

# Patterns of Mandibular Third Molar Impactions and Its Association with Carious Lesions and Periodontal Defects: A Retrospective Cross-Sectional Study

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**Purpose:** Clinical consensus on prophylactic extraction of impacted mandibular third molars is still debated. This study aims to explore the impaction patterns of mandibular third molars and their associated effects on the adjacent second molars within a Saudi population, thereby providing some clinical insights for prophylactic extraction.

**Methods:** This retrospective cross-sectional study evaluated 1700 orthopantomograms of Saudi patients, obtained from the dental hospital database at King Abdulaziz University, Jeddah, Saudi Arabia, from August 2024 to June 2025, with convenience sampling. Mandibular third molar impaction patterns were assessed according to Winter's classification, along with their association with pathological conditions, including carious lesions and periodontal defects affecting the adjacent mandibular second molars.

**Results:** 681 impacted mandibular third molars were identified and analyzed. The prevalence of these impactions was higher in females (54.2%) than in males (45.8%) ( $p < 0.05$ ). Mesioangular impaction pattern was the most frequently detected, followed by horizontal. A significant association was observed between gender and the impaction patterns ( $p < 0.001$ ), with the inverted and buccolingual impaction patterns predominantly observed in males, accounting for 100% and 90.0% of the impactions, respectively. The prevalence of carious lesions and periodontal defects was 23.9% and 66.9%, respectively. The two most frequent impaction patterns, horizontal and mesioangular, were significantly associated with these pathological conditions ( $p < 0.001$ ).

**Conclusion:** Prophylactic extraction of impacted mandibular third molars, particularly those exhibiting mesioangular and horizontal impaction patterns, should be considered to prevent the deleterious consequences of their retention. However, this recommendation is specific to the population inspected. Further studies focusing on diverse populations are encouraged to acquire evidence-based, population-specific recommendations to support broader clinical applicability.

**Keywords:** impacted tooth, third molar, periodontal disease, dental caries, mandible, panoramic radiography

## Introduction

Tooth impaction refers to a condition when a tooth does not erupt into its functional position in the oral cavity within its expected developmental timeline, often due to obstruction by other teeth, overlying bone, or soft tissue, resulting in it becoming embedded within the alveolar bone.<sup>1</sup> This condition is most commonly associated with maxillary and mandibular third molars, followed by maxillary canines.<sup>2</sup> Tooth impaction can be due to several factors, including space limitation, genetic reasons, innate deficiencies in the dental lamina, and inability to activate the underlying mesenchyme.<sup>3–5</sup>

A systematic review reported a 24.4% global prevalence of third molar impactions, with mandibular third molars being significantly more prone to impaction compared to maxillary third molars.<sup>6</sup> Mandibular third molar impaction has been reported to be associated with many pathological conditions; these include pericoronitis, caries lesion in the adjacent second molar with or without root resorption, periodontal defect and bone loss in the adjacent second molar, temporomandibular joint dysfunctions, cyst formation, halitosis, and malocclusion.<sup>7,8</sup> Due to these associated pathologies, mandibular third molars are often extracted as part of the standard dental practice.



Patients with pathologies usually present with symptoms that prompt them to seek dental care for treatment, as shown to impact their quality of life.<sup>9</sup> It is clear to extract impacted mandibular third molars when symptoms are present or they are involved with pathology;<sup>10</sup> however, there is an ongoing dispute concerning when prophylactic extraction of asymptomatic impacted third molars should be elected. There is a need for studies focused on impaction patterns of mandibular third molars that present a high risk of developing pathologies. This will aid in deciding whether prophylactic extraction is warranted.<sup>11–15</sup>

Investigations revealed that retained asymptomatic impacted mandibular third molars were associated with periodontal destruction extending to the adjacent second molars.<sup>7,8</sup> Additionally, they appear to increase the risk of caries in the neighboring second molars as a result of bacterial plaque accumulation.<sup>12,16</sup> Consequently, retained impacted mandibular third molars can contribute to the onset and persistence of diseases; thus, prophylactic extraction of these impacted teeth is regarded as a cost-effective intervention.<sup>17</sup>

There is a lack of clear evidence-based guidelines or clinical consensus on prophylactic extraction of impacted mandibular third molars. The decision to extract or retain these teeth is based on the clinician's professional judgment and the patient's preference. Asymptomatic impacted mandibular third molars, if they develop oral lesions, usually remain silent with slow progression. It can take a significant time for these lesions to enlarge and develop symptoms, which may in some instances necessitate more complex surgical interventions if dentigerous cysts or ameloblastomas were developed.<sup>7</sup> Therefore, investigations are essential to provide clinical guidance on which impaction patterns of asymptomatic impacted mandibular third molars merit consideration for prophylactic extraction.

While studies have explored the prevalence and implications of third molar impaction,<sup>3–5,14</sup> findings can vary across populations due to differences in genetic, anatomical, and behavioral factors. Data addressing the patterns of mandibular third molar impaction and their clinical consequences on the adjacent second molars, more specifically both caries and periodontal defect development, in the Saudi population are sparse. Understanding these patterns is essential for informed clinical decision-making, particularly regarding the need for prophylactic extraction.

Thus, the objective of this retrospective cross-sectional study is to investigate mandibular third molar impaction patterns and their association with periodontal defects and carious lesions in adjacent second molars within a Saudi population. The null hypothesis was that there is no significant association between impacted mandibular third molars and the presence of pathological conditions, carious lesions, and periodontal defects in their adjacent second molars. Additionally, the findings may provide clinical insights to assist dental professionals in making informed decisions regarding the prophylactic extraction of impacted mandibular third molars.

## Materials and Methods

### Research Approval

The Research Ethics Committee at the Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia, evaluated and approved this study (Proposal ID 066-05-22). The research was carried out in compliance with the 2013 revision of the 1975 Helsinki Declaration. Since this is a retrospective cross-sectional study involving only dental records, the committee exempted participants from written consent. All patients' records were anonymized, treated with strict confidentiality, and used solely for the purpose of this research and in accordance with the institutional guidelines regarding patient data protection.

### Study Population and Sample Size

This cross-sectional study retrospectively involved orthopantomogram (OPG) radiographs of Saudi patients obtained from the university dental hospital database who presented for different dental treatments. The needed sample size was calculated employing the Raosoft sample size calculator. Based on a response distribution of 50%, a 99% confidence level, and a 5% margin of error, the sample required was 643.<sup>18</sup>

### Inclusion and Exclusion Criteria

Inclusion criteria were orthopantomogram (OPG) radiographs in the database of the university dental hospital of Saudi patients, 18 years and above, with a minimum of one impacted mandibular third molar with mature root formation. The exclusion criteria include poor-quality radiographs, patients with a history of orthodontic treatment or trauma, missing mandibular second molars

adjacent to the impacted mandibular third molars, ramus developmental deformities, presence of cysts or pathology, and patients with congenital diseases or syndromes.

## Image Assessment

The study was conducted from August 2024 to June 2025 with a total of 1700 OPGs screened with convenience sampling of all eligible OPGs from patients presented to the Comprehensive Care Clinics. All OPGs were consecutively reviewed to minimize selection bias with no additional inclusion or exclusion criteria other than the predefined criteria. The OPGs were inspected for the presence of impacted mandibular third molars and the impaction pattern, which was determined by the angulation between the long axis of the impacted third molar and the adjacent second molar following Winter's classification and measured manually using a standard protractor. The detailed angles and their associated patterns are as follows. An angle between  $-10^{\circ}$  and  $+10^{\circ}$  is considered a vertical pattern, between  $+11^{\circ}$  and  $+79^{\circ}$  is mesioangular, between  $-11^{\circ}$  and  $-79^{\circ}$  is distoangular, between  $+80^{\circ}$  and  $+100^{\circ}$  is horizontal, and between  $+111^{\circ}$  and  $-80^{\circ}$  is inverted, while buccolingual impaction was identified by observing abnormal crown width, root foreshortening, and deviation from the typical mesiodistal orientation of the tooth's long axis.<sup>19</sup> In addition, the presence of carious lesions and periodontal defects in the neighboring mandibular second molars following Tai et al.<sup>20</sup> Briefly, for caries lesions, no dental lesion referred to an intact tooth with no signs of caries, filling, or prosthesis; a mild dental lesion was regarded when the caries was confined to the dentine and had not affected the pulp; a moderate dental lesion was when the caries had reached the pulp; however, it can be saved with root canal treatment; and a severe dental lesion was elected when the tooth was deemed non-restorable and to be extracted due to extensive caries involvement. Regarding periodontal defects classification, no periodontal defect was determined when no bone loss was observed; a mild periodontal defect identified as alveolar bone destruction less than half of the distal root of the mandibular second molar, which can be treated with non-surgical periodontal therapy; a moderate periodontal defect referred to when the bone destruction was more than two-thirds of the root, which mostly will require more complicated surgical periodontal treatment; and a severe periodontal defect is deemed when the bone destruction involves the whole distal root, furcation area, or reaches the mesial root of the mandibular second molar, which is very challenging to treat, and ultimately, both the second and third molars get extracted. All radiographs were evaluated by a single clinician who is an American Board-certified periodontist and dental implant surgeon and a fellow of the Royal College of Dentists of Canada in periodontology. Intra-examiner reliability was assessed by repeating the measurement twice, two weeks apart, on a random sample of OPGs using Cohen's kappa statistics, yielding an almost perfect agreement ( $K > 0.9$ ).

## Statistical Analysis

Statistical analysis was executed employing the Statistical Package for the Social Sciences (SPSS) version 20 (IBM SPSS, Armonk, NY, USA). Intra-examiner reliability was evaluated using Cohen's kappa statistics. Descriptive statistics were conducted to investigate frequencies and percentages. In addition, a Chi-Square test with Monte Carlo simulation to detect significant associations with a p-value  $< 0.05$  set for significance level.

## Results

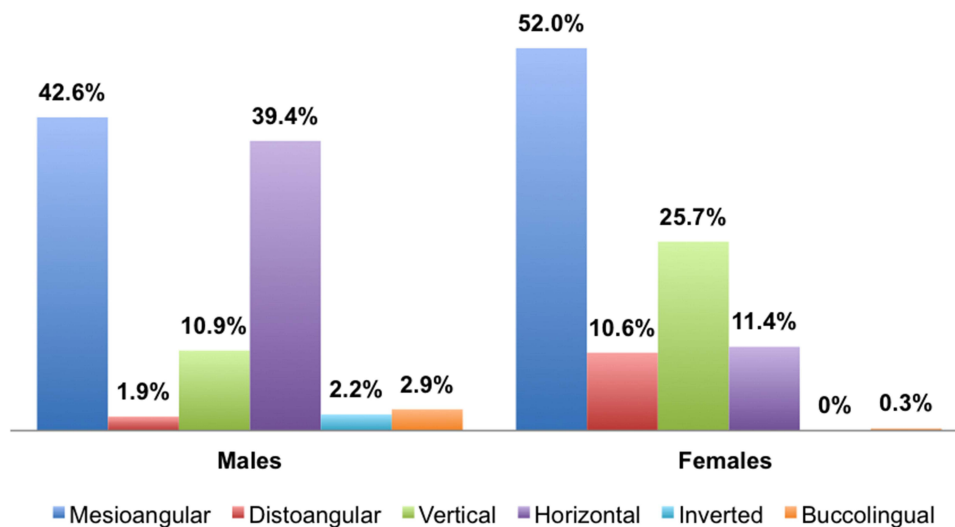
Among the 1700 orthopantomograms (OPGs) of Saudi patients screened, a total of 681 impacted mandibular third molars were identified and analyzed. The prevalence of these impactions was significantly higher in females (54.2%) than males (45.8%) ( $p < 0.05$ ). The mean age of the study sample was  $27.01 \pm 6.95$  years.

The most frequently observed impaction pattern in our study was mesioangular, which was detected significantly more often than the other patterns ( $p < 0.001$ ). The remaining patterns in descending order of frequency were horizontal, vertical, distoangular, buccolingual, and least commonly, inverted. [Table 1](#) represents the exact distribution, including percentages and the corresponding p-value. A significant association was observed between gender and the impaction patterns ( $p < 0.001$ ). Among males, mesioangular was the most common impaction pattern (42.6%), followed by horizontal (39.4%). While among females, the mesioangular impaction pattern was similarly the most frequent (52.0%), followed by vertical (25.7%). Notably, inverted and buccolingual impaction patterns were predominantly observed in males, accounting for 100% and 90% of the impactions, respectively. The distribution of various impaction patterns in relation to gender is illustrated in [Figure 1](#).

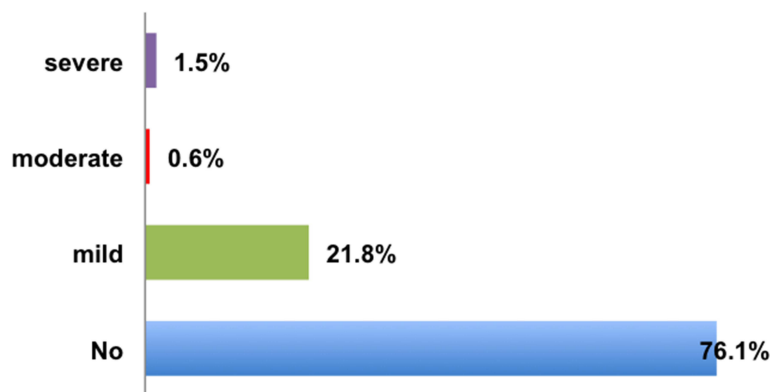
**Table 1** Distribution of Impaction Patterns Among Impacted Mandibular Third Molars

Impaction Pattern	Frequency	Percent	P-value
Mesioangular	325	47.7	< 0.001
Distoangular	45	6.6	
Vertical	129	18.9	
Horizontal	165	24.2	
Inverted	7	1.0	
Buccolingual	10	1.5	
Total	681	100	

The prevalence of carious lesions in the mandibular second molars adjacent to impacted third molars was 23.9%. The distribution of caries severity is detailed in Figure 2. A significant association was observed between caries severity and the impaction pattern ( $p < 0.001$ ). Horizontal and mesioangular mandibular third molar impaction patterns were comparably the most frequently associated with carious lesions in their adjacent second molars ( $p < 0.001$ ). When investigating the severity, the same two patterns, mesioangular and horizontal, were associated with the most severe form of carious lesions. Conversely, inverted and buccolingual showed no negative effect on their adjacent second molars, which were free of caries (Table 2).



**Figure 1** Distributions of mandibular third molar impaction patterns by gender.

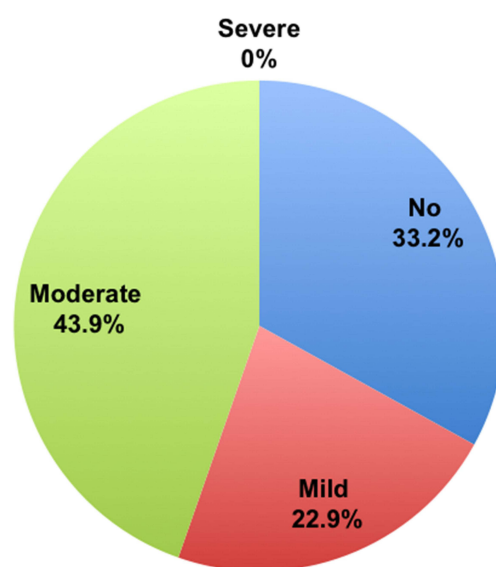


**Figure 2** Severity distribution of carious lesions in mandibular second molars adjacent to impacted third molars.

**Table 2** Distribution of Carious Lesions Severity in Mandibular Second Molars in Relation to Different Impaction Patterns of Third Molars

			Impaction Pattern						Total
			Mesioangular	Distoangular	Vertical	Horizontal	Inverted	Buccolingual	
Caries	No	Count	225	42	121	113	7	10	518
		% Within Caries	43.4%	8.1%	23.4%	21.8%	1.4%	1.9%	100%
		% Within Impaction	69.2%	93.3%	93.8%	68.5%	100%	100%	76.1%
		% of Total	33.0%	6.2%	17.8%	16.6%	1.0%	1.5%	76.1%
	Mild	Count	90	3	8	48	0	0	149
		% Within Caries	60.4%	2.0%	5.4%	32.2%	0%	0%	100%
		% Within Impaction	27.7%	6.7%	6.2%	29.1%	0%	0%	21.9%
		% of Total	13.2%	0.4%	1.2%	7.0%	0%	0%	21.8%
	Moderate	Count	4	0	0	0	0	0	4
		% Within Caries	100%	0%	0%	0%	0%	0%	100%
		% Within Impaction	1.2%	0%	0%	0%	0%	0%	0.6%
		% of Total	0.6%	0%	0%	0%	0%	0%	0.6%
	Severe	Count	6	0	0	4	0	0	10
		% Within Caries	60%	0%	0%	40%	0%	0%	100%
		% Within Impaction	1.8%	0%	0%	2.4%	0%	0%	1.5%
		% of Total	0.9%	0%	0%	0.6%	0%	0%	1.5%
Total		Count	325	45	129	165	7	10	681
		% Within Caries	47.7%	6.6%	18.9%	24.2%	1.0%	1.5%	100%
		% Within Impaction	100%	100%	100%	100%	100%	100%	100%
		% of Total	47.7%	6.6%	18.9%	24.2%	1.0%	1.5%	100%

Assessment of the periodontal condition of mandibular second molars adjacent to impacted third molars revealed a prevalence of 66.9% of periodontal defects due to alveolar bone loss caused by the impaction. The prevalence distribution of periodontal defects in mandibular second molars adjacent to impacted third molars, with further details on the defects' severity, is illustrated in [Figure 3](#). Similar to caries lesions, a significant association was observed between

**Figure 3** Severity distribution of periodontal defects in mandibular second molars adjacent to impacted third molars.

**Table 3** Distribution of Periodontal Defects Severity in Mandibular second Molars in Relation to Different Impaction Patterns of Third Molars

			Impaction Pattern						Total
			Mesioangular	Distoangular	Vertical	Horizontal	Inverted	Buccolingual	
Periodontal defect	No	Count	52	38	94	32	5	5	226
		% Within Defect	23.0%	16.8%	41.6%	14.2%	2.2%	2.2%	100%
		% Within Impaction	16.0%	84.4%	72.9%	19.4%	71.4%	50.0%	33.2%
		% of Total	7.6%	5.6%	13.8%	4.7%	0.7%	0.7%	33.2%
	Mild	Count	97	7	23	24	2	3	156
		% Within Defect	62.2%	4.5%	14.7%	15.4%	1.3%	1.9%	100%
		% Within Impaction	29.8%	15.6%	17.8%	14.5%	28.6%	30%	22.9%
		% of Total	14.2%	1.0%	3.4%	3.5%	0.3%	0.4%	22.9%
	Moderate	Count	176	0	12	109	0	2	299
		% Within Defect	58.9%	0%	4.0%	36.5%	0%	0.7%	100%
		% Within Impaction	54.2%	0%	9.3%	66.1%	0%	20%	43.9%
		% of Total	25.8%	0%	1.8%	16.0%	0%	0.3%	43.9%
	Severe	Count	0%	0%	0%	0%	0%	0%	0%
		% Within Defect	0%	0%	0%	0%	0%	0%	0%
		% Within Impaction	0%	0%	0%	0%	0%	0%	0%
		% of Total	0%	0%	0%	0%	0%	0%	0%
Total		Count	325	45	129	165	7	10	681
		% Within Defect	47.7%	6.6%	18.9%	24.2%	1.0%	1.5%	100%
		% Within Impaction	100%	100%	100%	100%	100%	100%	100%
		% of Total	47.7%	6.6%	18.9%	24.2%	1.0%	1.5%	100%

impaction patterns and associated periodontal defects ( $p < 0.001$ ). Distoangular followed by vertical and inverted mandibular third molar impaction were the least to be associated with periodontal defects in their adjacent second molars, while the most frequently associated with periodontal defects were mesioangular followed by horizontal impaction patterns. When assessing the severity, comparable to caries lesions, the same two patterns, mesioangular and horizontal, were associated with more extensive bone destruction; thus, more severe forms of periodontal defects. [Table 3](#) provides the detailed distribution of the various impaction patterns and their associated periodontal defects.

## Discussion

Prophylactic extraction of impacted third molars is a common procedure in the dental practice. In the United States, about 10 million are being removed annually.<sup>21</sup> However, different ethnic and population groups have different characteristics with variations in impaction patterns, leading to differences in the indications for third molar extraction. Therefore, investigating impaction patterns and their associated pathological effects across different ethnic groups will provide valuable clinical insights for developing ethnicity-specific indications for extraction.

The null hypothesis of this study was that there is no significant association between impacted mandibular third molars and the presence of pathological conditions, carious lesions, and periodontal defects in their adjacent second molars in our study population. However, it was rejected.

In this study conducted among a Saudi population, females exhibited a higher prevalence of mandibular third molar impactions. This finding is consistent with other studies.<sup>22–24</sup> A possible explanation is that males experience a longer period of growth, providing more alveolar space to accommodate third molar eruption, while females exhibit earlier growth cessation. In contrast, other studies showed no gender predominance regarding impaction prevalence.<sup>3,25</sup>

The most frequent impaction pattern of mandibular third molars in our study was the mesioangular. This is possibly due to failure in the normal eruption process, as usually mandibular third molars during eruption rotate from the horizontal plane within the alveolar bone to the mesioangular and then finally to the vertical plane.<sup>23</sup> Our finding was

in accordance with previous studies reporting the same pattern being the most common.<sup>23–27</sup> In contrast, another study identified vertical impaction as the most prevalent type of mandibular third molar impaction.<sup>28</sup>

Although a previous study reported no association between gender and mandibular third molar impaction pattern,<sup>23</sup> the present study identified a notable association. Mesioangular impaction pattern was the most common type in both males and females, which aligns with existing literature. This pattern likely reflects a developmental outcome possibly resulting from failure of the third molar to achieve proper reorientation within the alveolar bone irrespective of the gender. However, inverted and buccolingual impaction patterns were predominantly observed in males. These more complex impaction patterns seem to be attributed to anatomical differences, the larger and more robust mandibular structures in males. A large and more spacious mandible may allow for greater positional variability, thereby increasing the likelihood for rare and atypical impaction patterns. Another finding was the higher prevalence of distoangular impaction patterns in females compared to males. This observation is consistent with previous studies that reported similar results.<sup>23,29</sup>

Pathological conditions associated with impacted mandibular third molars are usually asymptomatic and progress slowly, often requiring years before clinical symptoms become apparent. As a result, diagnosis is frequently delayed, leading to complex treatment. Among these pathologies, the most commonly observed is caries on the adjacent mandibular second molars. In the present study, the prevalence of carious lesions in the mandibular second molars adjacent to impacted third molars was 23.9%. This finding is comparable to the results reported in previous investigations, 24.63% by Tai et al,<sup>20</sup> 25.4% by Marques et al,<sup>12</sup> and 21.12% by Patel et al.<sup>24</sup> However, lower prevalence was reported by Alsaegh et al (14.86%)<sup>23</sup> and Haddad et al (12.2%).<sup>27</sup> This current study demonstrated that horizontal and mesioangular impaction patterns were frequently associated with more carious lesions in adjacent mandibular second molars. Our finding was in alignment with the results of Alsaegh et al<sup>23</sup> and Claudia et al.<sup>30</sup> This could be related to the fact that the crowns of mesioangular and horizontal impacted mandibular third molars are oriented toward the adjacent second molars, often exerting pressure and establishing contact below the cemento-enamel junction. This increases the risk for carious lesion development in the second molars compared to other impaction patterns such as vertical, distoangular, or buccolingual. Furthermore, when mesioangular and horizontal mandibular third molar impactions contact the second molar at or below the cemento-enamel junction, the resulting poor proximal contact frequently creates a gap between the two teeth. This anatomical configuration promotes dental plaque accumulation, and the limited space impairs effective oral hygiene practice, predisposing to caries formation. Conversely, Tai et al observed more caries associated with mesioangular and distoangular impactions.<sup>20</sup> However, it is important to note that the different populations may have accounted for this discrepancy, as variation in demographic and behavioral factors can influence caries prevalence.

Another pathological condition associated with impacted mandibular third molars is the development of periodontal defects. In the present study, alveolar bone loss distal to mandibular second molars was detected in 66.9% of the impaction cases. Tai et al reported a lower prevalence of 35.30%.<sup>20</sup> Despite the difference in prevalence, both studies concur that the mesioangular impaction pattern is the most frequently associated with periodontal defects. Similar to the mechanism underlying carious lesion development, this finding is mainly attributed to the presence of the gap between the impacted third molars and the adjacent second molar. This facilitates plaque accumulation and the colonization of periodontal pathogens, leading to periodontal disease and bone destruction. Previous studies confirmed that prophylactic extraction of impacted mandibular third molars combined with periodontal debridement distal to second molars, adequate supportive periodontal therapy, and, when needed, further regenerative periodontal surgical interventions can effectively reduce or even eliminate periodontal defects related to mandibular second molars.<sup>31,32</sup> In light of these findings, and considering the associations observed in this present study, early prophylactic extraction of mesioangular and horizontal impacted mandibular third molars appears to be a rational approach in order to prevent potential deleterious effects on the second molars.

When considering prophylactic extraction of impacted mandibular third molars, possible surgical complications must be carefully assessed. Reported complications include bleeding, infection, and injury to the inferior alveolar nerve. Among these, postoperative paresthesia and loss of sensation in the involved area are relatively common and can significantly impact patients' quality of life. Although sensory recovery typically occurs within 8 weeks, permanent nerve impairment is reported to be between 0.1% and 0.9% of the cases.<sup>21,33</sup> Fortunately, complications can often be prevented with thorough assessment and appropriate surgery planning. In addition, clinicians can weigh these surgical complications against the potential long-term

consequences of retaining impacted mandibular third molars, particularly in mesioangular impactions. The mesioangular impaction pattern is considered the least complex to extract with a lower risk of surgical complications.<sup>20</sup> Given its low complexity extraction and the high risk of harmful effects it poses to the adjacent mandibular second molar if left untreated, a sufficient justification is presented for early prophylactic extraction, which outweighs the surgical risk.

One significant factor impacting patients' choice concerning prophylactic extraction of impacted mandibular molars is the cost. Patients' preferences in addition to clinicians' judgment together are the determinant for prophylactic extraction decisions. Patients who are unable to afford the procedure may reject the treatment and elect to leave it. In such cases, a monitoring strategy should be implemented to preserve the health of the adjacent second molars. This includes both clinical and radiographic assessments at intervals not exceeding 2 years.<sup>20</sup> However, if early signs of pathology are detected, extraction is advisable as early as possible to prevent further, more complex consequences.

This study has notable strengths. First, a large number of orthopantomograms were screened, enhancing the reliability and representativeness of the findings within the Saudi population. Second, the study provides population-specific data on mandibular third molar impaction patterns and their associated pathological outcomes, carious lesions, and periodontal defects affecting the adjacent second molars. These findings offer clinical insights and benefit prophylactic extraction decisions tailored to the characteristics of the investigated population. Lastly, the study employed standardized classification systems and previously validated assessment methods for investigating impaction patterns, carious lesions, and periodontal defects, strengthening the methodological reliability. It is necessary to note that the current study did not include a control group of non-impacted mandibular third molars due to its cross-sectional design and descriptive objective, a cross-sectional study, not a case-control study. Therefore, it did not involve a control group by design, as our intention was to describe the patterns and effects of impacted mandibular third molars, rather than to compare them with non-impacted cases. While we believe the current study's results offer important insights into the effects of third molar impaction, future studies with a prospective nature, comparative or case-control design could provide further insights into the differential effects of mandibular third molar impaction on adjacent second molars and confirm the benefit of their prophylactic extraction. In addition, generalizability of our findings is not applicable as it is specific to our population. Further studies focusing on diverse populations are essential to explore whether similar associations exist and to acquire evidence-based, population-specific recommendations that consider different anatomical, behavioral, and socioeconomic factors to support broader clinical applicability.

## Conclusion

Prophylactic extraction of impacted mandibular third molars, particularly those exhibiting mesioangular and horizontal impaction patterns in the Saudi population, should be considered to prevent the deleterious consequences of their retention, as these impactions were associated with pathological conditions, including carious lesions and periodontal defects affecting the adjacent second molars. Alongside clinical judgment, patient preferences should also be incorporated when considering prophylactic extraction, in accordance with international guidelines for patient-centered care. However, this recommendation should not be generalized, as it is specific to the population inspected. Further studies with different designs on diverse populations are essential to support broader clinical applicability.

## Abbreviations

OPG, Orthopantomogram; SPSS, Statistical Package for the Social Sciences.

## Data Sharing Statement

The data generated from this study are presented in this article. Further inquiries can be directed to the corresponding author.

## Ethical Approval and Informed Consent

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Research Ethics Committee at the Faculty of Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia (proposal ID 066-05-22). As this is a retrospective cross-sectional study involving only dental records; thus, the committee waived the need for

participants written consent. All patients' data was treated with strict confidentiality and was used solely for the purpose of this research and in accordance with the institutional guidelines regarding patient data protection.

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## Disclosure

The authors declare that they have no competing interests in this work.

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