

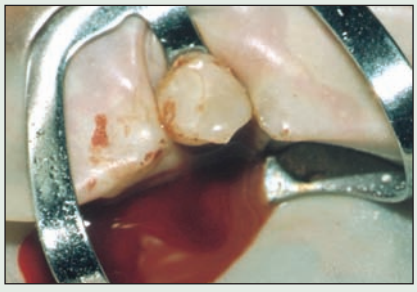

Figure 2: Other odontogenic infections may be amenable to drainage through an endodontic approach.

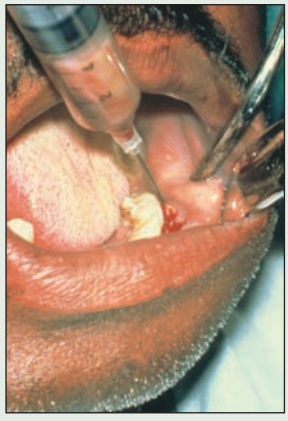

Figure 3: Odontogenic infections can sometimes be drained using an aspiration technique, but this approach does not allow continued drainage and may lead to re-accumulation of the abscess material.

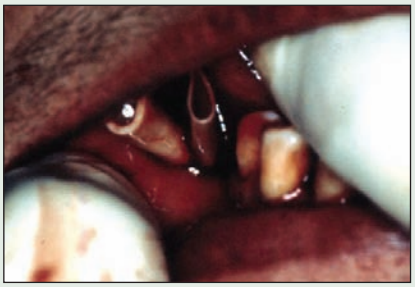

Figure 4: Drains secured and in position in the mandibular buccal vestibule.

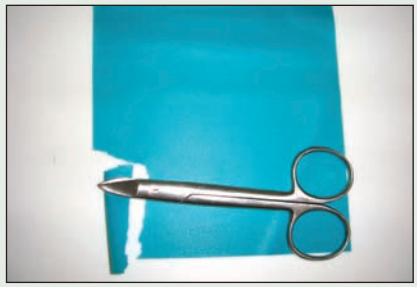

Figure 5: A drain can be easily fabricated in the dental office by cutting off a small piece of dental dam material and suturing it into the wound.

Figure 6: An alternative source for material to create a drain is the small finger of a nonlatex glove.

Placing a Drain

Where there is palpable fluctuance in the maxillary or mandibular vestibules, the practitioner may elect to make an intraoral vestibular incision. Occasionally, the mucosal wound edges of such incisions spontaneously fold onto each other or coapt, which may block drainage of the abscess and allow for re-accumulation of the fluid. A drain consisting of a neutral foreign material may be inserted into the incision to prevent wound collapse and allow continued drainage (**Fig. 4**).

The drain may consist of simple polyethylene tubing or other similar material. In the dental office, a piece of a nonlatex dental dam can be cut, placed between the wound edges and secured with a single suture (**Fig. 5**). Some practitioners may prefer to cut the dam material in a T shape, finding that the drain is more stable in the wound, but the author prefers a simple strip of dental dam material. Alternatively, the small finger of a nonlatex glove may be cut off and sutured into the wound to help ensure continued drainage (**Fig. 6**).

Following Up

It is imperative that the dental practitioner follow the patient postoperatively to ensure improvement and resolution of the infection. The practitioner must remove the foreign body or drain from the wound once drainage has ceased. Both placement of the drain and its removal must be recorded in the patient's chart.

In addition to incision and drainage, adjunctive oral antibiotics given in the appropriate dose per weight (depending on the age or medical condition of the patient) are useful in the management of most odontogenic infections.[1] However, if the infection has begun to spread with involvement of the airway, neck or eyelid, or if the patient has decreased oral intake, is lethargic or is otherwise medically compromised, then prompt referral to an oral and maxillofacial surgeon or to a hospital emergency room and intravenous antibiotics are recommended.[1–3] For young children, intravenous therapy should be considered early, as infection can spread quickly in these patients.[3,4]

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Dr. Sándor will be giving 2 presentations at the Jasper Dental Congress on Saturday, May 26: The Ever Changing Face of Dental Infections (morning) and Developments in Dental Implant Surgery of Interest to the General Practitioner (afternoon).

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QUESTION 2

When restoring endodontically treated fractured anterior teeth with a full-coverage restoration, what criteria are used to determine the ideal treatment?

Background to the Issue

When restoring endodontically treated fractured teeth with a full-coverage restoration, 2 main requirements must be met.

Preparation Height

First, a sufficient amount of preparation height (ideally 3 mm, as measured from the interproximal finish line[1]) must be available to provide adequate retention and resistance form for the final restoration. When a tooth has fractured, leaving less than 3 mm of height, the preparation can be lengthened by the addition of core material. The core material is usually secured to the tooth by a cast post with an indirect technique or by a titanium or fibre post with a direct technique.[2]

Alternatively, the preparation height can be increased by lowering the finish line in an apical direction. When the margins are "dropped" in this way, care must be taken to not impinge on the soft-tissue attachment of the biologic width. Consequently, this technique is favoured when placement of a supragingival finish line is possible (i.e., on teeth with clinical recession). When there is no evidence of clinical recession, then crown-lengthening surgery is required to apically displace the soft-tissue attachment and thus increase the preparation length.

Another means to lengthen a preparation with inadequate initial height is through a combination of "subtractive" crown-lengthening surgery and "additive" core build-up technique. This method simultaneously increases the preparation height in the apical and coronal directions. Similarly, combining orthodontic forced eruption with crown-lengthening surgery simultaneously increases preparation height in both apical and coronal directions.

Ferrule Effect

The second requirement in restoring endodontically treated fractured teeth with a full-coverage restoration is ensuring that the final restoration has adequate ferrule effect. Sorensen and Engelman[3] defined the "ferrule effect" as the 360° metal collar of the crown that encircles the prepared, parallel walls of dentin down to the shoulder of the preparation. This collar increases the resistance provided by the extension of the dentinal tooth structure.[4]

Libman and Nicholls[5] used fatigue loading to compare the effects of different ferrule lengths of a maxillary central incisor. They found that the initial failure, which was clinically "invisible," was breakage of the cement seal. This failure eventually led to the "visible" failures of cement leakage, secondary caries, crown dislodgement, and post and tooth fracture. They concluded that a minimum of 1.5 mm of ferrule height is needed to improve crown resistance.

When no ferrule is present, the occlusal forces are resisted exclusively by the post, which may eventually fracture or loosen. Therefore, 2.0 mm of ferrule length is recommended as a clinical minimum under crown restorations for long-term post-and-core survival.

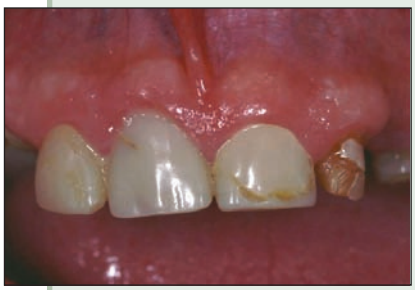

Figure 1: Patient requiring anterior reconstruction after tooth 13 fractured off at the gum line.

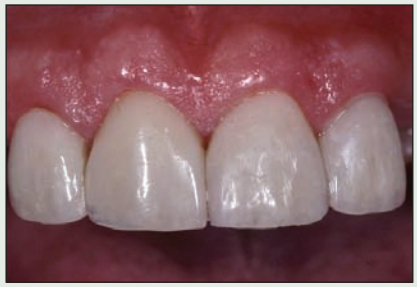

Figure 2: Composite cores are made to the future incisal edge position.

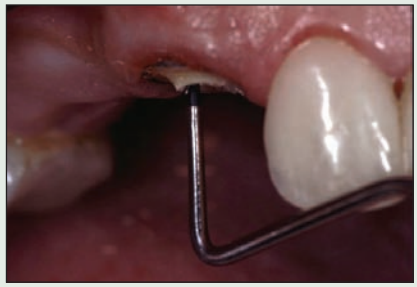

Figure 3: Tooth 13 has insufficient ferrule and will be restored with a bonded fiber post and composite core.

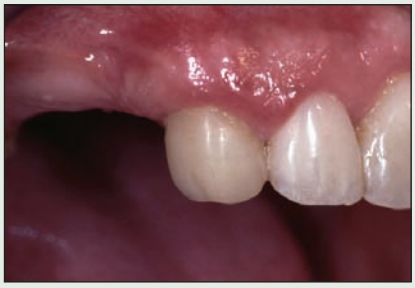

Figure 4: Short clinical crown with coronally positioned gingival margin. Crown lengthening surgery is required to obtain ferrule and improve tooth proportions.

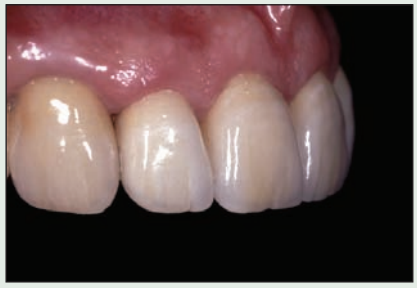

Figure 5: Final restoration with adequate ferrule and apically repositioned gingival margin.

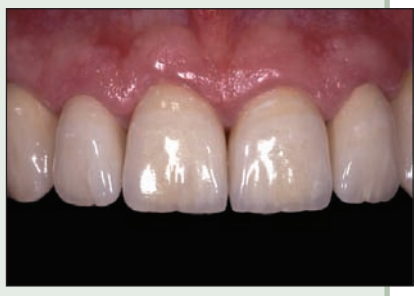

Figure 6: Final restorations have harmonious ginigval levels and good proportion.

Management of the Issue

When there is insufficient ferrule (less than 2 mm of sound tooth structure), clinical crown-lengthening and/or orthodontic forced eruption may be required. When deciding which of these treatment options to use, several factors must be considered, specifically, esthetics, root shape, crown-to-root ratio, probing depths and treatment time.

There are 2 common methods of obtaining sufficient ferrule: dropping the crown margins or forced eruption with surgery.

Dropping the crown finish line in an apical direction increases the preparation height at the gingival third and creates an adequate ferrule. This may require crown-lengthening surgery to apically reposition the supracrestal attachment apparatus and to thereby maintain biologic width.

However, obtaining ferrule in this way necessitates a compromise in the esthetic result, because of altered gingival levels, tooth length and proportion, as well as a compromise in the biologic outcome, resulting in decreased clinical attachment.

Consequently, a key factor in treatment planning will be the desired gingival esthetics (**Figs. 1** to **6**). The ideal clinical situation for crown lengthening is represented by a tooth with the following characteristics:

- inadequate ferrule height
- short clinical crown with long roots
- coronally displaced gingival margins
- width/length ratio that is less than ideal.

The second method to obtain adequate ferrule, which is used when the tooth proportions and gingival levels are ideal, combines crown-lengthening surgery with forced eruption. The forced eruption moves the gingival levels and the attachment apparatus coronally. The incisal edge can then be reduced by an amount equal to the extrusion, which results in a shorter crown. Afterward, crown-lengthening surgery can simultaneously provide ferrule and restore gingival height, tooth length and tooth width/length ratio to their original levels.

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Dr. Ceyhan will be a co-presenter at the Jasper Dental Congress with Drs. Lorne Kamelchuk and Bruce Yaholnitsky. Their session, titled Restorative Treatment Planning of Esthetic Dilemmas Using an Interdisciplinary Approach, will be presented on Saturday, May 26.

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QUESTION 3

What are the clinical disadvantages and limitations associated with metal-free partial dentures?

Introduction

Metal-free flexible removable partial dentures (RPDs) represent a growing market segment. Ads in dental journals and laboratory mailings highlight new products of this type, and a new treatment code in the American Dental Association's 2005 *Current Dental Terminology* describes these metal-free prostheses, differentiating them from conventional acrylic metal-free RPDs.[1]

Materials and Properties

The polymers used for metal-free RPDs include acrylics, plasticized acrylics, nylon and acetal resin (polyoxymethylene).

Acrylics are methacrylate resins that have limited flexibility and a tendency for brittle fracture. They can be trimmed with rotary instruments and polished to a high lustre. Acrylics are repairable; in addition, because uncured material bonds readily to cured material, an acrylic RPD can be relined. Acrylics are often used for provisional RPDs or for bases added to metal framework RPDs.

Plasticized acrylics are methacrylates with a solvent and/or softening agent added. The plasticizers increase flexibility and offset brittleness; however, they are known to leach from the acrylics, and the systemic effects of leached plasticizer are a concern.[2] Some patients complain of odour, taste or a burning sensation, possibly attributable to the plasticizer or solvent.[3] Plasticized acrylics exhibit time-dependent deformation (also known as "creep") and are therefore not suitable for definitive prostheses.

Nylon and polyoxymethylene are recent additions to the RPD market. These materials differ from acrylics in that they are hot-pressed into shape. No polymerization occurs during moulding or setting. Nylon, a polyamide, has repeating amide groups rather than carbon chains. Nylon is hypoallergenic, translucent, tough and very resistant to brittle fracture. Nylon RPDs are termed "unbreakable," but they are prone to creep, although to a lesser extent than plasticized methacrylates. Nylon bonds very poorly to acrylic and cannot be added to itself, which makes relining and repair difficult. The translucency of this material yields an esthetic result.

Figure 1 illustrates strain hardening of nylon after reheating and tightening of a clasp. The bulk of the clasp and the internal stress crack highlight the behavioural limitations of nylon. Low stiffness means that clasps must be "over-bulked" to achieve adequate retention of the RPD. Because of creep, the clasps lose their retention over time, and they cannot be tightened without introducing stress, which leads to cracks. No reports were found in the dental literature describing the physical properties or clinical behaviour of nylon RPDs.

Polyoxymethylene, also known as acetal resin, is the most interesting of the flexible RPD polymers. Twice as stiff as nylon, acetal RPDs are configured like metal framework RPDs, except that they are bulkier. Acetal resins are pressed at higher temperatures than nylon, which leads to less creep and superior dimensional stability. In vitro study has indicated that acetal occlusal rests can adequately support distal-extension RPDs for up to 3 years.[3] The dimensions of a rest preparation should be 2 mm wide by 1.5 mm thick (i.e., the greatest thickness toward the guide plane). To avoid wear, rests must be placed in zones free from opposing tooth contact. Colour stability and water sorption of acetal resins meet ISO standards, and the flexural properties are acceptable.[4–8]

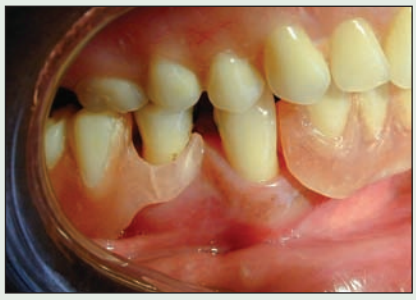

Figure 1: Nylon removable partial denture. A stress crack is evident where the nylon clasp was heated and adjusted for improved retention.

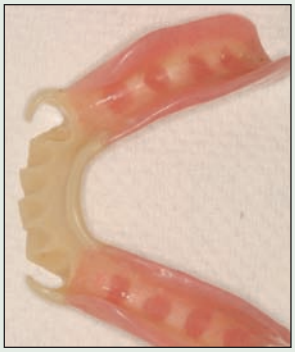

Figure 2: Acetal framework with acrylic bases.

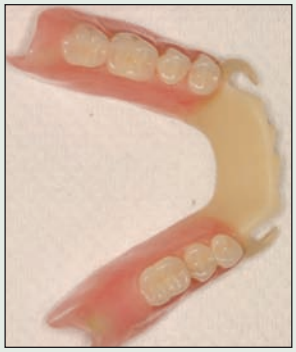

Figure 3: Acetal framework with interpenetrating polymer network teeth bonded to acrylic bases.

With the advantages of higher stiffness and creep resistance, acetal frameworks with acrylic can also be relined and repaired (**Figs. 2** and **3**). The inherent opacity of the ordered carbon chains in acetal resins results in opacity of the RPD, which is esthetically undesirable.

Clinical Benefits and Limitations

One clinical benefit associated with flexible polymer (metal-free) RPDs is a reduction in the mouth preparation required. Flexibility reduces seating interferences, and guide planes and reciprocating surfaces are inconsequential. Patients report that distal-extension RPDs made of flexible polymer are more comfortable than metal framework RPDs.

The brittleness of acrylics is a limitation, especially if there is no framework to reinforce the RPD. Plasticized acrylics are much less brittle, but they deform over time. Most acrylics can be relined and repaired, which gives them a distinct advantage over nylon and acetal resins. Nylon is not sufficiently rigid to construct a framework onto which acrylic can be processed. Acetal resin is stiffer than nylon, and acrylic bases can be processed onto acetal resin RPD frames. Acetal resin frames with acrylic bases offer strong, flexible, relinable RPDs that are superior to those made of acrylic or nylon in terms of properties and behaviour.

In one study,[9] 30 subjects, with a total of 37 partially edentulous arches, received restorations with cast-frame and flexible RPDs of similar design. Each subject wore each RPD for at least 12 months and was then asked to score comfort and function. All subjects scored comfort higher for the flexible RPD, and all but 1 subject scored the function of the flexible RPD as superior to that of the cast-frame RPD (the exception was a mandibular RPD). Overall, 29 of the 30 subjects preferred the flexible RPD, which suggests that patient preference is the main factor driving the trend toward metal-free, flexible RPDs.[9]

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Dr. Ewoldsen will be giving 2 presentations at the Jasper Dental Congress on Friday, May 25: Functional Impressions to Finished Dentures (morning) and Practical Partial Denture Design, Materials and Tooth Preservation (afternoon).

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Do you have a question about dental materials that you would like answered in a "Point of Care" article? If so, send your question to editor-in-chief Dr. John O'Keefe at jokeefe@cda-adc.ca

QUESTION 4

What measures can the clinician take to ensure the clinical success of metal-free (all-ceramic) crowns and bridges?

Defining High-Strength All-Ceramics

Cementable all-ceramic crowns and bridges are high-strength, metal-free restorations comprising a ceramic substructure (coping or framework) veneered with porcelain, for an esthetic result. For simplicity, cementation is preferred to adhesive luting, especially when the margins are subgingival. The strongest and toughest cementable ceramic used in dentistry today is yttria-stabilized zirconia. Cercon (Dentsply, York, Penn.) was the first such zirconia. It is milled from a pressed block, which is then fired to become fully dense before the veneer porcelain is applied.

Cercon has been tracked clinically in Europe for more than 5 years, and its success rivals that of porcelain-fused-to-metal (PFM) restorations.[1–3] Records from a 2-person private dental practice have shown successes comparable to that of PFM restorations (**Table 1**). One-year and 2-year clinical data from the University of Maryland have also shown a high success rate, with 100% of restorations retained and over 96% of recalled restorations rated alfa (Ryge criteria meaning clinically excellent) for anatomic form.[4]

Table 1 Records of clinical success with Cercon zirconia from a private practice (January 2000 to September 2005)

Total cemented restorations prepared with Cercon zirconia	648
Mean time of service	30.5 months
Framework fractures	2 (0.3%)
Secondary caries	3 (0.5%)
Porcelain chipping	7 (1.1%)
Polishable porcelain wear	10 (1.5%)
Total problems	22 (3.2%)

Data from practice of Dr. Sven Rinke, senior lecturer in prosthodontics and dental materials, University of Goettingen, Goettingen, Germany.

To ensure similar success, clinicians should receive training in case selection, tooth preparation, handling of the material and requirements for follow-up care. Attention to clinical detail and close communication with trained laboratory staff are essential. Some critical clinical issues are addressed next.

Design of the Preparation

Although the tooth preparation for all-ceramic restorations is very similar to that for PFM preparations, adherence to the following measures can significantly improve outcomes.

The requirements for axial, occlusal and incisal reduction for PFMs and high-strength, all-ceramic restorations are the same. However, the preferred cervical finish line for all-ceramic crowns is a heavy chamfer (0.8–1.0 mm). PFMs with cast margins can be fitted to less-defined finish lines. Teeth being prepared to receive all-ceramic restorations should have rounded (> 0.4 mm radius) axial, occlusal and incisal line angles with a minimum axial convergence of 6° to 8°. Well-defined, rounded margins and exaggerated axial convergence facilitate optical scanning of the die or coping pattern, which is a requirement of most yttria-stabilized zirconia systems.

Coping and Framework Design

A coping thickness of 0.3 mm is required, and the framework connector dimensions for all-ceramic fixed partial dentures should be at least 9 mm^2. A try-in before the application of veneering porcelain allows the operator to measure dimensions and observe interocclusal space for veneering porcelain (**Fig. 1**). The thickness of the veneering porcelain should be at least 0.5 mm but should never exceed 2 mm. It is essential that the zirconia framework support the veneering porcelain, especially in high-stress areas (**Fig. 1**).

The maximum span of Cercon frameworks, 47 mm, is limited only by the dimension of the manufacturer's largest milling block. Inter-abutment spans are restricted to 2 pontics because of strength limitations. It is prudent to increase the connector dimensions between posterior abutments to 12 mm^2 if the patient demonstrates tooth wear patterns consistent with parafunctional habits. The connector dimensions of the framework should always be described in the laboratory work authorization; increasing the cross-sectional area in most distal connectors provides a safety feature against fracture. As with all completed dental restorations, construction of an occlusal guard is recommended if clenching or bruxing habits are evident.

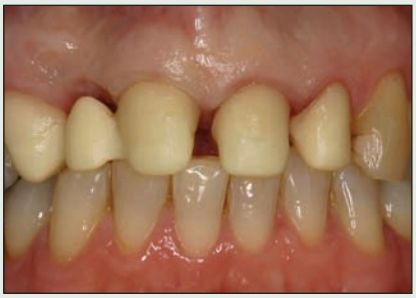

Figure 1: This Cercon framework for fixed partial denture and crowns has good connector dimensions and rounded line angles with optimal thickness for the veneering porcelain.

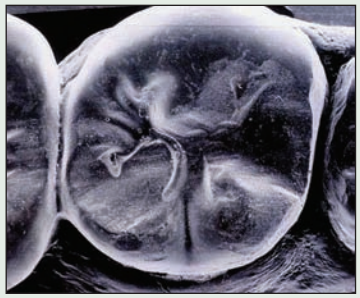

Figure 2: Occlusal precementation grinding is evident distolingually. Polishing of the roughened surface might have prevented chipping at 1 year (see **Fig. 3**).

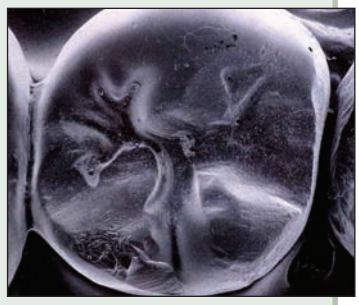

Figure 3: Edge chipping evident at 1 year is probably related to grinding adjustment.

Precementation Adjustments

Gentle grinding adjustments to zirconia, made with fine diamonds (20–40 µm) and water spray at 300,000 rpm, have no adverse effect on biaxial flexural strength.[5] The porcelains used to veneer zirconia are characteristically low in leucite or have no leucite at all. The surface of veneering porcelains is clinically acceptable if adjusted with medium, fine and extra-fine sandpaper disks (Sof-lex, 3M, St. Paul, Minn.) or fine (< 15 µm) diamonds, followed by polishing with diamond paste. Similarly, a sequence of diamond ceramic polishers (Dialite, Brasseler USA, Savannah, Ga.) produces clinically acceptable surfaces.[6] Machined, polished surfaces approach the smoothness of glazed surfaces, but machining cannot equal glazing. Grinding adjustments that leave a roughened surface predispose the surface to chipping later in the life of the restoration. (**Figs. 2** and **3**).

Visual Inspection of the Finished Restoration

Before cementation, clinicians are advised to visually inspect the restoration with low-incident fibreoptic transillumination. Cracks and flaws beneath the surface will redirect the light, which results in a dark shadow. As originally suggested by Anusavice and others,[7] transillumination is a simple, expeditious quality assurance measure. It is important that the visual inspection under fibreoptic light encompass 360° with slow rotation.

Conclusions

Patients wishing to avoid metallic dental restorations are drawn to zirconia for its biocompatibility. It is important for clinicians to understand the differences among today's zirconia materials. Not all crowns and fixed partial dentures described as being made of "zirconia" are in fact made of yttria-stabilized zirconia. Already it is becoming difficult for patients and dentists to identify which zirconia products offer superior strength and behavioural properties, and the compositional variations of zirconia restorative products will continue to expand. Yttria-stabilized zirconia copings and frameworks represent the highest-strength ceramic available today.

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