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. Readers are encouraged to do more reading on the topics covered. If you would like to contribute to this section, contact editor-in-chief Dr. John O'Keefe at jokeefe@cda-adc.ca.

QUESTION 1

How can dental erosion be prevented?

Background to the Problem

The cause of tooth wear is generally a combination of acid erosion, abrasion and attrition, but the interaction among these processes is complex and not fully understood. Although the impact of attrition and abrasion has been recognized for many years, the role of acid erosion is only now becoming more fully understood. Changes to the enamel surface can be difficult to diagnose, so the first signs of tooth wear may not be immediately recognizable (**Fig. 1**). The cusp tips of molars and premolars may become flattened, along with the facial surfaces of the upper incisors. If the erosion is allowed to progress, the enamel eventually wears away and small areas of dentin become exposed. This exposure is much easier for dentists to recognize, but it also means that considerable amounts of tooth have already been lost. Early diagnosis, which should help to prevent the lesion from progressing into the dentin, is therefore the ideal.

Management of the Problem

Dentin sensitivity may indicate that acid erosion is underway. Most patients with dentin sensitivity have clean teeth, and it is believed that the interaction between acidic diets and toothbrushing causes the sensitivity.[1] The first intervention should be a detailed dietary history, ideally including a weekend, as most people's diets differ between weekdays and weekends. It is also worthwhile to determine if the patient snacks and which foods are eaten between mealtimes. Recently, one of my patients reported avoiding acidic foods and drinks, but admitted to snacking (**Fig. 2**) as follow-up to treatment of an eating disorder. The dietician had advised eating small amounts of food frequently, and the chosen snack was apples, which the patient ate continually throughout the day. The patient assumed that because apples are "healthy," the teeth would not be at risk of damage, but this dietary habit had caused severe erosion. The patient also admitted having a

Figure 1: Dentin exposure indicating early erosive wear is just visible in this image. The small dentin lesion present on the palatal cusp of the upper first molar is an early sign of acid erosion. Dietary advice, with emphasis on avoiding frequent consumption of acid foods, is important to prevent further tooth wear.

Figure 2: Severe erosive tooth wear can be seen on the palatal surfaces of the upper incisors of a patient who ate several apples every day and who also had a bruxing habit.

Figure 3: The erosion on the facial surface of the upper incisors was caused by the patient's habit of holding sections of oranges against the teeth.

bruxing habit; the combination of acid erosion and attrition caused the tooth wear. It is also worthwhile to remember that patients may change their dietary habits; the clinical picture may therefore be historical rather than active. Yet another important factor in assessing dietary history is *how* acidic foods are consumed. We know from recent research that it is the frequency of exposure to acid that is important in the progression of erosion.[2] Repeated consumption of acidic foods or holding or swilling them in the palatal vault prolongs the acid attack, which increases the potential for erosion (**Fig. 3**). Therefore, it is important to discuss with patients not only what foods and beverages they consume, but also how they consume these items. The same principle applies if the source of acid is regurgitated gastric juice. Occasional regurgitation is not recommended but is unlikely to cause any significant problems. However, repeated and prolonged regurgitation can lead to severe destruction of the teeth.

Another important factor is the timing of toothbrushing. If toothbrushing is undertaken shortly after consumption of acids, the potential damage to teeth is much greater than if there is a slight delay, ideally at least 30 minutes.[3] Conversely, brushing teeth before meals, for example before breakfast, may be more protective than doing so afterward.

There is some evidence that fluoride can prevent erosion and abrasion.[3] Fluoride may harden the enamel or dentin surface, making it more resistant to acid attack. Therefore, nonabrasive toothpastes containing fluoride are preferred. However, caution is needed in the use of fluoride varnishes to prevent attrition.[4] A recent laboratory study showed that attrition increased after use of a fluoride varnish, possibly because of the relatively low pH of the material.

The question remains of what measures are needed once damage has occurred. Ideally, a person's teeth should last a lifetime, but restorative interventions have been shown to considerably reduce the life expectancy of teeth. Simply placing a filling may make the dentist feel better but is not always appropriate for the long-term prognosis of the tooth. More important, particularly in the case of many early lesions, there may be insufficient space to place a restoration. Periodic follow-up of the lesion using study casts or photographs will allow monitoring of the tooth wear and help assess if advice regarding acid intake has been successful. In certain situations, restorations will be indicated, but in many cases a preventive approach is more appropriate. If a desensitizing toothpaste is ineffective, applying a resin-based adhesive to the sensitive areas can help to limit the patient's discomfort. Recent research has also shown that frequent application (about every 3 months) of a dentin bonding agent to an erosive lesion can help to prevent further wear.[5]

Most patients want to keep their teeth for life, and they want their teeth to look good. Early diagnosis and prevention of the effects of acid erosion, abrasion and attrition are fundamental to achieving these goals.

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QUESTION 2

What should I do for an adolescent patient who is in the mixed dentition stage and who has an impacted maxillary canine?

Background

Other than the mandibular third molars, the maxillary canine is the tooth that most commonly becomes impacted, with a frequency of 0.8% to 2.8%; impaction of this tooth is 2 times more common in females than in males.[1,2] The impaction occurs palatal to the arch in 85% of cases and buccal to the arch in 15%.[1,2] Of all the maxillary teeth with a primary precursor, the maxillary canine is the last to erupt, and it has the longest and most varied path of eruption. This may be a reason for the high frequency of impaction. Other factors include delayed exfoliation of the primary canine, crowding, presence of pathology, ankylosis, abnormal position of the tooth bud, odontomes or supernumerary teeth, trauma, alveolar clefts and primary failure of eruption. A genetic trend has also been suggested.

Diagnosis

Evaluation of an impacted maxillary canine involves visual examination, palpation and radiographic examination. The position of the lateral incisor may be important: if the canine is labial to the lateral root, the lateral incisor may be proclined (**Fig. 1**). Annual inspection and palpation are recommended after 8 years of age. An impacted canine can often be palpated on the buccal surface, and if the canine cannot be palpated on the buccal surface by 10 or 11 years of age, the clinician should suspect impaction. In patients older than 10 years, radiography is indicated if the canines have not erupted and cannot be palpated. Two periapical images are obtained using the principle of horizontal and vertical parallax to determine if the canine is positioned buccal or palatal to the lateral root. If 3-dimensional cone-beam computed tomography is employed, the exact position of the canine can be identified, along with the amount of crowding and the degree of resorption of the incisors.

Management

A comprehensive assessment of the impacted canine must be undertaken to determine the exact 3-dimensional position, whether resorption of the lateral incisor has occurred and the prospects for alignment (**Fig. 2**). Important factors that affect prognosis include the patient's capacity for cooperation, age, oral and systemic health, skeletal relationship, and spacing or crowding in the arch. Treatment options include interceptive treatment, surgical exposure and orthodontic traction.

Interceptive Treatment

Interceptive treatment, which involves extraction of the primary canine, is appropriate when radiography shows that the permanent maxillary canine is inclined mesially and overlaps the permanent lateral incisor root without causing root resorption. This treatment facilitates eruption of the permanent canine and prevents its impaction. A greater degree of overlap decreases the chance for eruption. Ericson and Kurol[3] found that if the permanent maxillary canine overlaps less than half the lateral root and the primary canine is extracted, there is a 91% chance of the permanent tooth erupting into a normal position; this declines to 64% if the permanent canine overlaps more than half of the lateral root.

Surgical Exposure

If root resorption of the lateral incisor is evident, the primary canine should be extracted and the permanent canine may need to be surgically exposed. Occasionally, an impacted canine will

Figure 1: The maxillary lateral incisor is proclined because the impacted canine is positioned labial to the root.

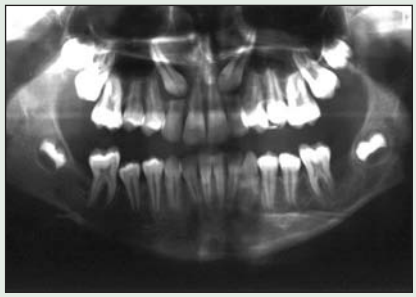

Figure 2: Eruption of the maxillary canines causes resorption of maxillary lateral incisors.

move into the arch on its own after surgical exposure or surgical creation of a path for eruption. This "open technique" is commonly performed if the canine has the correct axial inclination and does not need to be uprighted. Teeth with buccal impaction tend to erupt on their own, whereas those with palatal impaction tend to require guidance. Such guidance is achieved by orthodontic traction involving bonding of a bracket or button at the time of surgery and attachment of a gold chain, eyelet wire or elastic chain ("closed technique"), with the application of light orthodontic forces.

The prognosis after surgical exposure depends on the extent of displacement of the canine and how far it needs to move. Other factors include surgical trauma, the patient's age, the amount of spacing or crowding present, whether the tooth is ankylosed or has a dilacerated root, and the vertical, anteroposterior and transverse position of the canine and its root. During surgery, flaps should be reflected (by creation of a mucoperiosteal flap) to pull the canine through keratinized tissue. This is best accomplished in an interdisciplinary setting with the assistance of a periodontist.

No Treatment

Potential complications associated with simply observing (rather than treating) impacted maxillary canines include resorption of adjacent teeth (expected in 12.5% of cases of lateral incisors adjacent to impacted canines), ankylosis and development of a follicular cyst or odontogenic tumour, although the latter is rare.[1,2]

If an impacted canine is not diagnosed early, impaction and/or ankylosis of the permanent canine may occur, and complex orthodontic treatment may be needed.

Surgical Removal

If the maxillary canine has a horizontal or oblique position, surgical removal is often indicated, since it would be too difficult to treat the problem orthodontically. Other indications for surgical removal include poor patient cooperation. Replacement of the canine with the first premolar is adequate and may involve reduction of the palatal cusp. Other options include prosthodontic replacement.

Conclusion

Comprehensive interdisciplinary treatment of impacted canines can be complicated. Orthodontic eruption of impacted canines into the arch can take many months, and it may take even longer to attain correct torque and inclination once the tooth is in the arch; in this situation, the teamwork of a group of experienced specialists will be required.

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QUESTION 3

How should I treat a lateral root perforation in a tooth with a post-and-crown restoration?

Background

Perforations are undesirable incidents that may occur during any stage of endodontic treatment or during preparation of the post space. Some of these defects are caused by resorptive processes or caries, but most are due to iatrogenic causes. A perforation can have a significant impact on the long-term prognosis for the tooth, and it may be necessary to extract a tooth that has been perforated. Root perforations result in endodontic failures, accounting for approximately 10% of all such failures.[1] Perforations must be sealed to prevent the egress of noxious elements from within the tooth, which might further irritate associated periodontal tissues.[2] Surgical intervention is needed when intracanal procedures fail or are contraindicated (e.g., because of a long, wide post).

The sealing material employed has a strong influence on the prognosis. The criteria for an ideal repair material include sealability, biocompatibility, insolubility and ability to induce osteogenesis and cementogenesis. Many materials have been used to repair perforations, including amalgam, Cavit temporary endodontic sealer (ESPE America, Norristown, Penn.), Super-EBA cement (HI Bosworth Co., Skokie, Ill.), glass ionomer cements, calcium-hydroxide-based endodontic sealers, and Pro Root mineral trioxide aggregate (MTA; Dentsply-Tulsa Dental, Tulsa, Okla.),[3] but none fulfills all of the criteria listed above, and their success rates have been variable. Currently, MTA is considered the best material for sealing lateral perforations because it has many of the ideal properties of a perforation-sealing material such as sealing ability, biocompatibility and ability to set in the presence of moisture. One characteristic that differentiates MTA from other materials is its ability to promote regeneration of cementum, which facilitates regeneration of the periodontal apparatus.[1,4]

Additional studies are needed to better characterize the behaviour of this material in contaminated and noncontaminated perforations, and clinical procedures to control the level of the filling must be investigated.

Procedure

If the intracanal approach to perforation repair fails or is contraindicated, or if the tooth has a lateral perforation in the presence of a post-and-crown restoration, surgery is generally the best option (**Fig. 1**). After presurgical rinsing with chlorhexidine and administration of local anesthesia, a flap must be elevated to expose the root and the perforation. After exploration of the perforation area, a cavity must be prepared to adapt and retain the sealing material. This is usually accomplished with ultrasonic instrumentation (**Fig. 2**). Vigorous irrigation with saline is required during this procedure.

As noted above, MTA seems to be the best option for sealing a perforation. The surgical site must be copiously irrigated with saline, and the perforation site must be well isolated. After the MTA is mixed, it should be applied immediately to the perforation site (**Fig. 3**).

During the follow-up appointment 1 week later, sutures are removed and soft-tissue healing is evaluated. Additional follow-up evaluations of

Figure 1: Radiograph of the maxillary right lateral incisor, showing bone loss associated with lateral perforation and extravasated material. The patient had discomfort and a sinus tract. Surgery was the best option because of the post-and-crown restoration and because intracanal procedures had failed.

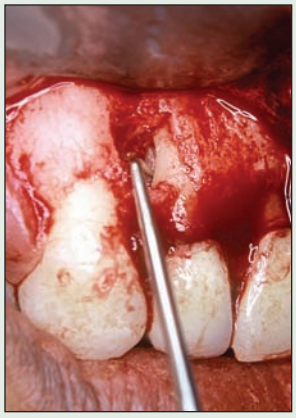

Figure 2: Preparation of the cavity with ultrasonic tips.

Figure 3: Sealing the perforation with mineral trioxide aggregate.

Figure 4: Radiograph obtained after the surgery. Note that in this case, the repair material was placed inside the tooth.

Figure 5: Follow-up radiograph obtained 12 months after the surgery, showing repair of the perforation and healing of the bone. The patient's symptoms had resolved, and periodontal probing depth was less than 3 mm.

periodontal health, periradicular healing and symptoms should be done at 3, 6 and 12 months (**Figs. 4** and **5**).

The prognosis after treatment of lateral perforation is unpredictable and may vary with the site of the defect, length of the root, access to the perforation, size of the perforation, area of contamination, presence or absence of periodontal communication, time after perforation and treatment, and the sealing and biological properties of the material used. The clinician should assess each case individually and try to seal the cavity either by an intracanal approach or a surgical approach, attempting to keep the tooth rather than extracting it.

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QUESTION 4

How can I prevent getting blocked out of a canal during root canal instrumentation?

Introduction

Regardless of the instrumentation technique used, successful outcomes in endodontic treatment require that canals be negotiated, enlarged and disinfected to the apical foramen. Before nickel-titanium rotary instruments can be used in the apical third of the root canal system, a smooth canal pathway must be created that can be negotiated to full working length. For small and calcified canals, this is typically accomplished with size 08, 10 and 15 hand files.

Step-by-Step Procedure

Once the canal orifice is identified, a precurved size 10 stainless steel file is gently twisted back and forth while it is advanced slowly and with light pressure to the apical third of the root canal. An irrigant such as sodium hypochlorite should be used during this instrumentation.

When the file reaches the apical third region, it can be operated in short amplitude movements in and out of the canal rather than in back-and-forth (stem-winding) movements. This is especially important in tight, calcified canals when the file is slowly advancing apically, because the strength of a stainless steel hand file operated in a push–pull motion is greater than the torsional strain that is exerted when winding a file back and forth.

A lubricant such as an ethylenediaminetetraacetic acid (EDTA) preparation may be chosen at this point to replace the sodium hypochlorite irrigant. The size 10 file can be moved in a filing motion 20, 30 or even 40 times to create a smooth canal pathway, then replaced with a precurved size 15 file. Once the size 15 file reaches the apical third region, it can be moved in a back-and-forth filing motion to create a smooth pathway from the canal orifice to the apical region, in a manner similar to the size 10 file.

At this stage, it is advantageous to perform coronal flaring of the coronal and middle thirds of the root canal system. This is typically done using some form of crown-down technique, beginning with larger instruments at the coronal end of the root canal and changing to progressively smaller diameter instruments to advance further apically. Coronal flaring of the root canal system allows for deeper penetration of canal irrigants and lubricants, and provides a better tactile sense of hand instrumentation in the apical third.

Common Problems Encountered during Instrumentation

In canals that are quite calcified, it may be necessary to switch to a precurved stainless steel size 08 file to penetrate to the apical third of the canal system. The same back-and-forth motion should be used. In such instances, it is wise to switch to 21-mm length files, which are stiffer and less likely to bend. Once the size 08, 10 and 15 files have penetrated to their limit, 25 mm (or 31 mm) hand files can be used. Coronal flaring can then be done as described above. Once working length has been determined, it is important to record this measurement.

If it becomes impossible to keep advancing apically with either the size 08 or 10 file, the file should be slowly withdrawn from the canal. It is important to note the direction in which the canal is curved by observing the curve of the withdrawn file in relation to the direction of the instrument stop. A new precurved file can then be introduced into the root canal, with the curve of the file oriented in the same direction as the instrument stop. With light apical pressure, the hand instrument is then slightly rotated back and forth in the same direction as the previous file. The operator should feel for an instrument "stick." Once the "stick" is felt, the hand file can be advanced further apically. As the new file advances, it is important to file the canal over a small amplitude to create a smooth pathway for the next larger hand file. If no further "stick" is detected and the use of a small file does not result in negotiation of the root canal, then referral to an endodontist for consultation and management would be indicated, especially in cases that are symptomatic or exhibiting signs of periradicular pathosis.

A common mistake is to rush through the small file sizes before creating an adequately smooth pathway for each instrument. This can lead to canal blockage with debris or dentinal mud or, even worse, ledge formation. To bypass ledges, small stainless steel instruments must be precurved to a slightly greater degee than the size of the canal curvature. Delicate back-and-forth (stem-winding) motion of the file down the canal near the ledge is

the best way to instrument beyond the blockage. Once the ledge is bypassed, the instrument can be used to file the canal over a short amplitude; the operator should be careful not to move the tip of the file above the ledge when filing in this manner. When moving up to the next file size, it may be difficult to withdraw the file past the ledge. Under such circumstances, it is important not to force the instrument, which will only make the ledge worse. If the irregularity in the canal still exists, it should be treated with smaller instruments for longer periods of time, all the while keeping the tip of the file apical to the defect.

How to prevent getting blocked out of a canal

- Use precurved size 08, 10 and 15 stainless steel instruments.
- Lubricate when instrumenting canals.
- Use a back-and-forth motion with light apical pressure.
- A push–pull motion for filing the canal causes less stress on a stainless steel instrument than a back-and-forth motion.
- Stiffer 21-mm instruments should be used in calcified canals.
- Use smaller instruments for a longer time. Don't rush through progressively larger instruments.
- After bypassing a canal irregularity, keep the tip of the file apical to the irregularity while instrumenting over a short amplitude.

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