

# Prevalence of distal step malocclusion in mixed dentition

**Running Title:** Prevalence of distal step Malocclusion

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**Abstract:** Distal step malocclusion can be explained as the distal surface of the mandibular deciduous second molar is distal to that of the maxillary deciduous second molar. Based on various combinations of skeletal components, patients with distal step malocclusion exhibit a wide range of underlying skeletal and craniofacial features. Prevalence of distal step malocclusion can vary among different racial and ethnic groups. The aim of this study is to determine the prevalence of distal step malocclusion in mixed dentition in a private dental institute. A study was carried out by collecting data by reviewing patients data and analysing the data of 86000 patients between June 2019 and March 2020 at the private dental institute. The sample size that was taken included 4420 number of children with mixed dentition aged 6-12 years old, who came to the private dental institute for consultation. The dental malocclusion status was analysed and recorded. Data of children that had distal step malocclusion were segregated and analysed with gender and age distribution. Data was statistically analysed using SPSS 2.0 (IBM 2019) PC Version for Windows, Chi-Test was conducted. Result was recorded. Out of 4420 patients, 395 patients had distal step malocclusion. The study revealed that the prevalence of distal step malocclusion in a private dental institute was only 8.9%, predominantly male patients. About 395 had distal step malocclusion which included 211(53%) were male patients and female patients were 184(47%). Statistically, the association of age and gender among patients with distal step malocclusion was not significant ( $p>0.05$ ), [Pearson Chi Square Test Value= 5.394; df= 6; p value= 0.494 ( $> 0.05$ )]. As a conclusion, the prevalence of distal step malocclusion in mixed dentition in the private dental institute was found to be 8.9%.

**Keywords:** distal, Gender, Mixed dentition, Prevalence study, School Age Population

## INTRODUCTION

Understanding the changes in the molar relationship from the deciduous dentition to the permanent dentition will give a better insight to orthodontic treatment approach. Terminal plane observes the relationship between the molars. Terminal plane can be defined as the mesial-distal relation between the distal surface of the upper and lower second primary molars when the primary teeth contact is in centric occlusion. Permanent first molars generally erupt by the age of 6 years. They are guided into position by distal surface of primary second molars. The future molar relationship of permanent dentition depends on the distal relationship of upper and lower primary second molar.

Terminal plane was classified by Baume in 1950 into three types, *Flush terminal plane*: When the distal surfaces of the upper and lower second primary molars were in the same vertical plane in centric occlusion; *Distal step*: distal step malocclusion can be explained as the distal surface of the mandibular deciduous second molar is distal to that of the maxillary deciduous second molar; and *Mesial step*: When the distal surface of the lower second primary molar is more mesial to that of the upper in centric occlusion. Distal step malocclusion is the least common molar relationship. It is a non-self-correcting malocclusion.

A study done by Lu Shen, Fang He, Cai Zhang, Haofeng Jiang & Jinhua Wang titled “ prevalence of malocclusion in primary dentition” revealed that the least common molar relationship is distal step ( 5.04%) of the population in mainland China. A similar study was carried out in India showing distal step composed only 2.4% of the population. Another study done by Yucel Yilmaz & Sera Simsek showed it lowest at 7.31%. Most cases of distal step developed into a Class II molar relationship in the permanent dentition. In addition to that, a study by Sergio Estelita showed that distal step produced a rather stable permanent first molar relationship compared to flush terminal plane.

This study will help create an awareness for both the parents and the dentists. It is encourage an early understanding and diagnosis of developing malocclusion for early intervention and spontaneous correction of the distal step malocclusion.

## MATERIAL AND METHODS

### **Study population:**

This was a retrospective study carried out from records of patients with mixed dentition who visited Saveetha Dental College. It was a university based study setting. The data was collected by analyzing the records of 86000 patients between June 2019-March 2020. Records of 6 to 12 year old patients in their mixed dentition who had completely erupted upper and lower first permanent molars were included in our study. Records of patients with malformed or grossly deformed or extracted permanent first molars were excluded from the study. The collected data includes the patient's age, gender and molar relation according to Angle's classification.<sup>32</sup> Patient's records which were incomplete were excluded from the study. The data collected were cross verified with intraoral photographs and randomly selected records were verified by the second examiner. Patients with distal step relation were segregated and the data was tabulated separately.

### **Sample size:**

Sample size is the total number of patients who visited Saveetha Dental College in their mixed dentition between 6-12 years old with distal step relation. Their distribution according to age, gender, and malocclusion were recorded.

### **Ethical approval:**

Ethical clearance was obtained from the Institutional Ethical Committee and Scientific Review Board [SRB] of Saveetha Dental College.SDC/SIHEC/2020/DIASDATA/0619-0320

### **Data analysis:**

The data collected were entered and subjected to statistical analysis using SPSS software. Descriptive statistics was done to find the prevalence of distal step molar relation. The data was further stratified based on the age and gender. Independent variables were age and gender while dependent variable was the molar relationship. Chi square test was done to look for any association between the age and gender in the study population. The level of significance was kept at  $p < 0.05$ .

## RESULTS AND DISCUSSION

A total of 4420 patients with mixed dentition, aged between 6-12 years old visited our hospital out of which 395 patients (8.9%) had class III occlusion [Figure 1]. In patients with class III, about 211 patients were male (53.42%) and 184 patients were female (46.58%) [Figure 2].

The majority of patients with class III occlusion were from the age group of 6 year old with 77 patients (19.49%). Whereas, 11 year olds had the least number of class III occlusion (11.39%). The age distribution also showed that 7 year olds had 57 patients (14.43%), 8 year olds had 56 patients (14.18%), 9 year olds had 50 patients (13.16%), and finally 12 years olds had 58 patients (14.94%) [Figure 3].

The males had more distal step occlusion compared to female patients in the age group of 6 years old. However, Chi square test showed the association between gender and age distribution among patients with class III malocclusion showed no significant difference as the p value was more than 0.05 ( $p$  value = 0.494). Implying no association between age and gender of patients with distal step occlusion in mixed dentition.

This research aimed to find out the prevalence of class III malocclusion in children with mixed dentitions, aged between 6-12 years old who visited a private dental college, in Chennai. Out of 4420 patients with mixed dentition, only 8.9% patients had class III malocclusion. The gender distribution showed 46.58% were female and 53.42% were males. Among the age group of 6-12 years old, the highest number of patients with class III malocclusion were seen in the 6 year old group.

The study done among Nigerian population on 11-18 year old children had reported the prevalence of class III to be 2%<sup>39</sup>. Studies done among the European population on 7-15 year old school children had reported the prevalence of distal step to be from 3.2%<sup>35</sup> and 5.21%.<sup>36</sup> Studies done among American population in 8-12 year old school children had reported a prevalence of 10%<sup>37</sup> and 9.1%<sup>38</sup> distal step malocclusion. In our study, about 8.9% had reported with class III malocclusion, which was higher than prevalence in Nigerian and European populations but similar to the prevalence seen in the American populations.

Among the Asian population, the study done by Danaie et al<sup>43</sup> in Iran children in the age group of 7-9 years old had reported the prevalence of class III malocclusion to be 2.1% which was lower than our present study. Another study which was done in Isfahan City of Iran, showed a prevalence of 7.8%, which was almost similar to the results of the present study. Whereas a study done in Shanghai, China, the population of 7-9 year old school children with Class III occlusion had a prevalence of 5.9%<sup>44</sup>, which was lesser than present study results. The study conducted in Lebanon on 9-15 years old school children showed that 5.1% of the children had class III malocclusion<sup>45</sup>, which was lesser to current study results. A study conducted by Alajlan et al<sup>41</sup> in Saudi Arabia (Hail city) in the age group of 7-12 years old had reported the prevalence of class III malocclusion to be 8.3% which was very similar to the present study results.

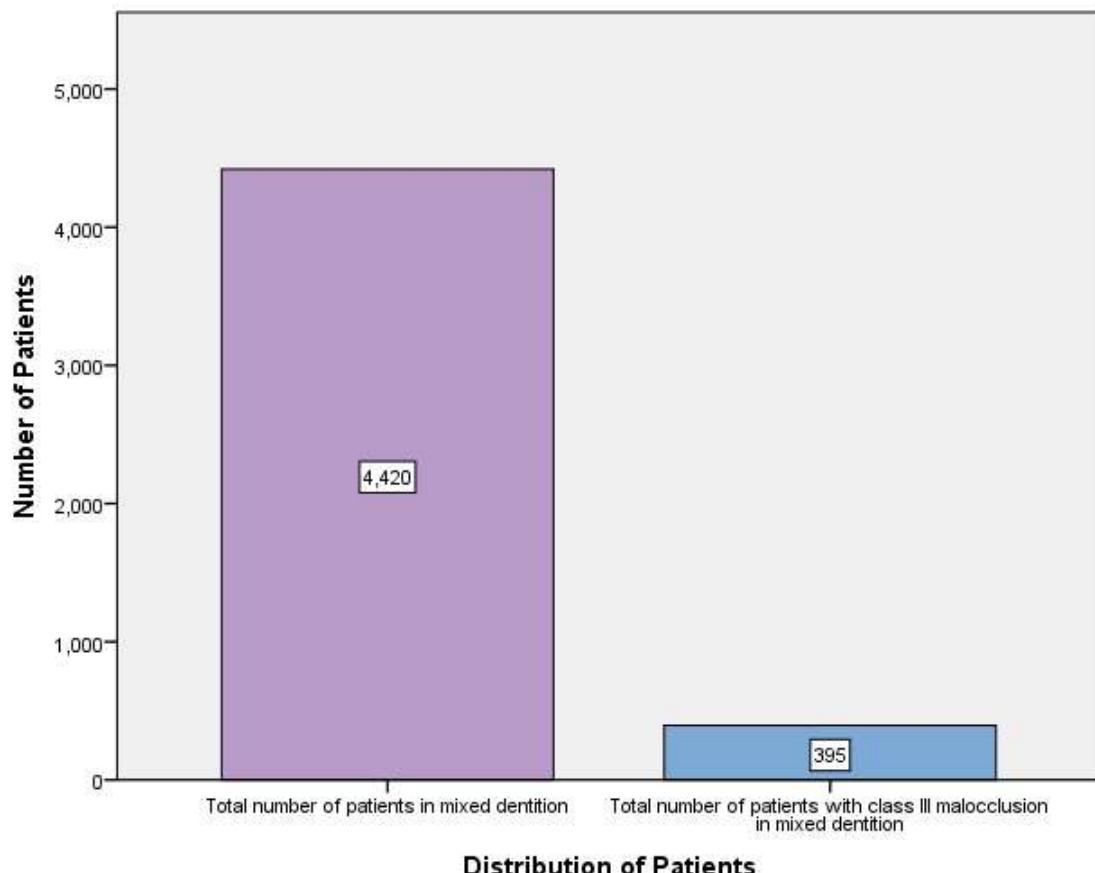
In Indian population, the study conducted in the State of Karnataka by Siddegowda et al<sup>46</sup> showed a prevalence of class III to be 3.1% among children of 10-12 years old. Whereas, a study done in only one city of Karnataka (Bangalore) among 8-12 years old schoolchildren showed a class III prevalence of 0.6%<sup>47</sup>. Another study from different states of India (Kerala), showed a class III prevalence of 4.1% among children aged 10-12 years old<sup>48</sup>. A study conducted in Maharashtra, showed a prevalence of 1% among the 10-16 years old children<sup>49</sup>. In a study conducted in Nalgonda, Telangana, the prevalence of class III malocclusion was 7.8% among the children aged between 6-10 years old<sup>50</sup>. All the studies from different regions of India showed a lesser prevalence of Class III malocclusion in mixed dentition when compared to the present study, except for the Nalgonda region which had a almost similar class III prevalence with the present study.

To summarise, our study results show that the prevalence of class III malocclusion is greater in our population when compared to the other European and Asian population except for the study done on the school children from America, Iran and Saudi Arabia whose prevalence of Class III malocclusion in mixed dentition was almost similar to the present study. The studies done on school children from different parts of India showed prevalence of Class III malocclusion to be less compared to present study. However, the prevalence of Class III in the children from Nalgonda was similar to the prevalence in our population.

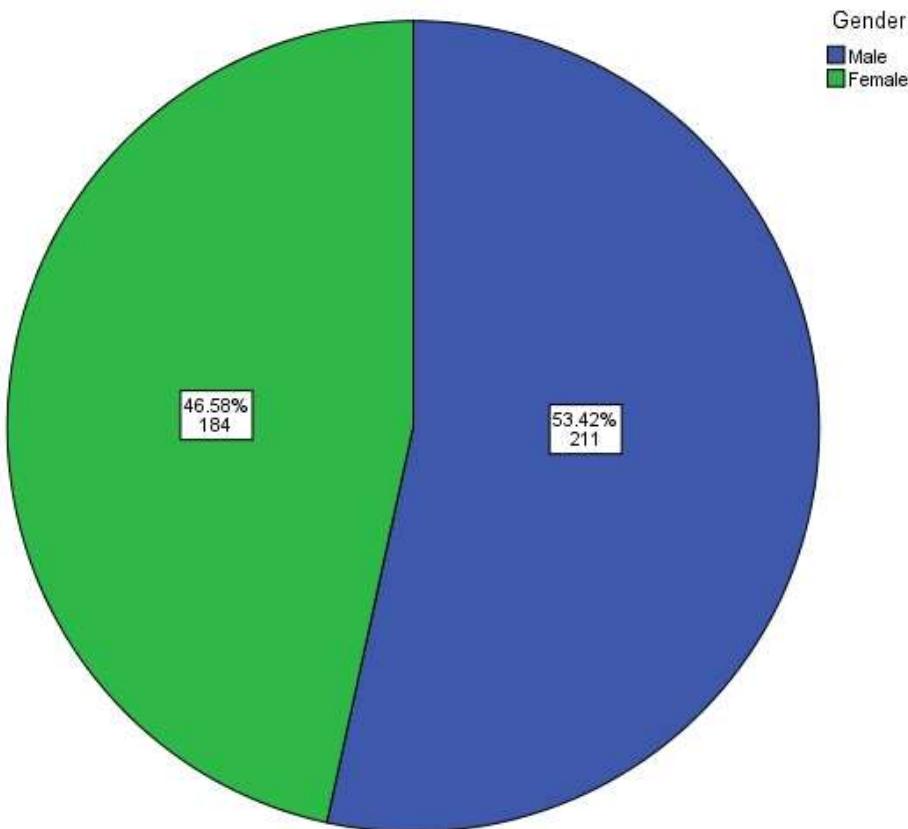
The high prevalence of class III prevalence in our study was due to the different study settings. Present study was conducted in a dental hospital set up and hence the prevalence of malocclusion could have been higher when compared to the general population. Whereas, previous studies were based on a school setting.

This study was based on data from a single university hospital based center, which could be argued as a limitation but this type of a setting has helped us to achieve higher sample size with high internal validity which enabled us to provide better results. It would be interesting to do a multi centered study based on school children in the future and to compare the results of the study with our results.





**Figure 1:** The bar graph shows the total number of patients with mixed dentition and number of distal step malocclusion patients with mixed dentition reported to the private dental institute.



**Figure 2:** Pie chart showing the distribution of distal step population based on gender. It shows that more number of males (blue) had class III occlusion when compared to females (green).

## CONCLUSION

To conclude, the prevalence of distal step in mixed dentition was found to be 8.9%, with almost equal distribution of males and females. 6 year old patients had higher prevalence rates of distal step occlusion among mixed dentition and least prevalence of distal step malocclusion was seen in the 11 year old patients.

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