

The Surgical Operating Microscope in Restorative Dentistry: Treatment of Second Molar Distal Caries Around Mesially Impacted Wisdom Teeth

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Abstract

A challenging problem of restorative dentistry is the diagnosis and treatment of distal surface caries on a second mandibular molar, resulting from chronic food impaction between the second molar and a mesio-angular impacted mandibular third molar located distal to the second molar. Decay removal is difficult due to compromised access, visibility and lighting. Placing a matrix band around the second molar class II preparation may be difficult since the proximal box may be located on undercut, sub-gingival or concave root structure. Due to access, lighting and visibility challenges, it is suggested that dentists use a surgical operating microscope, or binocular surgical telescopic loupes of 6-8x magnification or greater, combined with co-axial illumination, when treating these lesions, instead of using unaided vision and overhead lighting. As part of the treatment plan, the dentist should decide whether or not to extract the third molar, based on the potential future use of the third molar as a fixed or removable partial denture abutment, the potential food impaction, caries and periodontal risks of retaining the third molar, the prognosis of the second molar given the size of the distal decay, and the difficulties of restoring the second molar due to the presence of the third molar.

Keywords: third molar, caries, amalgam, distal surface, second molar, class II, matrix, impacted

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INTRODUCTION

The contact area between a mesially inclined mandibular third molar and the second molar mesial to it may have various morphological features that facilitate trapping of food and plaque at the contact area and correlate with an increased chance of caries development on the second molar distal surface. Such features include: if the mesial angulation of the third molar is over 30 degrees relative to the occlusal plane, resulting from mesio-angular or horizontal impaction;¹⁻⁵ or if the third molar contact area is at or below the cemento-enamel junction (CEJ) of the distal surface of the second molar.^{1,4,6}

A deep mesial inclination of the third molar may result in formation of a crevice between the two molars. This crevice consists of the distal surface of the second molar and the mesial surface (or, for horizontal impactions, the occlusal surface) of the third molar (**Fig. 1**). Located at the base of this crevice is the contact area between the two molars. This contact area may be undercut relative to the distal marginal ridge of the second molar, the height of contour of the distal surface of the second molar clinical crown, and/or the CEJ of the second molar (**Fig. 2**). Since tooth brush bristles may not effectively clean the undercut area, food and plaque may stagnate at the base of this crevice for long



Fig. 1: Four examples of second molar caries associated with mesially inclined third molars, some of which are advanced enough to require endodontic treatment of the second molar.

intervals of time before they are cleansed away.^{7,8} If episodes of prolonged stagnation of cariogenic foods occur frequently enough, second molar distal caries may form. Deep fissures on the occlusal surface of the third molar also trap food and plaque near the second molar distal surface and may also increase the risk of formation of second molar distal caries.

When distal second molar caries are incipient, the dentist could decide to have the third molar extracted, and use preventative measures such as routine fluoride mouth rinsing to facilitate the remineralization of the incipient distal second molar lesion, without treating and restoring the lesion. However, if the patient intends to keep the third molar, the dentist could decide to treat the incipient lesion, the rationale being that a small increase in lesion size can lead to a proportionately greater increase in the complexity of removing caries and restoring the tooth. The more the carious lesion expands apically along the root surface, the more difficult it is for a dentist to make a class II preparation with a proximal box floor that is wide enough to put the amalgam under compressive forces, but narrow enough so as not to encroach upon the pulp. In addition, with larger lesions, the apical extent of the carious lesion may be on a root structure that is concave, sub-gingival or



Fig. 2: Example of a mesio-angular third molar with food-retentive occlusal surface fissures, that can trap food and induce caries formation on the distal surface of the neighboring second molar.

undercut, such as to hinder placement of a matrix band that seals the floor of the preparation proximal box (**Fig. 1**).

Second molar distal caries secondary to mesio-angular impacted third molars tend to be diagnosed in patients who are relatively older, in their early thirties.^{2,4,9} Therefore, some authors view mesio-angular third molars in young patients as a long-term risk factor for inducing second molars caries, and hence recommend their prophylactic removal even if the second molar distal surface has not yet developed caries.^{1,3-5}

LONG-TERM TREATMENT PLANNING CONSIDERATIONS

If the mandibular third molar is asymptomatic and its long axis is relatively upright relative to the occlusal plane, it may be useful as a future removable or fixed partial denture abutment. The need to retain the third molar as a potential abutment is greater if the first molar in the same quadrant is missing or if the prognosis of the second molar is questionable due to extensive carious damage to the distal root. Here, endodontic treatment of the second molar may be required, and the dentist should assess if the endodontically treated and crowned tooth would be bio-mechanically stable given the compromise

of the distal root structure.

If the long axis of the third molar has a steep mesial inclination relative to the occlusal plane, it is more likely to serve as a food and plaque trap that facilitates caries development on the second molar,² and is less useful as an RPD or fixed bridge abutment. This favors extracting it.

Also, if the dentist determines that the third molar should ideally be extracted, but the patient may delay doing so for months or years, the dentist may decide to fill the occlusal surface of the third molar. Removing third molar occlusal decay stabilizes the third molar from further breakdown. Replacing the third molar occlusal fissures with a smoother surface restoration may prevent food or plaque from adhering to the third molar occlusal surface in proximity to the distal second molar surface.

REMOVING CARIES AND MAKING THE CLASS II PREPARATION

In removing decay from the second molar, the dentist may need to leave a small amount of decay in the axial wall of the proximal box so as to avoid an exposure, and instead to try to remove all decay from the margins of the class II preparation and to seal in the axial wall decay, hoping that the decay will become inactive indefinitely. Alternately, the dentist may attempt to use a two-stage caries management approach for such deep lesions.¹⁰⁻¹⁵

If the floor of the proximal box rests on radicular structure, it may be difficult to prepare a wide enough gingival floor for the proximal box because this risks an exposure. The use of slow-speed round burs with a range of smaller diameters (Nos. 2-5) allow for conservative caries removal without excessive drilling penetration into the proximal box axial wall. A thin high-speed 330 bur (which has a shorter cutting length compared to a 56 bur), also helps in creating conservative preparations that do not overly cut into the thin distal radicular structure of the second molar (Fig.3).

MATRIXING AND RESTORING THE PREPARATION

If the floor of the second molar proximal box is undercut relative to the mesial surface of the third molar, the mesial surface of the third molar may push too far mesially into the distal aspect of the subsequently placed matrix band. Hence, the mesial surface of the third molar may have to be slightly reduced, using a long, thin, fine diamond bur, but not reduced so much that a matrix band cannot touch the mesial aspect of the third molar.

Also, the distal aspects of the buccal and lingual walls of the second molar proximal box may have to be reduced if those distal aspects push the occlusal aspect of the matrix band too far distally such as to prevent the gingival aspect of the matrix band from sealing the gingival floor of the proximal box.

Ideally, the floor of the proximal box should be slightly apical to the contact area between the two molars, such that in the resulting restoration, food that traps at the base of the crevice between the two molars will contact amalgam surface and not caries-prone tooth surface.

Since the proximal box may be unusually long or sub-gingival, a sub-gingival matrix band may be needed. Scissors are used to remove one of the two bumps on the sub-gingival matrix band, since the second bump may impinge on the gingiva at the mesial of the second molar, such as to prevent full seating of the band at the distal (Fig. 4). A thin (0.001 inch) matrix band helps to ensure a tight contact between the two molars, particularly if wedging the matrix band may be impossible. The dentist should have multiple sizes of wedges available to accommodate different distances between the floor of the second molar proximal box and the mesial aspect of the third molar.

Sometimes, the Tofflemire retainer cannot be used because it will be displaced by the buccinator muscle due to the minimal width in the posterior aspect of the buccal vestibule. Instead, the matrix band, without the retainer, is placed and wedged.

If the proximal box is too long for the sub-

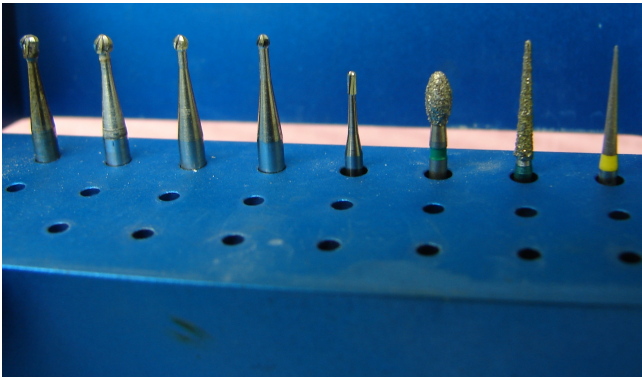


Fig. 3: An array of burs used for treatment of second molar caries, such as a range slow-speed round burs, a thin 330 bur for conservative preparations, a football diamond to level marginal ridges and protruding cusps on opposing teeth, and thin diamonds to trim the distal surfaces of proximal boxes.

gingival matrix band to reach the floor of the box, then the wedge cannot seal the band to the proximal box but instead only the wood of the wedge seals the proximal box, and the matrix band is located occlusal to the wedge. Here, the wedge functions to prevent gross excess of amalgam flowing past the floor of the proximal box during condensation and to help shape the inter-proximal aspect of the resultant class II restoration.

Sometimes, however, wedging the matrix band is not possible, and the dentist must fill the matrix preparation without a wedge. A cotton roll is placed in the buccal vestibule to help stabilize the band. The dentist also uses light finger pressure to brace the matrix band while condensing the amalgam. In the first minute after mixing amalgam, the amalgam is in a semi-liquid state, such that the dentist can condense it into the proximal box using light condensing forces, without distorting the weakly stabilized matrix band or pushing the amalgam beyond the floor of the proximal box. Some excess amalgam may flow buccally and lingually outside the proximal box but, after removing the band, this amalgam can be spatulated flush with the proximal box margins using a plastic instrument.

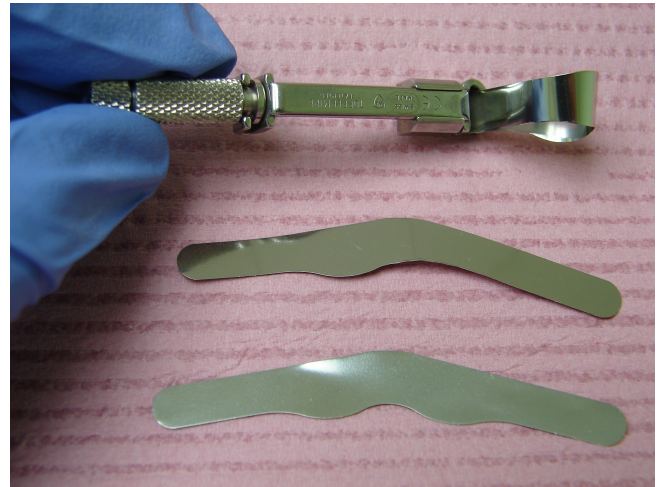


Fig. 4: Example of preparing a sub-gingival matrix band for use on a second molar class II preparation with sub-gingival proximal box.

FINISHING AND SHAPING THE RESTORATION

Fast condensation and quick removal of the matrix band allows the dentist to adjust the amalgam while it is still in a semi-liquid state. The dentist then uses a slightly moist cotton roll to wipe away excess occlusal amalgam and smooth the restoration. If possible, the mesial marginal ridge of the third molar should be made level with the distal marginal ridge of the second molar, to facilitate easier cleansing of the area of food.

In its earliest setting stages, the amalgam is weak enough such that, using high magnification and head-mounted lighting, the dentist can use an explorer tip to trim the amalgam flush with the distal surface of the second molar. The dentist positions the explorer tip at the mid-inter-proximal such that the tip is flush against the hard distal tooth surface, then moves the tip along the distal surface until all marginal flash has been trimmed away, both on the buccal and the lingual aspects of the distal surface.

HIGH MAGNIFICATION AND CO-AXIAL ILLUMINATION WHEN TREATING DISTAL SECOND MOLAR CARIES

The author suggests use of high magnification (6-8x or greater) combined with head-mounted co-axial illumination when diagnosing and removing decay from the second molar and making the class II preparation.¹² Use of high magnification (6-8x or greater) with head-mounted illumination aids in direct visual examination of the contact area between the two molars for signs of subtle carious discoloration or subtle cavitation that may not be visible radiographically, due to overlap between the radiopaque mesial aspect of the third molar and the lesion on the second molar.

It is difficult to see all of the carious lesion using unaided vision due to limited penetration of overhead lighting to and limited inter-arch space in the area. High magnification helps the dentist to distinguish visually between the color and texture of carious versus healthy tooth structure. If the dentist leaves some decay overlying the axial wall to prevent an exposure, high magnification facilitates verifying that there is no decay left along the margins of the class II preparation. When using tactile probing with an explorer to verify that there is no remaining soft caries material left, high magnification allows the dentist to see all aspects of the preparation surface to ensure that no part of it is un-probed.

A magnified view of the tooth allows for better comprehension of the anatomical dimensions of the molar crowns and roots. This improves the dentist's ability to determine where the long axes of the two molars are located, and aids in visualizing the location of the unseen pulp chamber of the second molar.

High magnification improves the ability to see the interface between the floor of the second molar proximal box and the mesial surface of the third molar, or between the second molar proximal box boundaries and the corrugated occlusal surface of the third molar (if the third molar has a deep mesial inclination such that its occlusal surface faces the distal surface of the second molar). This facilitates verifying that contact has been broken between the second

molar proximal box and the third molar.

In general, high magnification improves a dentist's ability to determine: if there is enough convergence of the buccal and lingual walls of the proximal box to allow for retention; that the floor of the proximal box is not divoted or thinned out; that the opposing maxillary tooth does not occlude into the occlusal-proximal aspect of the second molar proximal box, such as to create excess shear forces at the isthmus between the occlusal and proximal box aspect of the subsequently placed class II restoration; that all aspects of the class II preparation are thick enough (about 1.5-2 mm.) such that the resulting amalgam can withstand occlusal forces; and to detect morphological features of the proximal box that obstruct matrixing the preparation and sealing the gingival floor of the proximal box.

With magnification, it is easier to move a bur parallel to the axial wall when preparing the floor of the proximal box, and to prevent the bur from moving too far apically (which may create divots in the proximal box floor) or too far axially (which could impinge on the pulp).

High magnification (6-8x) and head-mounted illumination facilitate visualizing the contour of the unseen, sub-gingival aspect of the second molar proximal box, so that the explorer tip can more precisely be moved along this contour to remove amalgam overhang at the margin.

With high magnification, the dentist can also directly see where the opposing maxillary tooth is occluding into the proximal box amalgam when adjusting occlusion. Use of articulating paper may not always be practical because the amount of force needed to mark pre-maturities may fracture the setting amalgam, in those areas where it is under shear forces.

CONCLUSION

This article described diagnosis and treatment of caries on the distal surface of a second mandibular molar, resulting from chronic food impaction at the mesial aspect of a mesially inclined third molar distal to the second molar.

However, these concepts apply not only to mandibular second and third molars, but to any situation where there is a mesio-angular molar causing caries on the distal surface of a molar located mesial to it.

If the second molar caries deeply penetrates or structurally undermines the distal root or the furcation, the prognosis of the second molar may be questionable, and its extraction may be needed.^{5,2} Here, the dentist should avoid extracting the third molar unless it is symptomatic or is not useful as a potential fixed or removable partial denture abutment. Removal of a potentially useful third molar could result in the patient eventually having no second and third molars in that quadrant, should the second molar eventually be lost due to the intrinsic difficulties of restoring it. Of course, if the patient has already lost the first molar in that quadrant prior to treatment of the second and third molars, the patient risks eventually losing all molar teeth in that quadrant. The dentist must carefully plan and implement the treatment to prevent this outcome.

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