International Journal of Health and Medicine
Volume 2, Number 1 Year 2025
e-ISSN: 3047-793X, p-ISSN: 3047-7948, Page 278-283
DOI: https://doi.org/10.62951/ijhm.v2i1.253
Available online at: https://international.arikesi.or.id/index.php/IJHM

Radiographic Comparison of Mandibular Third Molar Mesioangulation in Orthodontic Treatment : Assessing the Impact of First Premolar Extraction Versus Non-Extraction Strategies

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Abstract. *The angulation of third molars plays a crucial role in dental health and orthodontic outcomes. This review examines changes in third molar mesioangulation after orthodontic treatment, comparing cases involving first premolar extractions with non-extraction protocols. Research has shown that premolar extractions often result in significant improvements in third molar angulation, promoting easier eruption and reducing the likelihood of impactions. Conversely, non-extraction cases generally demonstrate less favorable changes, with a higher frequency of impactions and limited spontaneous correction of molar positioning. The extent and direction of these changes depend on individual factors such as the degree of crowding and the developmental stage of the third molars at the start of treatment. Premolar extraction during orthodontic procedures appears to enhance third molar angulation, potentially lowering the risk of impaction and reducing the need for surgical removal. However, some studies highlight the influence of individual anatomical variations, suggesting that premolar extraction does not consistently produce uniform angulation changes in all patients. Therefore, orthodontic treatment planning should weigh the potential advantages of premolar extractions in improving third molar alignment, especially for patients with a higher risk of molar impaction.*

Keywords *Third Molar Mesioangulation; Premolar Extraction; Orthodontic Outcomes; Molar Impaction Risk, Panoramic Radiograph.*

1. INTRODUCTION

The development and influence of mandibular third molars on the dental arch have been widely debated, capturing the attention of specialists from various dental fields. Third molars are well-known among dental professionals and researchers for their unpredictable growth and complex eruption patterns, which set them apart in dental anatomy. The inconsistency and variability of third molar eruptions present significant challenges in clinical practice. Unlike other teeth with more predictable eruption patterns, third molars often display irregular trajectories, resulting in a high rate of impactions. This unpredictability makes managing third molars particularly difficult.

On average, the full eruption of third molars occurs earlier in males, with an estimated age of 20.33 ± 2.566 years (Putul, 2021). Several factors contribute to the likelihood of third molar impaction, including limited jaw space, anomalies in skeletal development, increased tooth dimensions, and delayed third molar maturation (Madani, 2024). Among all teeth, third molars are the most frequently impacted, particularly in the mandibular region. Statistics show that 57.3% of impacted third molars occur in the mandible, compared to 42.7% in the maxilla. Among various impaction patterns, the mesioangular

Received: December 17, 2024; Revised: December 31, 2024; Accepted: January 23, 2025; Published: January 27, 2025

orientation is the most common, representing 45.38% (n=344) of mandibular third molar impactions, followed by vertical impactions at 32.85% (n=249) (Lamichhane, 2023).

The extraction of premolars has been found to significantly improve the chances of successful third molar eruption (Brezulier, 2017). This improvement can be attributed to the additional space and changes in dental arch dynamics that result from premolar removal, which create a more favorable environment for the alignment and eruption of third molars.

Panoramic radiography is a key diagnostic tool for evaluating the positioning and angulation of third molars. This imaging technique offers a broad view of the maxillofacial region, making it possible to assess the spatial relationship of third molars to adjacent structures. It also allows clinicians to evaluate factors such as angulation, proximity to neighboring teeth, and patterns of impaction. Panoramic imaging has proven effective in analyzing common impaction patterns, such as mesioangular and vertical orientations, which supports more accurate diagnosis and treatment planning.

This review focuses on assessing the radiographic outcomes of third molar positioning following orthodontic treatment. It emphasizes the importance of non-invasive approaches in orthodontic planning, particularly in cases involving first premolar extractions. Premolar removal can significantly influence the space available in the dental arch and subsequently affect third molar eruption. By comparing changes in third molar angulation between patients who underwent premolar extractions and those who did not, this review aims to provide clinicians with evidence-based recommendations for patient-centered orthodontic treatment planning.

2. METHODS

In writing this literature review, the method used is a literature search in the form of theories and research data related to the comparison between third molar mesioangulation in orthodontic treatment with and without premolar extraction through Elsevier, Pubmed, and ScienceDirect. Journal searches were conducted using the keywords “Third Molar Mesioangulation, Premolar Extraction, Orthodontic Outcomes. Impacted Teeth, Panoramic Radiograph”

Table 1. Journal Inclusion Criteria

Criteria	**Inclusion**
Timeframe	2004-2024
Language	English and/or Indonesian
Journal Type	Research, Clinical trial, and/or Article review
Theme/Content	Comparison of third molar mesioangulation in orthodontic treatment with and without premolar extraction intervention

Initial searches across databases such as Elsevier, PubMed, and ScienceDirect yielded a broad range of studies, which were then filtered based on the inclusion criteria of publication timeframe (2004–2024), language (English and/or Indonesian), journal type (research and clinical trials), and relevance to the theme of third molar mesioangulation and orthodontic outcomes. Each article was assessed for eligibility based on its title and abstract, followed by a full-text review. Studies were included if they provided specific data or comparisons on the influence of premolar extractions on third molar angulation, with a focus on panoramic radiographic evaluations. To minimize bias, independent reviewers cross-checked the selected studies, and any discrepancies were resolved through discussion or consultation with a third reviewer.

The journal analysis involved providing a brief overview of journal contents related to the comparison between third molar mesioangulation in orthodontic treatment with and without premolar extraction as presented in each journal.

3. RESULTS AND DISCUSSION

The results obtained based on research conducted by researchers state that in the extraction group there was an The research findings indicate that in the premolar extraction group, there was a significant increase in third molar angulation. In male samples, the non-extraction therapy group showed an average increase in third molar angulation of 2.35 degrees, while the extraction therapy group recorded an average increase of 9.30 degrees after treatment. For female samples, a higher level of significance was observed ($p=0.001$) compared to males ($p=0.006$), with an average increase in angulation of 2.41 degrees in the non-extraction group and 9.5 degrees in the extraction group after treatment. These results demonstrate a clear difference in third molar (M3) angulation between orthodontic patients treated with and without premolar extraction. First premolar extraction creates additional space in the dental arch, allowing for the movement of other teeth. This additional space helps adjust the third molar's angulation, enabling it to grow more vertically (Huda, 2013).

From this, it can be concluded that planning orthodontic treatment is crucial, particularly in cases with a risk of third molar impaction. First premolar extraction can be considered for patients with small dental arches requiring additional space, as it provides sufficient room for the third molar to grow with proper angulation. Beyond changes in third molar angulation, premolar extraction can also impact facial aesthetics and dental stability. Extracting premolars can reduce dental protrusion, creating a more harmonious facial profile, especially in patients with crowded dental arches and protrusive teeth (Narmada, 2022).

These findings align with previous studies, which show that premolar extraction improves third molar angulation, thereby reducing the risk of impaction. For example, a study by Saysel et al. reported changes in third molar angulation in orthodontic patients treated with premolar extraction. This consistency supports the notion that first premolar extraction positively contributes to improving third molar angulation.

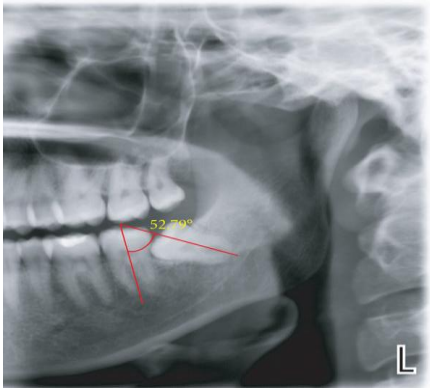

Figure 1

Changes in third molar angulation can be assessed through panoramic radiography, which serves as a key diagnostic tool for evaluating the position and angle of third molars in the jaw. In this study, radiography played a role in measuring the mesial tilt of the third molar. Panoramic radiography provides a comprehensive visualization of the relationship between the third molar and surrounding structures, such as the mandibular canal, jawbone, and available eruption space. Using reference planes like the occlusal plane, this technique enables accurate measurements of molar inclination angles (Vranckx et al., 2019).

By conducting radiographic analyses of differences in third molar angulation in patients undergoing orthodontic treatment with and without premolar extraction, treatment strategies can be optimized, particularly for patients at risk of third molar impaction. Radiographs not only provide direct visualization of the third molar's position and angle but also deliver objective data that supports clinical decision-making (Mihai et al., 2013).

Third molar angulation is measured by determining its position relative to the occlusal plane of the adjacent second molar. The process begins with identifying anatomical landmarks, where the long axis of the third molar is defined as a straight line from the crown tip (cusps) to the root apex. Reference planes, such as the second molar's occlusal plane or the mandibular baseline, are drawn based on the analysis needs. Once these lines are established, the angle is measured using a protractor. The center of the protractor is placed at the intersection point between the third molar's long axis and the reference plane, and the angle formed is carefully recorded. The angle is then categorized as mesioangular (less than 90° with forward tilt), vertical (approximately 90°), or distoangular (more than 90° with backward tilt). To ensure accuracy, each sample is measured three times, and the results are averaged. If there are multiple observers, the results are compared to minimize errors (Jung & Cho, 2015).

4. CONCLUSION

This review evaluated the alterations in third molar angulation following orthodontic treatment between groups with and without first premolar extraction. The results highlight that premolar extraction during orthodontic treatment can significantly influence third molar angulation, with greater changes observed in the extraction group compared to the non-extraction group. This outcome is likely attributed to the additional space generated by the removal of first premolars, which facilitates better alignment and angulation of the third molars, potentially lowering the likelihood of impaction. However, some studies indicate that third molar angulation is also substantially affected by individual anatomical and developmental factors, suggesting that premolar extraction does not always result in consistent angulation changes. This emphasizes the necessity of tailoring orthodontic treatment plans to each patient, particularly in cases where there is a heightened risk of third molar impaction. The findings from this study offer valuable insights for clinical decision-making regarding space management in orthodontics and contribute to minimizing the risk of complications associated with third molar impaction in the future

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