External Root Resorption and Caries of Mandibular Second Molar in Association with Third Molar Impaction Status

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External Root Resorption and Caries of Mandibular Second Molar in Association with Third Molar Impaction Status

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ABSTRACT

Impaction status of a mandibular third molar (M3) leads to some pathological conditions. Objective: This retrospective study was conducted to compare the effect of erupted (e-M3) and impacted mandibular third molars (i-M3) on caries in the adjacent second molar and external root resorption (ERR). Methods: We used cone beam computed tomography (CBCT) images of 200 patients with a mean age of 28.19 ± 8.3 years who had an e-M3 on one side of the mandible and an i-M3 on the other side of the mandible. All the images were evaluated for the existence of caries and ERR. Results: Caries was detected in 32.5% of cases of i-M3 and in 21% of cases of e-M3 (p = 0.01). ERR was present in 18.5% of cases of i-M3 and no resorption was observed in cases of e-M3 (p = 0.00). Conclusions: Caries and ERR in cases of i-M3 can be reliably identified via CBCT scan. Among patients with caries in the i-M3 group, the degree of caries was significantly lower on the other side of the mandible. Instead of prophylactic removal of e-M3, periodic clinical and radiologic examinations are advised.

Key words: caries, CBCT, external root resorption, mandibular third molar

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INTRODUCTION

Of all tooth impactions, that of mandibular third molars (i-M3) is most common because of inadequate space in the mandible, distal eruption of dentition, vertical condylar growth, increased crown size, and other impediments.1,2 Impaction of a mandibular third molar (M3) leads to some pathological conditions, including pericoronitis, odontogenic cyst or tumors, bone loss, external root resorption (ERR), and caries of the adjacent mandibular second molar (M2).3 Among these disorders, ERR is an insidious condition that is believed to result from mechanical or inflammatory factors and is not promptly and readily diagnosed until dental pulpitis or periapical inflammation of the adjacent M2 occurs.4 Caries is one of the common pathological features associated with i-M3 and the adjacent tooth.4 This lesion is a hidden entity on the distal surface of M2, and may gradually develop into pulpitis and apical periodontitis for which endodontic treatment or extraction is ultimately required.5

Previous studies have involved two-dimensional radiographic techniques such as panoramic, periapical and bitewing imaging, which are not as precise as cone beam computed tomography (CBCT) in caries detection.6,7 Like all two-dimensional radiographs, when projected onto a two-dimensional plane dentomaxillofacial radiographs have the potential to be misinterpreted for reasons, such as image enlargement, distortion by projection errors, blurred images, and complex maxillofacial structures. CBCT images provide diagnostic information in the sagittal, axial, and coronal planes without overlap of structures.8 CBCT is now widely used because it has high resolution, the amount of radiation emitted is low, and interpretation of images does not vary greatly, which enhances the accuracy of the detection of caries and
ERR.\textsuperscript{5} In CBCT units, exposure parameters and field of view can be appropriately adjusted, according to the diagnostic requirements, to optimize the radiation dose and enhance image quality.\textsuperscript{5}

The influence of asymptomatic erupted mandibular third molars (e-M3s) on adjacent M2s to date remains largely unknown. An M2 adjacent to e-M3 is also vulnerable to various periodontal problems, especially gingival inflammation, increased periodontal pocket depth, and alveolar bone resorption.\textsuperscript{3} Some authors have suggested that the removal of an M3, whether impacted or not, improves the periodontal status of the adjacent M2, leads to less frequent local inflammatory periodontal disease, and positively affects overall periodontal health.\textsuperscript{9,10} Currently, there is no substantial evidence that the occurrence of adjacent M2 disorders such as caries and ERR is associated with e-M3.\textsuperscript{11}

The aim of this retrospective study was to compare the effect of erupted (e-M3) and impacted mandibular third molar (i-M3) on the adjacent M2s with regard to caries and ERR in conditions of identical microflora.

**METHODS**

The study protocol was carried out according to the principles described in the Declaration of Helsinki, including all amendments and revisions. The ethical approval was granted by the Ethical Committee of the Abant Izzet Baysal University, Bolu, Turkey (Institutional Review Board Number 2017/96).

This was a retrospective study of patients at the Department of Oral and Maxillofacial Radiology, Dentistry Faculty, the Abant Izzet Baysal University, who underwent surgical removal of M3s between 2014 and 2017.

The CBCT images of patients older than 23 years who had an e-M3 on one side of the mandible and i-M3 in the other side were included in the study because it generally takes 5 years for a molar tooth to erupt fully in the oral cavity. The upper age limit in this study was 35 years because the periodontal recession and root dentine exposure in patients older than 35 years may confound findings and add to the risk of caries already imposed by association with the neighboring wisdom tooth. Eruption of teeth was confirmed clinically through an oral examination. An e-M3 is defined as an M3 that has completely erupted, reaches the occlusal plane, and lacks rotation, with a 0- to 10-degree angle between its long axis and that of M2.\textsuperscript{3} CBCT images had to adequately display the relationship between the M2 and the adjacent M3. The exclusion criteria were as follows: involvement of M3 with cystic or tumorous lesions; extension of tumors or bone defects to the posterior aspect of the mandible; M2 with extensive carious lesions, crowns, or distal fillings, as well as M2 involved in root canal therapy; extraction or simultaneous impaction of M2; and low quality of CBCT image because of the presence of high-density materials or other reasons that preclude an unambiguous view of local anatomy and structures. The final sample comprised a total of 200 CBCT images from 88 male and 112 female patients, whose mean age was 28.19 ± 8.3 years (range, 23 to 35 years). General information about patients (age and gender) was obtained from the patients’ medical records.

All the images were randomly assigned for examination to two observers who were experienced in dentomaxillofacial radiology. These observers evaluated the images in the axial, coronal, and sagittal planes. To verify our methods of identifying caries and ERR by CBCT image analyzes, we statistically assessed the intraobserver agreement by checking the consistency of observations regarding the caries and ERR results in images from 20 randomly selected patients whose images were repeatedly examined by the same observer for 2 consecutive weeks. To evaluate the interobserver agreement as well, two of us (S.B. and S.K.) independently assessed the images for presence of caries and ERR. When ideas concerning the radiographic findings on CBCT images differed, we discussed them with another co-author (K.D.) and then obtained the final consensus. When a consensus could not be reached for one set of images, those images were excluded from the study.

Using Pell and Gregory’s classification,\textsuperscript{12} we assessed height of eruption in relation to the occlusal plane (class A, B, or C) and amount of tooth covered by the anterior border of the ramus (class I, II, or III). We assessed the angulation of the M3 according to Winter’s classification\textsuperscript{13}: vertical; horizontal; mesioangular; distoangular; and transverse (rare inverted positions were excluded).

We used the criteria of Al-Khateeb and Bataineh\textsuperscript{14} to determine the presence of ERR when a clear loss of substance in the root of an adjacent M2 was detected. The differential diagnosis of dental caries on M2 and ERR was based on their radiographic appearance. When the radiolucency had irregular structure and the dental crown of the third molar, the presence of ERR was based on their radiographic appearance. The differential diagnosis of dental caries on M2 and ERR was based on their radiographic appearance. When the radiolucency had irregular structure and the dental crown of the third molar, the appearance was considered representative of caries, as is shown in Figure 1., because ERR of the second molar was in the cervical region and the radiolucency is in close contact with the dental crown of the impacted third molar, as is shown Figure. 2.

**Statistical Analysis**

The SPSS 10.0 software (SPSS Inc., IBM, Armonk, N.Y.) was used for storing and analyzing data. The level of significance was set at a P-value less than
0.05. The intraobserver and interobserver agreement on CBCT findings were estimated by the Cohen $\kappa$ test. The Cochran Q test was used to assess the frequency of lesions, and the McNemar test was used for paired comparisons of e-M3s and i-M3s.

RESULTS

The Cohen $\kappa$ test revealed good intraobserver reliability of our method of identifying caries ($\kappa = 0.8132$, $P = 0.007$) and ERR ($\kappa = 0.7813$, $P = 0.007$) through CBCT images, as well as good interobserver reliability ($\kappa = 0.8427$, $P = 0.006$, and $\kappa = 0.7954$, $P = 0.007$, respectively), thus validating the reliability and reproducibility of our methods. Statistically significant differences were found in the existence of caries and ERR comparing the e-M3s and i-M3s groups.

Caries Results

Caries was detected in 32.5% ($n = 65$) of i-M3s and 21% ($n = 42$) of e-M3s ($P = 0.01$). Of the 65 patients with carious lesions in the side with the i-M3, only 10 patients exhibited caries in the other side of mandible (with the e-M3) as well ($P = 0.01$).

Resorption Results

ERR was detected in 18.5% ($n = 37$) of the i-M3s, but no resorption was observed in the e-M3s ($P = 0.00$). Of the 37 patients with ERR on the side of the i-M3s, none had ERR on the other side (with the e-M3s; $P = 0.00$).

Classification Results

When we evaluated the frequency of lesions according to Pell and Gregory’s classification, no statistically significant difference was observed between i-M3s and e-M3s with regard to the presence of carious lesions ($P = 0.72$) or presence of ERR ($P = 0.50$; Table 1). According to Winter’s classification, the rate of caries (36.5%) and ERR (16.3%) were highest in mesiangular angulation. No statistical difference was detected among the subgroups of Winter’s classification in terms of the presence of carious lesions ($P = 0.51$) and ERR ($P = 0.77$; Table 2).

DISCUSSION

Some authors consider all partially erupted M3s as hazards, whereas other authors have expressed reservations. Until now, the evidence supporting removal vs. retention of nonimpacted M3s has been lacking, and clinical evidence for nonimpacted M3s that affect adjacent M2 has to date been largely nonexistent. The prevalence of distal caries in the M2 ranged from 13.4% to 30.1% in these studies.

Li et al. in their study stated that the presence of e-M3 did not increase the risk for distal caries and ERR in the adjacent M2, but the risk for alveolar bone resorption was significantly increased. Li et al. could not ignore the adverse influence of an e-M3 on the periodontal health of the adjacent M2 in the clinical setting, and they recommended regular periodic clinical and radiographic examinations. They also suggested the prophylactic removal of e-M3 as a treatment choice.

In our study, although no resorption was observed in M2 adjacent to e-M3, the prevalence of carious lesions was 21%.

Chou et al. in their study estimated that partial eruption of an M3 negatively affected the caries status of the adjacent M2. Their study showed that when M2 and M3 are at the same occlusal plane level, the distal rate of caries in M2 increased. This result may be related to the higher contact point between M2 and M3. In the study by Chou et al., the prevalence of distal caries on M2s adjacent to M3s was found to be 35.7%; in our study, the prevalence of caries in M2s adjacent to e-M3s was 21%. The differences between studies in caries rates may be related to discrepancies in imaging modalities, patients’ ages, and cultural differences, including differences in socioeconomic and education levels. The mean age of patients in the study by Chou et al. was 45 years. Ožeç et al. in their study stated that the contact region

![Figure 1. Distal caries in the second molar. The radiolucency has irregular structure and margins, and a clear gap exists between the dental crown of the impacted third molar and the distal aspect of the second molar. (A) Panoramic radiograph. (B) Sagittal cone beam computed tomography section showing distal cervical caries (arrow) of mandibular second molar.](image)

![Figure 2. External root resorption on the second molar. The radiolucency is in close contact with the dental crown of the impacted third molar. (A) Panoramic radiograph. (B) Sagittal cone beam CT section showing external root resorption (arrow) in middle and apical thirds of the root.](image)
Table 1. The frequency of caries and external root resorption among impacted mandibular third molars according to Pell and Gregory’s classification

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Table 2. The frequency of caries and external root resorption among impacted mandibular third molars according to Winter’s classification

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between M3 and M2 is a very important factor in caries formation. Distal caries formation in M2 is more likely to be related to mesioangular and horizontal angulation of M3, according to Pepper et al.\(^3\) We too observed that, with mesiangular angulation, in comparison with other angulation types, the rates of caries (36.5%) and ERR (16.3%) were highest. With mesial inclinations (mesioangular and horizontal), the area of contact between M3 and M2 is larger, which leads us to believe that the inflammatory process will be more severe and has a greater potential for damage of the dental surface and increasing ERR.\(^4\) Similarly, we observed that ERR was mostly seen in the M2s adjacent to the mesiangular i-M3s, but horizontal angulation did not have much effect compared with the mesioangular angulation.

To the best of our knowledge, the literature to date includes no similar study of the effect of both e-M3 and i-M3 on the development of distal caries and ERR in M2s in the same oral microflora. Our study has the usual limitations of a retrospective investigation and relatively small sample size. We suggest that further studies be conducted on larger study samples to confirm the results of this retrospective study.

**CONCLUSION**

Within the limitations of this study, caries and ERR in the i-M3s were not very rare and could be reliably identified through CBCT scan. Among patients with caries in the i-M3s, caries was significantly lower on the other side of the mandible. Thus, instead of prophylactic removal of e-M3, routine radiological examinations are advised.

**CONFLICT OF INTEREST**

There are no conflicts of interest or any financial or personal relationships with other people or organizations that could inappropriately bias the conduct and findings this study.
REFERENCES


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