



## Evaluation of the Mesiodistal Angulations of Maxillary and Mandibular Permanent Canines, 1st Premolar, 2nd Pre Molar, 1st Molar and 2nd Molar in Relation to Infraorbital and Bi-Gonial Plane in Angles Class I ,Class II, Class III Malocclusions Seen in Panoramic Radiographs

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### KEYWORDS

Infraorbital,  
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### ABSTRACT:

Three goals of orthodontic treatment are stability, aesthetics, and functional occlusion. Placing orthodontically treated teeth in the proper mesiodistal angulation is crucial for balancing occlusal forces and proper function, which in turn ensures stability of the maxillofacial complex. The panoramic radiograph is the technique that is most frequently used to assess root parallelism following orthodontic treatment, as well as to offer information about the teeth and their axial inclinations. Panoramic imaging has useful for this purpose and is a valuable screening tools in diagnosis and planning treatment of orthodontic patients. Axial inclinations should be examined both clinically and radiographically. The panoramic radiograph proved to be an important and valuable tool for assessing mesiodistal axial inclination. The aim of this retrospective study to evaluate the mesiodistal angulation of maxillary and mandibular permanent canines, 1<sup>st</sup> premolar, 2<sup>nd</sup> premolar, 1<sup>st</sup> molar and 2<sup>nd</sup> molar in relation to infra orbital and bi-gonial plane in Angles Class I, Class II, Class III malocclusions. valuable tool for assessing mesiodistal axial inclination.

**Methodology:** It was a Retrospective Study in the Department of Orthodontics And Dentofacial Orthopedics. Ethical committee approval has obtained from the Institutional Ethical Committee. In this retrospective study, pre- and post-treatment panoramic radiographs of 50 patients. The calculated sample size was 50 patients departmental OPG was included in the study. Inclusion Criteria was no severe skeletal anomalies (vertical, transversal, and/or sagittal), No need for fixed or removable functional treatment, Completed permanent dentition, no missing or impacted teeth. No abnormal crown/root morphology, treated with fixed preadjusted orthodontic appliance using a 0.018 and 0.022-inch slot MBT prescription, having a 3 mm or less crowding for non-extraction cases, having a 7 mm or more crowding for extraction cases, Completed fixed orthodontic treatment, and Pre and post-treatment panoramic radiographs with good image quality and high resolution. A for measuring the various parameters like mesiodistal angulation.

### Introduction:

To ensure stability of the maxillofacial complex, it is essential to position the teeth with orthodontic treatment

in the correct mesiodistal angulation in order to balance occlusal forces and appropriate function.<sup>1</sup>Evaluating the axial inclinations of teeth has significant relevance to



orthodontics<sup>1</sup>The panoramic radiograph is the technique that is most frequently used to assess root parallelism following orthodontic treatment, as well as to offer information about the teeth and their axial inclinations.

Panoramic imaging will be useful for this purpose and is a valuable screening tool in diagnosis and planning treatment of orthodontic patients. Three goals of orthodontic treatment are stability, aesthetics, and functional occlusion. After active treatment, all teeth must have optimal axial inclinations as a need for achieving a functional occlusion. establishing adequate axial inclinations of the teeth with nearly parallel roots is another goal of orthodontic treatment. In an occlusion analysis, the mesiodistal axial inclination (tip) of permanent teeth should also be considered. Axial inclinations should be examined both clinically and radiographically at the start and conclusion of orthodontic therapy. The aim of this retrospective study to evaluate the mesiodistal angulations of maxillary and mandibular permanent canines, 1<sup>st</sup> premolar, 2<sup>nd</sup> pre molar, 1<sup>st</sup> molar and 2<sup>nd</sup> molar in relation to infraorbital and bi-gonial plane in Angles Class I, Class II, Class III malocclusions.

## Research Methodology

### Study Design

- **Type:** Retrospective study

**Study Setting Location:** Dentofacial Orthopedic and Orthodontics Department

### Ethical Considerations

- **Approval:** Ethical committee approval was obtained from the Institutional Ethical Committee.

### Study Population

- **Participants:** 50 patients
- **Data Collection:** Pre- and post-treatment panoramic radiographs of these patients were used.

### Inclusion Criteria

No prior orthodontic treatment,

No severe skeletal anomalies (vertical, transversal, and/or sagittal),

No need for fixed or removable functional treatment,

Completed permanent dentition, no missing or impacted teeth except (18,28,38,48 )

No abnormal crown/root morphology,

Treated with fixed preadjusted orthodontic appliance using a 0.018 and 0.022-inch slot MBT prescription, having a 3 mm or less crowding for non-extraction cases, having a 7 mm or more crowding for extraction cases,

Completed fixed orthodontic treatment, and

Pre- and post-treatment panoramic radiographs with good image quality and high resolution.

### Exclusion criteria

prior orthodontic treatment,

Severe skeletal anomalies (vertical, transversal, and/or sagittal),

Need for fixed or removable functional treatment,

Mixed dentition, missing or impacted teeth,

Abnormal crown/root morphology,

Un Completed fixed orthodontic treatment, and

Pre- and post-treatment panoramic radiographs with low image quality and low resolution.

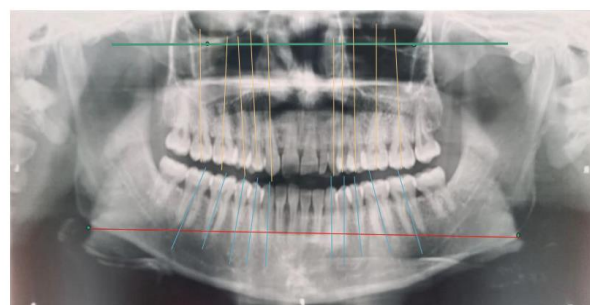
### Radiograph Analysis

- **Time Points:**

**T0:** Before fixed orthodontic treatment

**T1:** After fixed orthodontic treatment

- **Standardization:** Panoramic radiographs were taken at a standardized level for consistency.



### Explanation of Procedures

In this retrospective study, panoramic radiographs of 50 patients were analyzed before (T0) and after (T1) their



fixed orthodontic treatments. These radiographs were taken at a standardized level to ensure consistency and accuracy in the analysis. The study focused on evaluating changes in the dentofacial structure resulting from the orthodontic treatment.

The data collection and analysis were conducted within the Dentofacial Orthopedic and Orthodontics Department, following approval from the Institutional Ethical Committee to ensure ethical compliance.

## Results

### Maxillary Teeth:

Significant differences were found between Class I, II, and III malocclusions for the left canine, right 1st premolar, left 1st premolar, right 1st molar, left 1st molar, right 2nd molar, and left 2nd molar. Highly significant differences ( $p < 0.001$ ) were noted particularly between Class I and III, and Class II and III malocclusions for these teeth.

### Mandibular Teeth:

Significant differences were found between Class I, II, and III malocclusions for the left 1st premolar only. The right 1st molar, left 1st molar, right 2nd molar, and left 2nd molar did not show significant differences across classes.

Overall, the study highlights the significant differences in mesiodistal angulation of certain maxillary and mandibular teeth post-treatment among patients with different classes of malocclusion.

## Discussion

There is a correlation between the mesiodistal angulations of maxillary permanent canines, 1st premolar, 2nd premolar, 1st molar, and 2nd molar in relation to the infraorbital plane in Angles Class I, Class II, and Class III malocclusions as seen in panoramic radiographs.

The study found significant differences in mesiodistal angulations for several maxillary teeth post-treatment, particularly between Class I and III, and Class II and III malocclusions. Specifically, significant differences were noted for the left canine, right 1st premolar, left 1st

premolar, right 1st molar, left 1st molar, right 2nd molar, and left 2nd molar. The highly significant differences ( $p < 0.001$ ) suggest that the mesiodistal angulations of these teeth are correlated with the infraorbital plane in different malocclusion classes, thus rejecting the null hypothesis.

For mandibular teeth, significant differences in mesiodistal angulation were found only for the left 1st premolar across malocclusion classes, with Class I vs III and Class II vs III showing significant differences ( $p = 0.01$  and  $p = 0.002$ , respectively). Other mandibular teeth did not show significant differences, indicating that the mesiodistal angulations of most mandibular teeth are not strongly correlated with the bi-gonial plane across different malocclusion classes, partially supporting the null hypothesis.

There is a correlation between the mesiodistal angulations of maxillary and mandibular permanent canines, 1st premolar, 2nd premolar, 1st molar, and 2nd molar in relation to the infraorbital and bi-gonial planes in Angles Class I, Class II, and Class III malocclusions as seen in panoramic radiographs.

The significant differences in mesiodistal angulations for several maxillary teeth and the left mandibular 1st premolar post-treatment suggest a correlation with the infraorbital and bi-gonial planes in different malocclusion classes. However, the lack of significant differences for most mandibular teeth implies a more complex relationship. Therefore, while there is some support for the hypothesis, it is not uniformly strong across all teeth, indicating a partial rejection of the null hypothesis.

## Conclusion

The significant differences observed in the mesiodistal angulation of maxillary teeth post-treatment support the hypothesis that these angulations may correlate with the infraorbital plane in different classes of malocclusion. However, for the mandibular teeth, the significant difference found only in the left 1st premolar suggests a less consistent correlation with the bi-gonial plane. Further analysis is needed to explore these correlations and validate the hypotheses.



	Rt. Canine Mean (SD)	Lt. Canine Mean (SD)	Rt 1 <sup>st</sup> PM Mean (SD)	Lt 1 PM Mean (SD)	Rt 1 <sup>nd</sup> M Mean (SD)	Lf 1 <sup>st</sup> M Mean (SD)	Rt 2 <sup>nd</sup> M Mean (SD)	Lf 2 <sup>nd</sup> M Mean (SD)
<b>Class I</b>	90.25 (2.71)	91.07 (2.51)	91.4 (1.75)	92.85 (1.39)	92.7 (3.39)	92.15 (4.99)	95.9 (10.1)	94.27 (9.02)
<b>Class II</b>	90.18 (2.32)	88.94 (2.27)	91.73 (2.28)	92.1 (1.52)	91.89 (3.46)	94.15 (5.72)	94.31 (9.78)	95.26 (8.9)
<b>Class III</b>	91.0 (4.63)	88.88 (3.55)	84.88 (1.16)	85.44 (6.72)	83.22 (3.96)	79.33 (6.53)	81.0 (7.44)	80.0 (11.31)
<b>One way Anova F test value</b>	F = 0.248	F = 3.853	F = 45.0	F = 18.7	F = 24.5	F = 22.8	F = 8.12	F = 9.01
<b>p value, Significance</b>	p = 0.781	p = 0.029*	p < 0.001**	p < 0.001**	p < 0.001**	p < 0.001**	p = 0.001*	p = 0.001*
<b>Class I vs II<sup>^</sup></b>	p = 0.997	p = 0.04*	p = 0.846	p = 0.740	p = 0.757	p = 0.506	p = 0.863	p = 0.943
<b>Class I vs III<sup>^</sup></b>	p = 0.810	p = 0.109	p < 0.001**	p < 0.001**	p < 0.001**	p < 0.001**	p < 0.001**	p = 0.001*
<b>Class II vs III<sup>^</sup></b>	p = 0.783	p = 0.998	p < 0.001**	p < 0.001**	p < 0.001**	p < 0.001**	p < 0.001**	p = 0.001*

**Table 1: Comparison of Mesiodistal Angulation of Maxillary Canine, 1st Premolar, 1st Molar, 2nd Molar in post treatment between Class I, Class 2, Class III malocclusion respectively**

**Table 2: Comparison of Mesiodistal Angulation of Mandibular Canine, 1st Premolar, 1st Molar, 2nd Molar in post treatment between Class I, Class 2, Class III malocclusion respectively**

<b>Mandibular</b>	Rt. Canine Mean (SD)	Lt. Canine Mean (SD)	Rt 1 <sup>st</sup> PM Mean (SD)	Lt 1 PM Mean (SD)	Rt 1 <sup>nd</sup> M Mean (SD)	Lf 1 <sup>st</sup> M Mean (SD)	Rt 2 <sup>nd</sup> M Mean (SD)	Lf 2 <sup>nd</sup> M Mean (SD)
<b>Class I</b>	91.25 (4.36)	90.45 (4.32)	88.65 (7.53)	89.78 (5.4)	71.7 (14.99)	73.17 (14.04)	70.5 (11.5)	71.42 (10.87)
<b>Class II</b>	90.47 (4.93)	89.47 (6.04)	89.52 (8.28)	91.26 (5.6)	74.42 (15.77)	75.63 (13.74)	71.15 (11.95)	72.36 (12.3)
<b>Class III</b>	87.33 (0.7)	88.66 (3.96)	83.0 (7.24)	82.61 (7.16)	78.38 (7.3)	74.83 (5.67)	70.11 (4.88)	72.11 (7.16)
<b>One way Anova F test value</b>	F = 2.727	F = 0.431	F = 2.285	F = 7.00	F = 0.693	F = 0.183	F = 8.034	F = 0.038



<b>p value, Significance</b>	<b>p =0.076</b>	<b>P =0.653</b>	<b>p=0.113</b>	<b>p=0.002*</b>	<b>p=0.506</b>	<b>p=0.833</b>	<b>p=0.967</b>	<b>p =0.963</b>
<b>Class I vs II<sup>^</sup></b>	<b>P =0.835</b>	<b>P =0.818</b>	<b>p =0.934</b>	<b>p=0.709</b>	<b>p=0.824</b>	<b>p=0.82</b>	<b>p=0.980</b>	<b>p=0.961</b>
<b>Class I vs III<sup>^</sup></b>	<b>P =0.065</b>	<b>p=0.653</b>	<b>p=0.179</b>	<b>p=0.01*</b>	<b>p=0.479</b>	<b>p=0.944</b>	<b>p=0.996</b>	<b>p=0.987</b>
<b>Class II vs III<sup>^</sup></b>	<b>P =0.170</b>	<b>p=0.917</b>	<b>p=0.108</b>	<b>p=0.002*</b>	<b>p=0.772</b>	<b>p=0.987</b>	<b>p=0.969</b>	<b>p=0.998</b>

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