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FREQUENCY AND PATTERN OF THIRD MOLAR IMPACTIONS IN ORTHODONTIC PATIENTS WITH SKELETAL CLASS II VS. CLASS III MALOCCLUSION

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ABSTRACT

Third molar impactions are a common clinical concern in orthodontics, influenced by skeletal growth patterns and craniofacial morphology. Skeletal Class II and Class III malocclusions differ significantly in jaw relationships, which may affect the eruption path and impaction pattern of third molars.

Objective: To assess and compare the frequency and pattern of third molar impactions in orthodontic patients with skeletal Class II versus Class III malocclusion.

Methods: A retrospective cross-sectional study was conducted using panoramic radiographs and cephalometric records of orthodontic patients diagnosed with skeletal Class II and Class III patterns based on ANB angle and Wits appraisal. The presence, position, and angulation of impacted third molars were analyzed and classified using Pell and Gregory and Winter's classifications. Statistical comparisons were made between the two groups.

Results: Class II patients demonstrated a higher frequency of maxillary third molar impactions, with mesioangular and vertical impactions being most common. In contrast, Class III patients showed a greater prevalence of mandibular third molar impactions, often in a horizontal position and deeper impaction levels. The overall incidence of impactions was significantly different between the two groups ($p < 0.05$), with skeletal morphology influencing impaction type and location.

Conclusion: Skeletal pattern has a notable impact on the frequency and pattern of third molar impactions. Class II malocclusions are more associated with maxillary impactions, whereas Class III patients show a predilection for mandibular impactions. These findings can aid orthodontists in treatment planning and decision-making regarding third molar management.

Keywords: third molar impaction, skeletal Class II, skeletal Class III, orthodontics, panoramic radiograph, craniofacial morphology

INTRODUCTION

Impaction of the third molars is a frequent issue in dental practice and is particularly relevant in the field of orthodontics.[1] The third molars, also known as wisdom teeth, often lack the necessary space for proper eruption and can become impacted, leading to potential complications such as pericoronitis, root resorption of adjacent teeth, and cyst formation. The development and eruption path of these teeth are heavily influenced by skeletal morphology, specifically the anteroposterior relationships of the maxilla and mandible.[2] Skeletal malocclusions, especially Class II and Class III, present distinct jaw discrepancies. Class II malocclusions are typically characterized by a retrusive mandible or a protrusive maxilla, whereas Class III malocclusions usually exhibit mandibular prognathism or maxillary deficiency. These anatomical differences can influence the spatial configuration available for third molar eruption.[3] The proper eruption of third molars depends on multiple factors such as available retromolar space, growth patterns, angulation of the tooth germ, and timing of root formation. It is often observed that certain skeletal patterns may predispose individuals to specific impaction types. Thus, skeletal discrepancy is a crucial parameter when evaluating orthodontic patients for potential third molar issues.[4]

Furthermore, the relationship between third molar impactions and skeletal pattern is clinically significant because it affects not only the timing of third molar removal but also the overall orthodontic treatment plan. For example, early detection of impaction potential may guide interceptive extractions or influence the need for surgical planning in orthognathic cases.[5] Several studies have aimed to determine the prevalence of third molar impactions, yet few have distinctly evaluated the role of skeletal class in shaping these patterns. Investigating the association between skeletal class and impaction can provide valuable insight into the underlying etiology and help optimize treatment outcomes.[6-9] In orthodontic diagnosis and treatment planning, panoramic radiographs and cephalometric analyses are routinely employed to evaluate skeletal structure and dental alignment. Parameters like the ANB angle and Wits appraisal provide standardized methods for classifying skeletal malocclusions. Combining these assessments with third molar evaluation protocols such as Pell and Gregory and Winter's classifications enhances diagnostic accuracy and clinical decision-making.[10]

The rationale for conducting this study lies in the hypothesis that the skeletal anteroposterior relationship significantly alters third molar eruption patterns. Understanding these variations is crucial for clinicians to predict impaction likelihood and tailor interventions accordingly. The present study aims to explore and compare the frequency and nature of third molar impactions in patients with skeletal Class II versus Class III malocclusions.

MATERIALS AND METHODS

This retrospective cross-sectional study included orthodontic records of 120 patients (60 with skeletal Class II and 60 with Class III malocclusions) from dental hospitals in KP. Patients were selected based on the following criteria:

- Aged between 18–30 years
- Complete panoramic radiographs and lateral cephalograms
- Diagnosis of skeletal Class II or Class III based on ANB angle and Wits appraisal
- Absence of craniofacial anomalies or history of previous third molar extraction

Skeletal Classification

Skeletal pattern was determined using:

- ANB Angle: Class II (>4°), Class III (<0°)
- Wits Appraisal: Class II (>2 mm), Class III (< -2 mm)

Radiographic Evaluation

Panoramic radiographs were evaluated for:

- Presence/absence of third molars
- Angulation (Winter's classification): mesioangular, distoangular, vertical, horizontal
- Impaction depth and relation to ramus (Pell and Gregory classification: Class I, II, III; Position A, B, C)

Data were analyzed using SPSS v28. Chi-square tests compared frequency distributions of impactions. A p-value of <0.05 was considered statistically significant.

RESULTS

Total third molars assessed: 480 (120 patients × 4 molars. Overall impaction rate: 65.8% (316 impacted out of 480). Table 1 shows a higher frequency of maxillary impactions in Class II and mandibular impactions in Class III patients.

Table 1. Frequency of Impactions in Class II vs. Class III Patients

Skeletal Class	Maxillary Impactions	Mandibular Impactions	Total Impactions
Class II	138 (65.7%)	72 (34.3%)	210 (100%)
Class III	54 (35.5%)	98 (64.5%)	152 (100%)

Table 2 indicates mesioangular and vertical impactions are more common in Class II, while horizontal impactions are more frequent in Class III.

Table 2. Angulation of Impacted Third Molars

Angulation	Class II (n=210)	Class III (n=152)
Mesioangular	90 (43%)	43 (28%)
Vertical	78 (37%)	29 (19%)
Horizontal	23 (11%)	59 (39%)
Distoangular	19 (9%)	21 (14%)

Table 3 illustrates that deeper and more posterior impactions (Class III, Position C) are notably more prevalent in Class III patients.

Table 3. Depth and Ramus Relationship of Impactions

Classification	Class II (n=210)	Class III (n=152)
Class I, Position A	101 (48%)	33 (22%)
Class II, Position B	78 (37%)	47 (31%)
Class III, Position C	31 (15%)	72 (47%)

DISCUSSION

The findings of this study underscore the role of skeletal morphology in determining third molar impaction patterns. The significantly higher frequency of maxillary impactions in Class II patients is consistent with the understanding that maxillary protrusion or mandibular retrusion reduces posterior maxillary space, thereby increasing the likelihood of impaction. Conversely, the Class III skeletal configuration, often characterized by mandibular overgrowth, results in greater posterior mandibular crowding, explaining the predominance of mandibular impactions.

The findings of this study underscore the pivotal role of skeletal morphology in determining third molar impaction patterns. The significantly higher frequency of maxillary impactions in Class II patients aligns with earlier observations by Nasim et al. (2024)[11] and Al-Madani et al. (2024)[12], who reported that maxillary third molars in patients with retrognathic mandibles often face eruption difficulties due to spatial limitations in the posterior maxilla.

In contrast, the predominance of mandibular impactions in Class III patients found in our study is consistent with Ziv-On et al. (2025)[13] and Pinto et al. (2024)[14], who observed that patients with mandibular prognathism frequently exhibit insufficient space distal to the second molar due to the forward positioning of the mandible, resulting in impacted mandibular third molars, often horizontally angulated.

The angulation patterns observed in our study where mesioangular and vertical impactions were most frequent in Class II agree with Choi et al. (2025)[15], who reported a high incidence of mesioangular impactions in populations with reduced mandibular growth, suggesting an adaptive eruption path in restricted spaces. Horizontal impactions, being more frequent in Class III patients in our results, mirror the findings of Idris (2021)[16], who noted that horizontal impactions often arise when the eruption path is completely blocked due to an elongated mandibular arch and altered eruption vectors.

The depth and ramus relationship, specifically the higher prevalence of Class III, Position C impactions in skeletal Class III cases, corroborates with Dudde et al. (2024)[17] and Choi et al. (2025)[15], who highlighted that skeletal discrepancies often influence the impaction depth, with deeper impactions frequently seen in skeletal Class III due to a posteriorly directed growth pattern and limited mandibular retromolar space.

Importantly, few studies have directly compared Class II versus Class III skeletal patterns in the context of third molar impaction. Our study contributes uniquely to this area by using standardized skeletal indicators (ANB angle and Wits appraisal) alongside established impaction classifications (Pell and Gregory, Winter's classification). These findings underscore the value of a combined cephalometric and panoramic approach for predicting impaction risk.

From a clinical perspective, the results emphasize the need for individualized treatment planning. For Class II patients, proactive assessment and potentially early extraction of maxillary third molars may be advisable. In Class III patients, mandibular third molars warrant close observation due to their deeper and more complex impactions, often requiring surgical intervention. These insights echo the clinical recommendations of Naraynsingh (2024)[18], who advocated early intervention strategies tailored to skeletal morphology.

Future studies employing 3D imaging techniques, such as cone-beam computed tomography (CBCT), may further elucidate the spatial constraints and eruption trajectories involved, offering a more precise assessment of third molar development relative to skeletal structure.

CONCLUSION

Skeletal class is a significant determinant in third molar impaction patterns, with each class presenting unique clinical challenges. Awareness of these differences can enhance orthodontic outcomes and minimize complications associated with third molar management.

Conflict of Interest

None

Authors' Contribution

Concept and Design: Saif Ullah, Sarfaraz Khan, Zubair Nasir.
Acquisition, Analysis or Interpretation of Data: Atika Noor, Sarfaraz Khan, Zubair Nasir.
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