

# “Evaluation of Effects of First Premolar Extraction on Third Molar Angulation Changes in Class II Malocclusion-A Radiographic Study”.

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**Abstract** Background: Third molars present more problems than other teeth because they are the last teeth to erupt, and so it is important to assess their development when designing an orthodontic treatment plan. The aim of this study was to compare the angulation of the mandibular third molar and retromolar space before and after orthodontic treatment in cases involving first premolar extraction.

Records of 50 non extraction and 50 1<sup>st</sup> premolar extraction patients were examined, the pre-treatment and post treatment pantomograph were digitized and various angular and linear measurements were made. Changes in third molar angulations from pre-treatment to post-treatment for the two groups were compared for statistical differences using student's t test. Statistical analysis shows that there is no significant difference in the change in third molar angulation in either group. Results suggest that factors other than premolar extraction may affect the third molar angulation.

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## I. Introduction

Third molars hold a unique position in the dentofacial complex because of their formation, development and evolution. Generally, they begin their formation at 8-9 years of age and emerge into oral cavity around the age of 18-25 years.

Development of third molars and their influence on dental arches has been of great concern to the dental profession.<sup>1</sup>

In modern population, impaction rate is higher for third molars than any other tooth.

Reasons for impactions are multifactorial but some of the common reasons are listed below<sup>2</sup> -

- Inadequacy of retromolar space.
- If remodeling of ascending ramus is arrested the eruption of third molar will come to standstill.
- Lack of compensatory periosteal apposition at posterior border of maxillary tuberosity.
- Direction of tooth eruption during functional phase of eruption.

Sometimes, third molars are ignored when drawing up an Orthodontic treatment plan; it is assumed that they will not erupt, a situation that will indicate their removal. But it is important to conserve all dental organs and to maintain maximum masticatory function as a key treatment objective. Nevertheless, it has been estimated that 54% of mandibular third molars are removed prophylactically, even though they do not present any subjective symptoms<sup>3</sup>

Orthodontic closure of premolar extraction site has been associated with significant up righting of third molars<sup>4</sup>

In 1987, M. Richardson observed an increase in retromolar space after a five-year follow-up in a group of patients. He hypothesized that this was due to remodeling in the retromolar area and to mesial movement of the first molar<sup>5</sup>.

Developing third molars continually change their angular position and undergo important pre-eruptive rotational movements. These rotational movements take place when third molar bud comes into close proximity to the second molar<sup>6</sup>. Richardson found that there was an average change of 11.2 degrees of mandibular third molar between 10 and 15 years of age with respect to the mandibular plane. This indicated a tendency for the tooth to become upright, with the angle of mandibular third molar to the mandibular plane tending to decrease. These rotational movements are extremely important since, if they fail to occur, impactions are inevitable<sup>7</sup>. Therefore, it will be useful to know the effect of appliance therapy on final and crucial rotational movement of developing third molars.

There is strong possibility that appliance therapy that holds back mandibular molars or actively tips them distally may have the effect of encouraging abnormal rotational movements and uprighting rotational changes in the developing third molars, thereby increasing the possibility of eruption. Extraction of premolars to allow mesial drifting of the buccal segments has been the subject of many investigations<sup>8,9</sup>.

The orthodontist should be aware of the relationship of the mandibular third molars to the remaining teeth in the dental arch. The main points to be decided are whether these teeth will erupt or become impacted, whether they will cause crowding of the mandibular anterior teeth, and whether the extraction of other teeth will prevent crowding and influence their eruption.<sup>10</sup>

Prophylactic removal of third molars are generally done by the orthodontist and general practitioner to prevent future crowding, relapses, or to prevent further pathology like cyst or pericoronitis, or TMJ dysfunction.<sup>11</sup>

But if this study reveals any significant findings, then we can preserve the third molars which can be advantageous for an orthodontist as well as for the patient in many ways like –

In cases of missing or grossly decayed 2<sup>nd</sup> molars, mesialization of 3<sup>rd</sup> molars can be used as a treatment. Unnecessary surgical exposure and discomfort to the patient can also be prevented.

This study is planned to assess and evaluate the changes in the third molars angulations relative to the reference plane and to the second molar long axis. These changes were compared in the patients treated with extraction of premolars and in patients treated with non-extraction.

For orthodontist the decision whether or not to remove third molars could be postponed until the end of orthodontic treatment except for situations in which removal of third molar is mandatory since beginning of the treatment.

Follow up evaluation of third molars position during treatment can contribute to more realistic prognosis.

## **II. Aim And Objectives**

AIM- Evaluation of third molar angulation changes in premolar extraction and non-extraction cases of class-II malocclusion.

OBJECTIVES-

1. To study the various angular and linear changes in third molar position in pre-treatment and post treatment orthopantomograph in extraction cases in class II malocclusion.
2. To study the various angular and linear changes in third molar position in pre-treatment and post treatment orthopantomograph in non-extraction cases in class II malocclusion.
3. To study the various angular and linear changes in third molar position in in extraction and non-extraction cases in class II malocclusion.

## **III. Materials And Methods**

The sample of this study included pre-treatment and post treatment orthopantomographs (OPGs) of 100 patients treated by fixed orthodontic appliances at the department of orthodontics. All patients had skeletal or dental class II malocclusion treated with and without premolar extraction. Fifty patients were treated without extractions and fifty were treated with four premolar extractions. Pre-treatment ages of extraction and non-extraction patient ranged from 15 to 25 years. All pre-treatment orthopantomographs were taken 1 month prior to start of orthodontic treatment. All of the post-treatment pantomographs were taken on the day the active orthodontic appliances were removed or within one month of debonding. All pre and post treatment radiographs were taken on the same radiographic unit. Both pre and post treatment radiographs were traced on matte acetate paper.

**INCLUSION CRITERIA-**

- 1) High quality pre and post treatment pantographs without any magnification and distortion errors.
- 2) Patients with skeletal or dental class II malocclusion with moderate anchorage requirement.
- 3) Age group-15-25 years
- 4) Bilaterally unerupted third molars which can be seen clearly on panoramic radiograph.
- 5) Treatment of extraction case includes full closure of extraction spaces.
- 6) Patients with No missing teeth and with no history of any previous extraction.
- 7) With no history of previous orthodontic or orthognathic surgical treatment.

**EXCLUSION CRITERIA-**

- 1) Patients with congenitally missing tooth or impacted tooth and transposed tooth
- 2) Patients with Craniofacial syndromes.
- 3) History of Previous orthodontic treatment,

- 4) Poor quality radiographs
- 5) Patient with dentofacial deformity, developmental anomalies or facial asymmetry
- 6) Patient with erupted third molars at start of the treatment.

**Sample Size Calculation:** Quota sampling technique was adopted to select sample orthopantomographs of the patients attending to the Department of Orthodontics and Dentofacial Orthopaedics, Triveni Institute Of Dental Sciences, Hospital And Research Centre, Bilaspur Chhattisgarh, India.

The total sample size in this study was 100 (50 in each group)

#### **MATERIALS USED:**

1. Orthopantomogram
2. Acetate tracing paper of 0.003 inches thickness and 0.5 mm Hard and Black tracing pencil.
3. Geometry box with a complete set of instruments such as scale, protractor etc.
4. Illuminated view box
5. Paper clips

#### **IV. Methodology**

Before the commencement of the study, ethical clearance was obtained from Institutional Ethical Review Board of Triveni Institute of Dental Sciences, Hospital and Research Centre, Bilaspur.

**Source of Data:** Orthopantomographs were obtained from patients coming to the Department of Orthodontics. The PLANMECA PROLINE XEC, Digital Cephalostat machine was used for all OPGs. The exposure parameters for all radiographs were according to PLANMECA PROLINE XEC, Digital Cephalostat machine catalogue. Radiographs were taken by a single trained radiographic technician on patients standing in natural head position.

This study was designed to study the effects of extraction and non-extraction in patients undergoing orthodontic treatment on third molar angulations. It had 2 groups, one control i.e., patient treated with non-extraction and other experimental wherein patients were treated with premolar extractions.

Tracing of all the teeth has been done on OPG, Position of third molars were analyzed before and after orthodontic treatment.

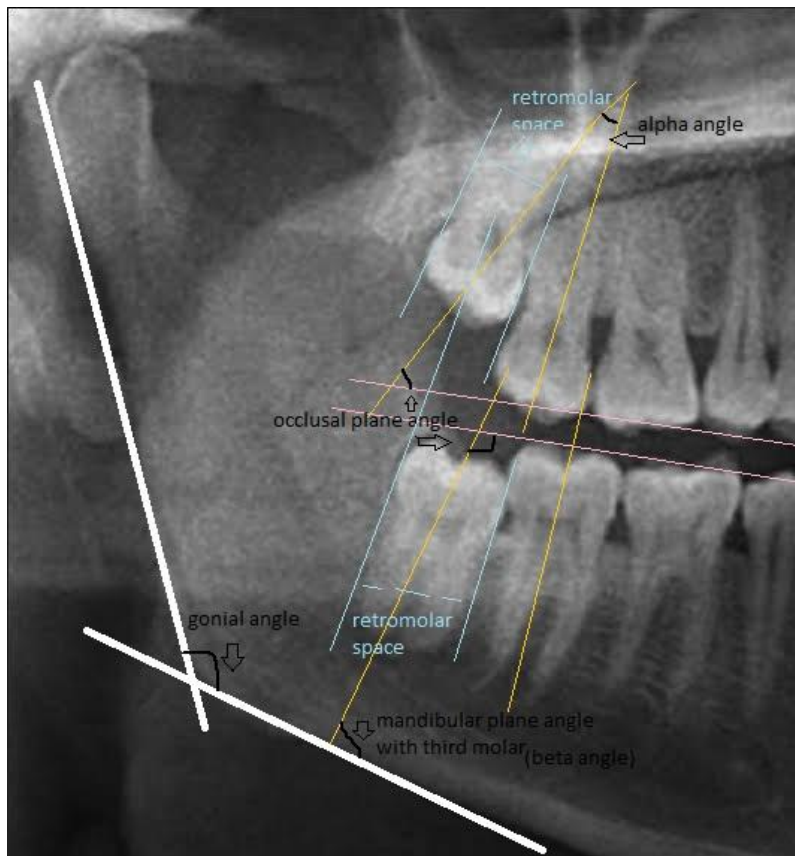
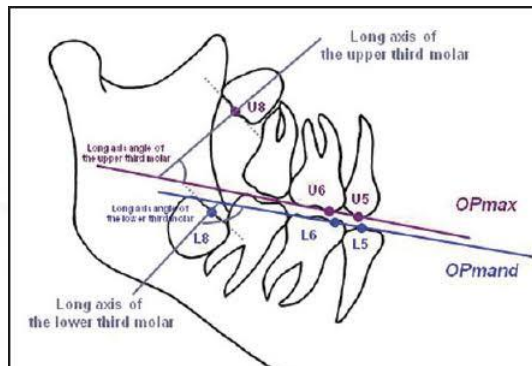
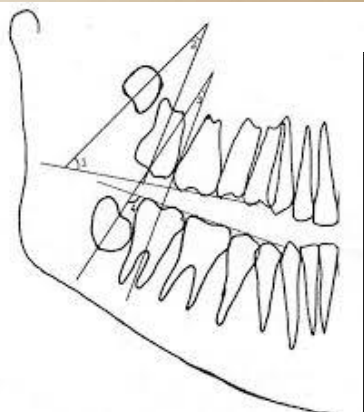
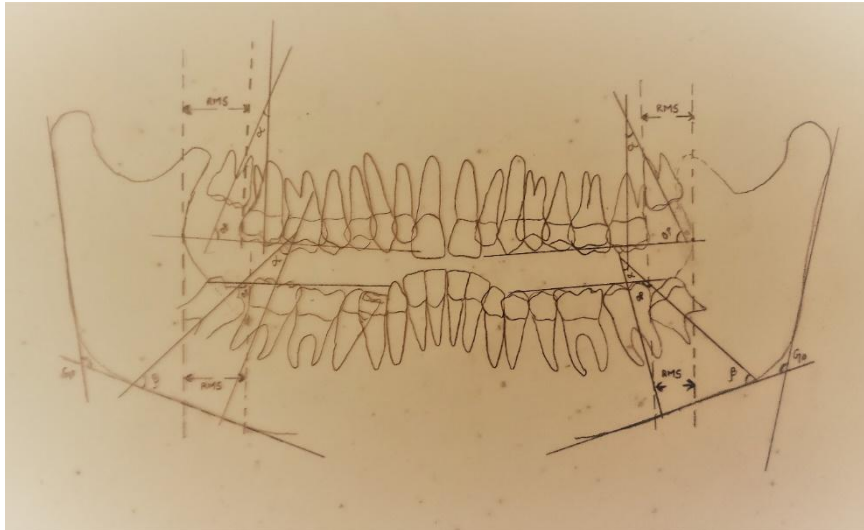
The following series of linear and angular measurement were made.

Angles included in the study are-

- ALPHA ANGLE- intersection of longitudinal axes of the third molar and the second molar.
- BETA ANGLE- intersection of the longitudinal axis of the third molar and the mandibular plane.
- GONIAL ANGLE- effect of third molars on gonial angle (angle between imaginary tangential line along the inferior border of mandible and along the posterior border of ramus.)
- OCCLUSAL PLANE ANGLE- effect of third molars on occlusal plane.

Linear measurement includes-

- RETROMOLAR SPACE- effect of third molar on retromolar space available in maxilla and mandible.



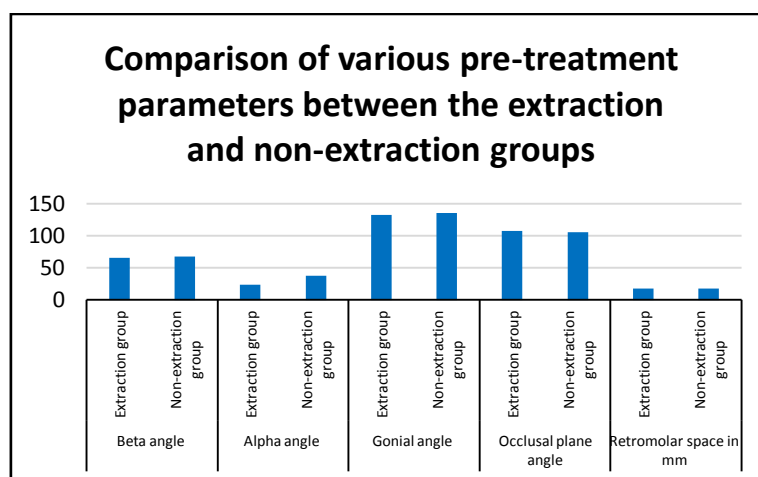
### V. Result

The data was tabulated in Microsoft Excel software and analyzed with SPSS V.24 software. Independent t test was used for the comparisons between the groups. The p value  $\leq 0.05$  was considered as statistically significant.

**Table 1. Comparison of various pre-treatment parameters between the extraction and non-extraction groups**

Variable	Group	Mean	SD	Mean Difference	P value
Beta angle	Extraction group	66.2	11.4	2.0	0.239
	Non-extraction group	68.2	12.3		
Alpha angle	Extraction group	23.6	2.8	13.8	0.000*
	Non-extraction group	37.4	8.5		
Gonial angle	Extraction group	133.2	6.7	2.5	0.004*
	Non-extraction group	135.7	5.2		
Occlusal plane angle	Extraction group	107.8	9.4	1.6	0.230
	Non-extraction group	106.2	10.1		
Retromolar space in mm	Extraction group	17.9	3.6	0.3	0.545
	Non-extraction group	18.2	3.7		

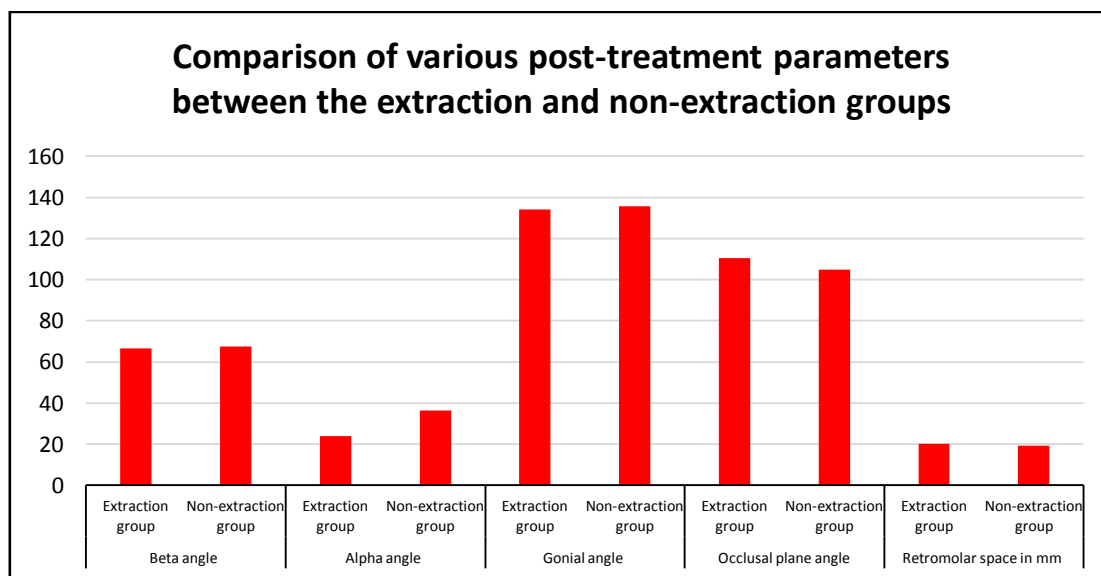
\*Statistically significant difference exists between the groups



**Table 2. Comparison of various post-treatment parameters between the extraction and non-extraction groups**

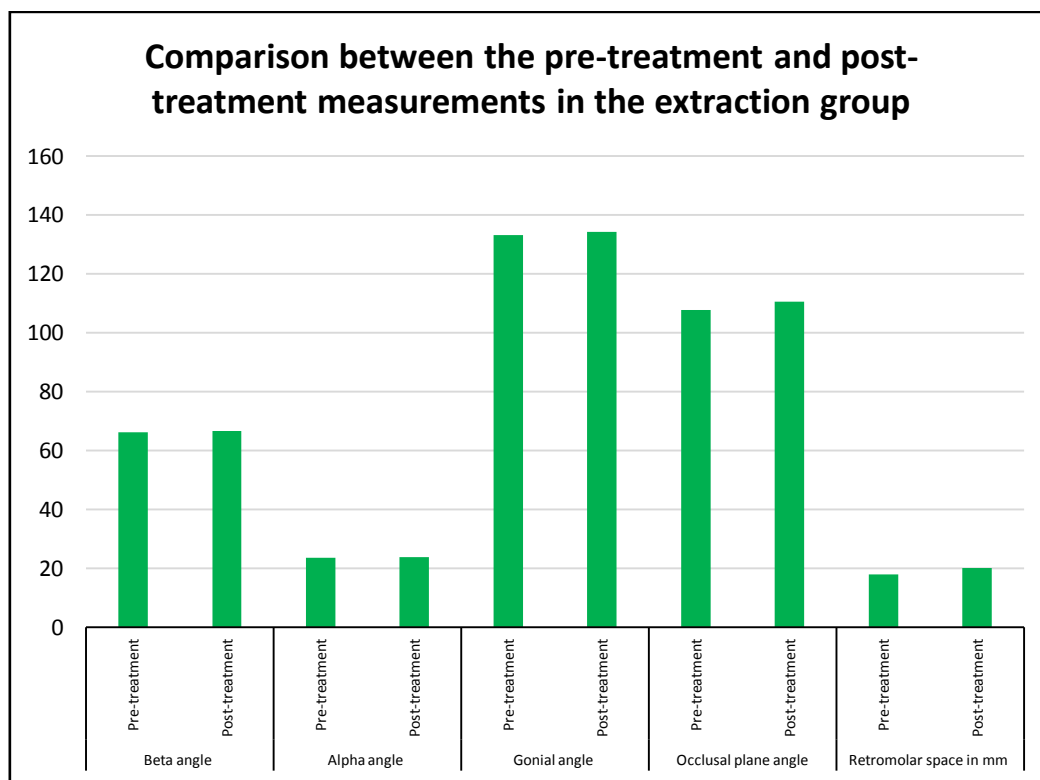
Variable	Group	Mean	SD	Mean Difference	P value
Beta angle	Extraction group	66.7	10.4	0.9	0.542
	Non-extraction group	67.6	11.5		
Alpha angle	Extraction group	23.8	2.6	12.5	0.000*
	Non-extraction group	36.3	7.8		
Gonial angle	Extraction group	134.2	6.5	1.6	0.063
	Non-extraction group	135.8	4.8		
Occlusal plane angle	Extraction group	110.6	9.3	5.9	0.000*
	Non-extraction group	104.7	10.5		
Retromolar space in mm	Extraction group	20.1	3.4	0.7	0.213
	Non-extraction group	19.4	3.4		

\*Statistically significant difference exists between the groups



**Table 3. Comparison between the pre-treatment and post-treatment measurements in the extraction group**

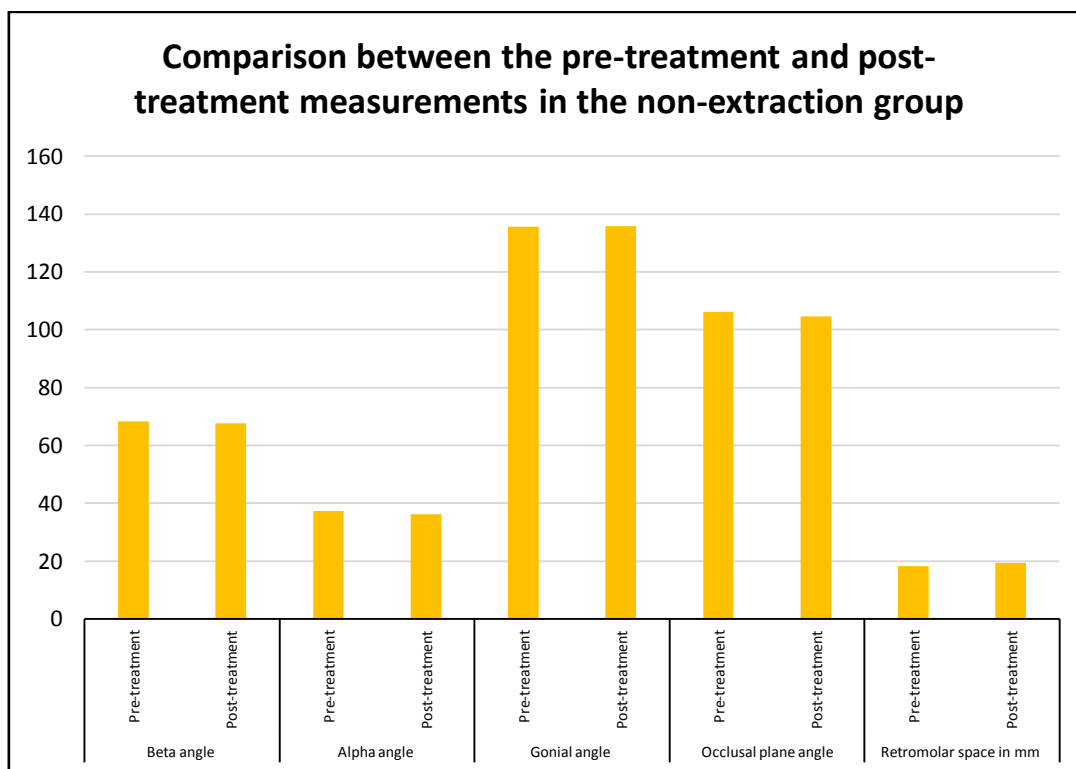
Variable	Group	Mean	SD	Mean Difference	P value
Beta angle	Pre-treatment	66.2	11.4	0.5	0.614
	Post-treatment	66.7	10.4		
Alpha angle	Pre-treatment	23.6	2.8	0.2	0.270
	Post-treatment	23.8	2.6		
Gonial angle	Pre-treatment	133.2	6.7	1.0	0.164
	Post-treatment	134.2	6.5		
Occlusal plane angle	Pre-treatment	107.8	9.4	2.8	0.707
	Post-treatment	110.6	9.3		
Retromolar space in mm	Pre-treatment	17.9	3.6	2.2	0.680
	Post-treatment	20.1	3.4		



**Table 4. Comparison between the pre-treatment and post-treatment measurements in the non-extraction group**

Variable	Group	Mean	SD	Mean Difference	P value
Beta angle	Pre-treatment	68.2	12.3	0.6	0.118
	Post-treatment	67.6	11.5		
Alpha angle	Pre-treatment	37.4	8.5	1.1	0.091
	Post-treatment	36.3	7.8		
Gonial angle	Pre-treatment	135.7	5.2	0.1	0.991
	Post-treatment	135.8	4.8		
Occlusal plane angle	Pre-treatment	106.2	10.1	1.5	0.619
	Post-treatment	104.7	10.5		
Retromolar space in mm	Pre-treatment	18.2	3.7	1.2	0.331
	Post-treatment	19.4	3.4		





## VI. Discussion

For the sake of better orthodontic planning, it is important to determine the future of third molar position on the basis of clinical observation. The result of this study suggests that factors other than extractions could influence the inclination and subsequent eruption of third molars. Like previous third molar study this study did not reveal any basis to predict the eruption of third molars since third molar angulation improved whether or not teeth were extracted. Also, even with this improvement in angulation third molar may become impacted.

Study done by **cagri turkoz et al<sup>12</sup>, ahmed et al<sup>13</sup> and nagwa enany<sup>14</sup>** showed that improvement in the angulation of unerupted mandibular third molar is unpredictable as some showed improvement others showed no change and some showed worse angulation.

**tarazona et al<sup>15</sup>, richardson me<sup>5</sup>, kim et al<sup>16</sup>, elsey and rock<sup>17</sup>, saysel,<sup>18</sup> suruchi jain<sup>19</sup> et al and arth k patil<sup>20</sup>** showed Premolar extractions had a positive influence on the developing third molar angulations, and these improved angulations might favour third molar eruptions later in life.

Non-extraction therapy did not have any adverse effects. Third molar angulations were minimally improved or maintained, whereas study by **artun et al<sup>21</sup>, stagers et al<sup>1</sup> and m. kachoei<sup>2</sup>** did a study on comparison of the effects of first premolar extractions on third molar angulations and found that premolar extractions does not improve the third molar angulation any differently than in non-extraction. Similar findings seen with the present study which also shows that extractions of premolar do not necessarily indicates third molar eruption.

**luz victoria et al<sup>22</sup>, donald dierkes<sup>23</sup>** in 2017 studied effect of orthodontic treatment involving first premolar extractions on mandibular third molar angulation and retro-molar space and showed that retromolar space was significantly increased in extraction cases. And increased verticalization of third molar in women and increased inclination was seen in men. However, our study shows increased retromolar space but statistically insignificant changes in vertical third molar movement.

**k. haavikko<sup>24</sup>** in 1978 studied on predicting angulation development and eruption of lower third molar and showed that there is no correlation between the size of the initial and follow up angulation of third molar and the gonial angle or the angulation of the second molar tooth, present study also shows the same changes and thus supports the results made by haavikko et al.

## VII. Conclusion

Orthopantomogram represents useful tool for assessing the prognosis of eruption of the third molar at the beginning and at the end of the orthodontic treatment. This study was directed to determine the angulation of third molar by using measurement on conventional panoramic radiograph and evaluated the changes in the third molar angulations relative to various reference planes and to the second molar long axis.



The results of this study showed that third molar angulation changes is less in non-extraction and more in extraction cases but these differences are statistically insignificant. The pre-treatment angulation differences were part of the morphological differences which affect extraction/non-extraction decision like tooth size, arch length discrepancy, mandibular growth pattern, corpus length, curve of spee, incisors inclination etc, while the changes in angulation after treatment may occur due to extraction of teeth but factors other than extraction could have affect like rotational pre-eruptive tooth movements. The changes seen in present study may be attributed to the mesial movement of the buccal segment following space closure and an increase in the space for the rotational up righting movements of the third molar.

Orthodontists should advise patients that premolar extractions will not ensure that the third molars will erupt and have sufficient space to achieve good alignment but if they do not erupt, they may need less surgical procedures for removal.

Conclusion made by this study implies that orthodontic treatment involving premolar extractions does not improve third molar angulation any differently than non-extraction treatment. Third molar angulation improved regardless of the method of orthodontic treatment. However, an improvement in angulation does not necessarily mean that third molars will erupt in good position. Factors other than premolar extractions influence third molar angulation and eruption. Therefore, it is prudent for the orthodontist to inform their patients that premolar extractions may not prevent the need for third molar extractions in future. Decision of extraction of third molars before or during orthodontic treatment should be taken after thorough clinical and radiographical examination.

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