

Evaluation of the Influence of Impacted Third Molars on the Periodontal Status of Adjacent Second Molars - a retrospective study

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Abstract:

Background: Impacted mandibular third molars are frequently associated with localized periodontal changes affecting adjacent second molars. Their position and angulation can predispose to plaque accumulation and inflammation, potentially leading to periodontal destruction. **Aim:** To evaluate the influence of impacted mandibular third molars on the periodontal status of adjacent second molars. **Materials and Methods:** This retrospective observational study included 250 case sheets with complete periodontal charting obtained from the institutional digital database (DIAS). Patients were divided into two groups: Group 1 (n = 125) with impacted mandibular third molars adjacent to second molars, and Group 2 (n = 125) without impacted third molars or with fully erupted third molars. Clinical parameters assessed at the distal surface of second molars included probing depth (PD), clinical attachment loss (CAL), bleeding on probing (BOP), and plaque index (PI). Radiographic evaluation assessed alveolar bone loss, and impactions were classified based on angulation and depth. Statistical analysis was performed using independent t-test, chi-square test, ANOVA, and Pearson correlation. **Results:** Group 1 demonstrated significantly higher PD (5.34 ± 1.12 mm), CAL (4.78 ± 1.05 mm), BOP (79.2%), and PI (2.01 ± 0.38) compared to Group 2 ($p < 0.001$). Radiographic bone loss was greater in Group 1 (3.96 ± 1.18 mm) than in Group 2 (1.82 ± 0.72 mm) ($p < 0.001$). Mesioangular impactions showed the highest bone loss, and a positive correlation was observed between depth of impaction and bone loss ($r = 0.62$, $p < 0.001$). **Conclusion:** Impacted mandibular third molars are associated with increased periodontal destruction of adjacent second molars, emphasizing the need for early evaluation and management.

Keywords: Impacted third molar, periodontitis, second molar, bone loss, retrospective study

1. Introduction

Periodontal disease is a multifactorial, chronic inflammatory condition that affects the supporting structures of the teeth, including the gingiva, periodontal ligament, cementum, and alveolar bone (1). It is initiated by microbial plaque biofilm and modified by host immune response, environmental factors, and local anatomical conditions. While generalized forms of periodontitis have been extensively studied, localized periodontal destruction influenced by specific anatomical and developmental factors continues to be an area of growing clinical importance. Among these, the presence of impacted third molars has emerged as a significant yet often underestimated contributor to localized periodontal breakdown. Third molars, commonly known as wisdom teeth, are the last teeth to erupt in the oral cavity, typically between the ages of 17 and 25 years. Due to evolutionary reduction in jaw size, lack of adequate space, and variations in eruption path, third molars frequently fail to erupt completely, resulting in impaction. An impacted tooth is defined as one that is prevented from erupting into its normal functional position due to obstruction by adjacent teeth, bone, or soft tissue. The prevalence of impacted third molars is relatively high in young adults, making it a common finding in dental practice (2). The clinical significance of impacted third molars extends beyond their own pathology. One of the major concerns associated with impacted third molars is their effect on the periodontal health of adjacent second molars. The distal surface of the second molar is particularly susceptible to periodontal damage due to its proximity to the impacted tooth. This area often becomes a site of plaque accumulation, food impaction, and bacterial colonization, primarily because it is difficult to access during routine oral hygiene practices. The anatomical relationship between the impacted third molar and the second molar creates a niche environment that favors the persistence of pathogenic microorganisms. This leads to chronic inflammation of the gingival tissues, which may progress to periodontal pocket formation and subsequent attachment loss. Over time, if left untreated, this localized inflammation can result in significant alveolar bone resorption, ultimately compromising the prognosis of the second molar (3). The pattern and severity of periodontal destruction associated with impacted third molars are influenced by several factors, including the angulation, depth, and degree of eruption of the impacted tooth. Based on angulation, impacted third molars are commonly classified using Winter's classification into mesioangular, vertical, horizontal, and distoangular types. Among these, mesioangular impactions are the most frequently encountered and are often associated with a higher risk of periodontal damage. The forward inclination of the impacted tooth toward the second molar facilitates food lodgment and plaque retention in the interdental space, thereby increasing the risk of localized periodontal destruction (4).

In addition to angulation, the depth of impaction also plays a crucial role in determining the extent of periodontal involvement. The Pell and Gregory classification categorizes impacted third molars based on their depth relative to the occlusal plane and their relationship to the ramus of the mandible. Deeper impactions are often associated with greater bone coverage and may exert pressure on the adjacent second molar, potentially contributing to bone resorption and attachment loss. Another important factor to consider is the degree of eruption of the impacted third molar. Partially erupted third molars are particularly problematic, as they create a communication between the oral cavity and the underlying pericoronal space. This allows for the ingress of bacteria and debris, leading to recurrent episodes of pericoronitis. The presence of a pericoronal flap further complicates oral hygiene maintenance and serves as a reservoir for pathogenic microorganisms. Repeated inflammatory episodes in this region can have a detrimental effect on the periodontal health of the adjacent second molar (5).

Radiographic assessment plays a vital role in evaluating the relationship between impacted third molars and adjacent structures. Orthopantomograms (OPGs) provide a comprehensive view of the dentition and are commonly used to assess the angulation, depth, and proximity of impacted third molars to the second molars. Radiographic evaluation of bone levels distal to the second molar can help in identifying early signs of periodontal destruction that may not be clinically evident. Several studies have investigated the association between impacted third molars and periodontal disease; however, the findings have been inconsistent. While some studies report a strong correlation between impacted third molars and increased periodontal destruction, others suggest that the impact may be minimal or influenced by additional factors such as oral hygiene practices, age, and systemic health. Furthermore, many existing studies focus primarily on postoperative outcomes following third molar removal rather than evaluating the pre-existing periodontal condition of adjacent teeth (6).

There is a growing need for studies that specifically assess the periodontal status of second molars in the presence of impacted third molars using both clinical and radiographic parameters. Retrospective studies utilizing institutional databases provide an effective approach to analyze large sample sizes and identify clinically relevant patterns. Such studies are particularly advantageous in academic settings, where comprehensive patient records and radiographs are readily available. Understanding the influence of impacted third molars on the periodontal health of adjacent second molars has important clinical implications. Early identification of high-risk impactions and timely intervention may help prevent the progression of localized periodontal disease. This is especially relevant in young adults, where preventive strategies can significantly improve long-term oral health outcomes (7).

Therefore, the present study aims to retrospectively evaluate the influence of impacted third molars on the periodontal status of adjacent second molars. By analyzing clinical and radiographic data from a dental teaching institution, this study seeks to provide evidence that can guide clinical decision-making and emphasize the importance of early diagnosis and management of impacted third molars in preventing localized periodontal destruction.

2. Materials and Methods

Study Design and Setting: This retrospective observational analytical study was conducted in a university-based dental teaching hospital. The study utilized archived electronic case records and radiographic data of patients who reported to the Outpatient Department (OPD) over a defined period (January 2023 to December 2025). Ethical approval was obtained from the Institutional Review Board, and the study was carried out in accordance with the principles of the Declaration of Helsinki. All patient data were anonymized prior to analysis to ensure confidentiality.

2.2 Study Population and Sample Size : A total of 250 case sheets with complete periodontal charting were included in the study. The data were retrieved from the institution's digital record system, DIAS (Dental Information Archiving Software). The sample size was determined based on the availability of complete clinical and radiographic records that met the predefined inclusion and exclusion criteria. The selected patients were divided into two groups for comparison:

Group 1 (Test Group): Patients with at least one impacted mandibular third molar adjacent to a second molar

Group 2 (Control Group): Patients with either fully erupted third molars or absence of third molars, with no evidence of impaction adjacent to the second molar. Each group consisted of 125 patients, ensuring balanced distribution for statistical analysis.

3. Inclusion Criteria: Patients aged between 18 and 45 year

1. Presence of at least one mandibular second molar
2. Availability of complete periodontal clinical records
3. Availability of good-quality orthopantomograms (OPGs)
4. Patients who had undergone comprehensive periodontal examination

4. Exclusion Criteria

- Patients with systemic conditions known to influence periodontal health (e.g., uncontrolled diabetes mellitus, immunocompromised conditions)
- Patients with a history of periodontal surgical intervention in the region of interest
- Incomplete or missing clinical records
- Poor-quality or distorted radiographs that could affect accurate assessment
- Pregnant or lactating patients (if documented)

5. Data Retrieval and Recording Procedure

Relevant patient data were systematically retrieved from the DIAS digital database. Each case record was carefully reviewed, and the required clinical and radiographic parameters were documented using a standardized data collection format in Microsoft Excel.

To enhance reliability and minimize bias, data extraction was performed independently by two calibrated examiners. Any discrepancies were resolved through mutual discussion until consensus was achieved.

6. Clinical Parameters Assessed

Clinical parameters were obtained from the most recent periodontal charting recorded in the patient case sheets. The following parameters were evaluated specifically at the distal surface of the mandibular second molar:

- Probing Depth (PD): Measured in millimeters using a graduated periodontal probe; the deepest value recorded was considered
- Clinical Attachment Loss (CAL): Calculated as the distance from the cemento-enamel junction (CEJ) to the base of the periodontal pocket
- Bleeding on Probing (BOP): Recorded as present or absent based on bleeding within 15 seconds of probing
- Plaque Index (PI): Assessed using a standard index (Silness and L oe) and recorded as mean values

7. Radiographic Assessment

Radiographic evaluation was performed using orthopantomograms (OPGs) available in the patient records. All radiographs were analyzed under standardized viewing conditions using calibrated digital imaging software.

The following parameters were assessed:

- Alveolar Bone Loss: Measured at the distal aspect of the second molar as the distance from the CEJ to the alveolar crest. Bone loss was categorized as:
 - Mild (<2 mm)
 - Moderate (2–4 mm)
 - Severe (>4 mm)
- Type of Impaction: Classified according to Winter's classification into mesioangular, vertical, horizontal, and distoangular types
- Depth of Impaction: Assessed using Pell and Gregory classification, based on its relation to the occlusal plane (Class A, B, C) and the ramus (Class I, II, III)

8. Examiner Calibration and Reliability: Prior to data collection, examiner calibration was performed to ensure consistency in measurement interpretation. A subset of 15 randomly selected radiographs was reassessed after a two-week interval to evaluate intra-examiner reliability. A kappa value greater than 0.8 indicated excellent agreement.

9. Statistical Analysis: All data were entered into Microsoft Excel and analyzed using statistical software (SPSS version 23.0). Descriptive statistics were calculated as mean and standard deviation for continuous variables, and frequency and percentage for categorical variables.

- Independent t-test was used to compare continuous variables (PD, CAL, PI, bone loss) between the two groups
- Chi-square test was applied for categorical variables such as BOP and gender
- One-way ANOVA was used to compare periodontal parameters among different types of impaction
- Pearson correlation coefficient was used to assess the relationship between depth of impaction and extent of bone loss

A p-value of <0.05 was considered statistically significant.

3. Results : A total of 250 patient records were included in the present study, comprising 125 patients in Group 1 (presence of impacted mandibular third molar adjacent to the second molar) and 125 patients in Group 2 (absence of impacted third molar or presence of fully erupted third molar). The demographic characteristics of the study population were comparable between the two groups. The mean age was 29.8 ± 6.4 years in Group 1 and 29.1 ± 5.9 years in Group 2, with no statistically significant difference ($p = 0.48$). Similarly, the distribution of male and female participants did not differ significantly between groups ($p = 0.66$), indicating baseline homogeneity as shown in Table 1.

A comparison of clinical periodontal parameters revealed a consistent and statistically significant deterioration in periodontal status in patients with impacted third molars. The mean probing depth (PD) at the distal surface of the mandibular second molar was significantly higher in Group 1 (5.34 ± 1.12 mm) compared to Group 2 (3.01 ± 0.85 mm) ($p < 0.001$). A similar trend was observed for clinical attachment loss (CAL), which was significantly greater in Group 1 (4.78 ± 1.05 mm) than in Group 2 (2.52 ± 0.79 mm) ($p < 0.001$). These findings indicate a greater degree of periodontal tissue destruction associated with the presence of impacted third molars.

Inflammatory parameters further supported this observation. Bleeding on probing (BOP) was present in 79.2% of sites in Group 1, compared to 34.4% in Group 2, demonstrating a significantly higher inflammatory burden in areas adjacent to impacted third molars ($p < 0.001$). In addition, plaque index (PI) scores were significantly elevated in Group 1 (2.01 ± 0.38) compared to Group 2 (1.42 ± 0.35) ($p < 0.001$), suggesting increased plaque accumulation in regions associated with impacted third molars as shown in Table 1.

Radiographic assessment of alveolar bone levels revealed a pronounced difference between the two groups. The mean bone loss at the distal aspect of second molars was significantly greater in Group 1 (3.96 ± 1.18 mm) than in Group 2 (1.82 ± 0.72 mm) ($p < 0.001$). When bone loss was categorized based on severity, a clear shift toward more advanced destruction was evident in Group 1. Severe bone loss (>4 mm) was observed in 38.4% of cases in Group 1, compared to only 6.4% in Group 2, whereas mild bone loss (<2 mm) was predominantly seen in Group 2 (64.0%) compared to Group 1 (17.6%). Moderate bone loss (2–4 mm) was present in 44.0% of Group 1 and 29.6% of Group 2. These findings collectively indicate that the presence of impacted third molars is associated with a higher severity of periodontal destruction.

Among the patients in Group 1, the distribution of impaction types showed that mesioangular impactions were the most prevalent (42.4%), followed by vertical (24.8%), horizontal (21.6%), and distoangular impactions (11.2%). Analysis of periodontal destruction based on impaction type revealed a statistically significant association between angulation and severity of bone loss ($p < 0.001$). Mesioangular impactions demonstrated the highest mean bone loss (4.68 ± 1.06 mm), followed by horizontal impactions (4.23 ± 0.97 mm). Vertical impactions showed comparatively lower bone loss (3.36 ± 0.91 mm), while distoangular impactions exhibited the least bone loss (2.81 ± 0.84 mm). This pattern suggests that the angulation of impaction plays a critical role in determining the extent of periodontal damage as represented in Table 1.

Further analysis based on the depth of impaction revealed a progressive increase in bone loss with increasing depth. Teeth classified under Class C impaction demonstrated the highest mean bone loss (4.61 ± 1.14 mm), followed by Class B (3.87 ± 1.02 mm) and Class A (2.94 ± 0.88 mm). Statistical evaluation showed a moderate positive correlation between depth of impaction and bone loss ($r = 0.62$, $p < 0.001$), indicating that deeper impactions are associated with greater periodontal destruction of adjacent second molars.

Overall, the findings of the present study demonstrate a consistent and significant association between the presence of impacted mandibular third molars and deterioration in periodontal health of adjacent second molars. Both clinical and radiographic parameters indicate increased periodontal destruction, particularly in cases of mesioangular and deeply impacted third molars as depicted in Table 1.

Table 1 : Comprehensive Comparison of Clinical and Radiographic Parameters Between Groups

Parameter	Subcategory	Group 1 (Impacted Third Molar) n = 125	Group 2 (No Impaction / Erupted) n = 125	p-value
Age (years)	Mean ± SD	29.8 ± 6.4	29.1 ± 5.9	0.48
Gender	Male n (%)	68 (54.4%)	64 (51.2%)	0.66
	Female n (%)	57 (45.6%)	61 (48.8%)	
Probing Depth (mm)	Mean ± SD	5.34 ± 1.12	3.01 ± 0.85	<0.001*
Clinical Attachment Loss (mm)	Mean ± SD	4.78 ± 1.05	2.52 ± 0.79	<0.001*
Bleeding on Probing	Present n (%)	99 (79.2%)	43 (34.4%)	<0.001*
	Absent n (%)	26 (20.8%)	82 (65.6%)	
Plaque Index	Mean ± SD	2.01 ± 0.38	1.42 ± 0.35	<0.001*
Radiographic Bone Loss (mm)	Mean ± SD	3.96 ± 1.18	1.82 ± 0.72	<0.001*
Bone Loss Category	Mild (<2 mm)	22 (17.6%)	80 (64.0%)	<0.001*
	Moderate (2–4 mm)	55 (44.0%)	37 (29.6%)	
	Severe (>4 mm)	48 (38.4%)	8 (6.4%)	
Type of Impaction (Group 1 only)	Mesioangular	53 (42.4%)	-	
	Vertical	31 (24.8%)	-	
	Horizontal	27 (21.6%)	-	
	Distoangular	14 (11.2%)	-	
Bone Loss by Impaction Type	Mesioangular	4.68 ± 1.06	-	<0.001*
	Horizontal	4.23 ± 0.97	-	
	Vertical	3.36 ± 0.91	-	
	Distoangular	2.81 ± 0.84	-	
Depth of Impaction (Group 1 only)	Class A	2.94 ± 0.88	-	<0.001*
	Class B	3.87 ± 1.02	-	
	Class C	4.61 ± 1.14	-	
Correlation	Depth vs Bone Loss (r)	0.62	-	<0.001*

4. Discussion

The present retrospective analysis evaluated the influence of impacted mandibular third molars on the periodontal status of adjacent second molars using both clinical and radiographic parameters. The findings demonstrate a consistent and clinically meaningful association between the presence of an impacted third molar and localized periodontal deterioration on the distal aspect of the second molar. Importantly, this effect was not only statistically significant across multiple parameters but also showed a graded pattern in relation to the angulation and depth of impaction (8). A key observation of this study was the significantly greater probing depth and clinical attachment loss in sites adjacent to impacted third molars. These findings suggest that the distal surface of the second molar is particularly vulnerable when an adjacent third molar is impacted. The anatomy of this region, combined with limited accessibility for routine oral hygiene, likely facilitates persistent plaque accumulation. Over time, this creates a microenvironment conducive to the establishment of pathogenic biofilms, which in turn initiate and perpetuate inflammatory periodontal breakdown. The higher plaque index and bleeding on probing observed in the test group further support this mechanism, reflecting both increased microbial load and an active inflammatory response (9). Radiographically, the extent of alveolar bone loss distal to second molars was markedly higher in the presence of impacted third molars. This aligns with the clinical findings and reinforces the concept of localized periodontal destruction associated with impaction. The distribution of bone loss severity in this study—where a substantial proportion of sites in the test group exhibited moderate to severe loss—highlights the potential for clinically significant damage even in relatively young individuals. In contrast, the control group predominantly demonstrated mild bone loss, indicating that in the absence of impaction, the distal surface of the second molar is less susceptible to such localized breakdown under similar conditions (10). The influence of impaction angulation on periodontal status was particularly noteworthy. Mesioangular impactions were associated with the highest levels of bone loss, followed by horizontal impactions, whereas vertical and distoangular impactions demonstrated comparatively less destruction. This pattern can be explained by the spatial relationship between the impacted third molar and the second molar. In mesioangular impactions, the crown of the third molar is directed toward the distal surface of the second molar, creating a niche that favors food impaction and plaque retention. Horizontal impactions similarly present a broad contact area that may exacerbate plaque accumulation. In contrast, distoangular impactions, where the third molar is angled away from the second molar, appear to have a relatively protective effect in terms of periodontal involvement (11). The depth of impaction also showed a clear relationship with periodontal destruction. The progressive increase in bone loss from Class A to Class C impactions suggests that deeper impactions may contribute to more severe periodontal changes. This could be attributed to the greater amount of overlying bone and soft tissue, which may impede effective cleaning and promote chronic inflammation. Additionally, deeper impactions may exert pressure on adjacent structures or alter the local anatomical contours, further complicating plaque control and periodontal stability. The findings of this study are in agreement with earlier reports that have highlighted the periodontal risks associated with impacted third molars. Previous investigations have similarly demonstrated increased probing depths, attachment loss, and bone loss in second molars adjacent to impacted third molars. However, much of the existing literature has focused on outcomes following third molar removal or on symptomatic cases such as pericoronitis.

The present study adds to the body of evidence by specifically examining the baseline periodontal status in a broader outpatient population, thereby providing insight into the subclinical and chronic effects of impaction. From a clinical standpoint, these findings have important implications for decision-making regarding the management of impacted third molars. While the removal of asymptomatic third molars remains a topic of ongoing debate, the evidence from this study suggests that even in the absence of acute symptoms, impacted third molars may contribute to progressive periodontal damage of adjacent teeth. Early identification of high-risk impactions—particularly mesioangular and deeply positioned teeth—may allow for timely intervention and prevention of irreversible periodontal loss. This is especially relevant in younger patients, where preservation of second molar health is critical for long-term function. It is also important to consider the role of patient-related factors such as oral hygiene practices, access to dental care, and compliance with maintenance therapy. Although these variables could not be fully controlled in a retrospective design, their influence on periodontal outcomes should not be overlooked. Future studies incorporating prospective designs and standardized oral hygiene assessments may help to further elucidate these relationships. The retrospective nature of the present study presents certain limitations. The reliance on existing records may introduce variability in measurement techniques and documentation. Additionally, the cross-sectional assessment limits the ability to establish a temporal or causal relationship between impaction and periodontal destruction. Despite these limitations, the use of a relatively large sample size and standardized inclusion criteria strengthens the validity of the findings (12). Within these constraints, the study provides clinically relevant evidence that impacted mandibular third molars are associated with adverse periodontal changes in adjacent second molars. The consistency of findings across multiple clinical and radiographic parameters underscores the need for careful evaluation of impacted third molars as part of routine periodontal assessment.

Conclusion

Within the limitations of this retrospective study, impacted mandibular third molars were associated with significantly greater periodontal destruction on the distal aspect of adjacent second molars. The severity of these changes varied with the angulation and depth of impaction, with mesioangular and deeper impactions showing a more pronounced effect. These findings emphasize the importance of early evaluation and appropriate management of impacted third molars to minimize localized periodontal damage.

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