

# The Prevalence of Malocclusion and the Need for Orthodontic Treatment among Adolescents of the Eastern UP Region of India: An Epidemiological Study

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**Abstract-** *This study has been done to determine the prevalence of malocclusion and orthodontic treatment need among 12 to 16 years old school going adolescents using the dental health component (DHC) of the index of orthodontic treatment need (IOTN). A cross-sectional survey was conducted among 1876 school going adolescents of 12 to 16 years age group. Data collection using random selection of sample has been obtained from different schools situated in rural and urban areas of different districts of eastern UP India. The data were recorded in assessment forms to calculate the prevalence of malocclusion and estimate of DHC of the IOTN index. Out of 1876 subjects, most common occlusions in order of prevalence were Angle's Class I (85.2%), Angle's Class II (11.6%), Angle's Class III (3.3%), crowding (26.5%), excessive overjet (> 2 mm-37.8%), excessive overbite (> 2 mm-52.9%), edge to edge bite (4.1%), anterior crossbite (2.2%). The most common facial profiles determined in the sagittal plane were the straight facial profile (61.2%). The prevalence of Grade 1 and 2 DHC was 57.6%, Grade 3 was 22.4%, Grade 4 and 5 was 20%.*

**Keywords:** Prevalence, orthodontic treatment need, malocclusion, India, overjet

## 1. Introduction

The prevalence of malocclusion and orthodontic treatment need has been reported by different researchers that vary according to locations, diverse racial groups, age groups, and gender. A number of epidemiological studies on malocclusion has been reported by different investigators worldwide as well as in India.<sup>[1-5]</sup> Particularly in India, most of these studies were carried out in the north and south India while available literature are very less in eastern and western India. Demand for orthodontic treatment is increasing in most of the countries and so in India and most common reason for this hike may be increase aesthetic demand along with awareness about the orthodontic condition and motivation for the treatment of the same. No illustrative data regarding the epidemiological status of malocclusions are available in the eastern UP. A shortage of epidemiological data on the distribution of the dentofacial characteristic among adolescent age groups in UP populations provided the rationale for the current research. As per the authors' best knowledge, this will be the first prevalence study of malocclusion from the eastern region of UP. The present study was therefore designed to determine the prevalence of malocclusion in adolescents in Eastern UP India and to assess the DHC (Dental Health Component) of the orthodontic treatment need index. IOTN (Index of Orthodontic Treatment Need) index formulated by Shaw et al.,<sup>[6]</sup> is widely accepted and used by various researcher worldwide.<sup>[7-9]</sup> It is perceived as a system to assess treatment need because of its simple design and convenient in use.<sup>[10-12]</sup> Epidemiological studies related to malocclusion not solely facilitate designing orthodontic care but also help in understanding the level of needed assets and preventive measures along with planning the proper oral health care programme. The present study focused on to estimate the

prevalence of malocclusion and therefore the orthodontic treatment needs in line with DHC of IOTN among school going adolescents of various districts of eastern UP India.

## 2. Methodology

### 2.1 Study population

This study was designed to conduct in the randomly selected 5 districts (Varanasi, Jaunpur, Chandauli, Gazipur, and Mirzapur) of eastern UP India. Sample size was calculated based on the prevalence of malocclusion in a pilot study ( $p = 46\%$ ). A total sample size of 1876 was considered to be sufficient to create any statistically significant difference. The present study group comprised of randomly selected, school going 1876 adolescents, male and female, aged from 12 to 16 years, who enrolled in the various government, government added and private schools in urban and rural areas. A total of 20 schools were selected using simple random sampling technique in which 14 schools from rural and 6 were from urban areas. 200 adolescents were examined from each school, those fulfilling inclusion criteria were included in the study. Selected children underwent final examination. Finally, 1876 school going adolescents of age 12 to 16 years were enrolled for the study that consisted of 956 male and 920 female subjects. The study was conducted over a period of 16 months from November 2016 to March 2018. Informed consent was obtained along with one witness before the examination. Who were having previous or still going orthodontic treatment, medically compromised, handicapped, other craniofacial anomalies like ectodermal dysplasia, down syndrome, cleft lip and palate and subjects without informed consent were excluded from the survey. Ethical clearance was obtained before the

start of the study from the Ethical approval Committee of IMS BHU (ECR1526/inst/UP/20 14 Dt. 31.1.14).

## 2.2 Examination procedure

All the subjects were examined by an experienced professional examiner after obtaining informed consent from the subjects. The principal examiner was trained and calibrated by the well-experienced staff of the orthodontic and public health dentistry department. The examiner practiced recordings on thirty 12 to 16-year-old students presented in the OPD of Faculty of Dental Sciences IMS BHU and the recordings were calibrated by the examiner. The same examination was repeated a day after and the result of the two examinations was compared and checked for intraexaminer reliability ( $Kappa = 0.80$ ). A well trained intern assisted the examiner throughout the oral examination procedure. Clinical examination of the study subjects was conducted using diagnostic gloves, millimeter ruler, caliper, CPI probes and plane mouth mirrors under the adequate natural light. All occlusal relationships were evaluated at Maximum Intercuspation. The examination was for the type of malocclusion, including Angle's classification, crowding, spacing, overjet, overbite, open bite, and crossbite as defined in **Table 1**, Facial profile was assessed as straight, concave or convex depending on the spatial relationship of mandible and maxilla. Orthodontic treatment need was recorded using the DHC of the IOTN index. The DHC records the various traits of malocclusion and the treatment needs of the subjects are concluded as grade 1 (no treatment need), grade 2 (mild need), grade 3 (moderate need), grade 4 (severe need) and grade 5 (extreme need). An assessment form was used that was prepared according to the guidelines of WHO Oral Health Assessment.<sup>[13]</sup> The data were recorded in the assessment forms. Proper sterilization was maintained throughout the examination. After the oral examination, an oral health education program was conducted by the examiner for all the study subjects.

## 2.3 Statistical analysis

The data was entered into the MS Excel (2013) and was subjected to statistical analysis using the Statistical Package for the Social Sciences version 17.0. The chi-square test and Z-proportionality test were applied and the significance level was set at 0.05 ( $P < 0.05$ ).

**Table 1:** Description of variables used in study

Variables	Detentions
Angle's molar relation	Class I Class II Class III
Overjet	Normal Excess (>2mm) Reverse
Overbite	Normal Excess (>2mm) Edge to edge
Open bite	Present/absent
Posterior crossbite	Present/absent
Spacing	Present/absent
Crowding	Present/absent
Facial profile	Straight Convex Concave

**Table 2:** DHC (dental health components) Grades of IOTN

Grade 1 and 2	No/little need of treatment
Grade 3	Moderate need
Grade 4 and 5	Definite need

**Table 3:** Distribution of sample

Criteria	Count (n)	Percentage (%)
Total sample studied	1876	100%
<b>Gender distribution</b>		
Male	956	51%
Female	920	49%
<b>Location distribution</b>		
Rural	1380	73.6%
Urban	496	26.4%

## 3. Results

A total of 1876 adolescents were examined in the survey as per the inclusion criteria. Of these, 956 were males (51%) and 920 were females (49%) in which 1380 (73.6%) were from rural and 496 (26.4%) from urban areas. As shown in **Table 4**, out of 1876 subjects: 1597 (85.2%) of subjects had Angle's Class I occlusion in which class I normal occlusion (NO) was present in 956 (51%) and class I malocclusion (MO) was present in 641 (34.2%) subjects, 218(11.6%) had Angle's Class II and 61(3.2%) had Angle's Class III occlusion. 1140(60.8%) of subjects had normal overjet ( $0 \leq 2mm$ ), 709 (37.8%) of subjects had excessive overjet ( $>2mm$ ) and 27 (1.4%) of subjects had reverse overjet. 778 (41.5%) of subjects had normal overbite, 993 (41.8%) of subjects had excessive overbite( $>2mm$ ) and 77 (4.1%) of subjects had edge to edge bite. Crowding was present in 23.7% of subjects, while 76.3% of subjects had no crowding. Spacing was present in 22.6% of subjects, while 77.4% of subjects had no spacing. A posterior crossbite was present in only 1.1% of subjects. An open bite was present in only 1.5% of subjects. 1148 (61.2%) of subjects had a straight profile, while 666 (35.5%) of subjects had convex profile and 62 (3.3%) of subjects had a concave profile. As shown in **Table 5**, out of 1876 subjects in whom 1081 (57.6%) had no need for any treatment, 420 (22.4%) needed a borderline treatment and 375 (20%) needed a definite treatment. Furthermore, of the 1081 subjects (57.6%) who didn't need any treatment, 59.5% were males and 55.4% were females. Similarly, of the 420 subjects (22.4%) who needed borderline treatment, 25.2% were males and 19.5% were females. Of the 375 subjects (20.0%) who needed definite treatment, 18.9% were males and 21.1% were females. The association between the genders was found to be statistically significant. Similarly, grade 1 and 2 need of treatment present in 57.4% of urban and 58.3% of rural participants while grade 3 treatment need was observed in 22.4% of rural as well as urban population and definite need of treatment was required in 20.2% urban and 19.4% rural adolescent population. The association between the rural and urban need of orthodontic treatment was not found to be statistically significant.

## 4. Discussion

The present research is the first epidemiological survey on dentofacial characteristics conducted in the adolescent population of eastern UP India. A large number of studies

are already published in different literature from various countries describing the various form of epidemiological status of malocclusion. Although various studies are there, comparisons of the observation from these studies are incommensurable because of the variations in the study design due to different factors like age of the study subject, size of the study samples and the methodology adapted to record occlusal traits of malocclusion. Epidemiological status of malocclusion is having the diverse form with respect to different regions, age, and gender. Count of studies are less those have been conducted in urban as well as rural Indian regions to assess the prevalence among adolescents.<sup>[2-3,14,21]</sup> Epidemiological studies like frequency distribution and orthodontic treatment need assessment are the primary and simplest study to be performed in a given population to have an overview on the severity of the condition. So we did the same. In the present study, we observed that 85.2% had Angle's Class I occlusion that combines 51% normal occlusion (NO) and 34.2% malocclusion (MO), 11.6% had Class II and 3.3% had Class III malocclusion. Total prevalence of malocclusion will be 49%.

**Table 4:** Prevalence of different malocclusions in the studied sample

Variables	Count (n)	Percentage (%)
<b>Angle's molar relation</b>		
Class I (NO+MO)	1597 (956+641)	85.2 (51+34.2)
Class II	218	11.5
Class III	61	3.3
P value	< 0.05	
<b>Overjet</b>		
Normal	1140	60.8
Excess	709	37.8
Reverse	27	1.4
P value	< 0.05	
<b>Overbite</b>		
Normal	778	41.5
Increased	993	52.9
Edge to edge	77	4.1
P value	< 0.05	
<b>Open bite</b>		
Present	28	1.5
Absent	1848	98.5
P value	< 0.05	
<b>Crowding</b>		
Present	444	23.7
Absent	1432	76.3
P value	< 0.05	
<b>Spacing</b>		
Present	423	22.6
Absent	1453	77.4
P value	< 0.05	
<b>Posterior cross bite</b>		
Present	21	1.1
Absent	1855	98.9
P value	< 0.05	
<b>Facial profile</b>		
Straight	1148	61.2
Convex	666	35.5
Concave	62	3.3
P value	< 0.05	

No= Normal Occlusion, Mo= Malocclusion

**Table 5:** Dental Health Component of IOTN grades

DHC grades	Count (n)	Percentage (%)	Male/female (%)	Urban/rural (%)
Grade 1 and 2	1081	57.6	59.5/55.4	57.4/58.3
Grade 3	420	22.4	25.2/19.5	22.4/22.4
Grade 4 and 5	375	20.0	18.9/21.1	20.2/19.4
P value		<0.05	<0.05	>0.05

The findings of our results confirmed that the most prevalent malocclusion was Angle's Class I followed by Angle's Class II, while the least prevalent malocclusion was Class III. Till now, whatever prevalent studies performed around the world, almost all studies came up with the conclusion that class I, class II, class III malocclusion are having their prevalence in descending order. Less than 30% total prevalence of malocclusion in India reported in regions of Himachal Pradesh, Haryana, Udupi, Mandu, and Chennai.<sup>[1,14-17]</sup> Prevalence of 30 to 60% reported in Bangluru North, Udaipur, Delhi, Mumbai, Nagpur, and Bagalkot.<sup>[2, 18-22]</sup> Distribution of more than 60% reported in Karnataka, Kozhikode, Jaipur, and Hyderabad.<sup>[3, 23-25]</sup> Other than Indian cities, less than 30% prevalence was reported in the region of France,<sup>[26]</sup> while 30-60% reported in Tanzania, Italy, Nigeria, and some Finnish cities,<sup>[4,27-29]</sup> and prevalence of malocclusion more than 60% was reported in Rio de Janeiro, regions of Iran, American Negroes and Caucasian subjects, Bogota, Gale, Central Antolia, regions of China, and Brazil.<sup>[5, 30-37]</sup> In a study performed in Karnataka state class I malocclusion was reported in 79.2% population followed by class II in 20.7% and class III in only 0.1% subjects,<sup>[3]</sup> In Kozhikode (Kerala), class I normal occlusion was 16.7% and malocclusion was 69.8% while class II came up with 9.3% and class III was present in 4.1% population.<sup>[23]</sup> Similar type of study in Bagalkot gave a higher prevalence of class I malocclusion with 67.8% and the class III was least with 1.6% prevalence.<sup>[22]</sup> In the northern region, a survey performed in children of Delhi that gave 45% prevalence of malocclusion in which class I having the highest share of 26% and class III was least.<sup>[19]</sup> In a study performed in Tirana, Albania population gave 40.4% class I, 29.2% class II, and 3.2% class III malocclusion prevalence.<sup>[38]</sup> In the present study, spacing was present in 22.6%, crowding was prevalent in 23.7%, excess overjet and overbite was distributed in 37.8% and 52.9% subjects respectively while open bite was present in only 1.5% population. Posterior crossbite distribution was also less, only 1.1%. In a study in Karnataka, spacing was less (14.7%) while crowding was more distributed (50.9%). In the same state, overjet was increased in 26.9% while overbite was increased in 56.5% in which 15% having complete overlap and openbite was present in only 1.5% of total subjects.<sup>[3]</sup> In a study in Kozhikode, Increased overjet (>3mm) was present in 23.2% while increased overbite was present in 35.6% and the open bite was observed only in 0.29%.<sup>[23]</sup> In our study straight facial profile was observed in 61.2%, convex was observed in 35.3% and 3.3% was concave profile. Straight profile was less than convex profile in a study performed in Karnataka population.<sup>[3]</sup>

In the present study, the results of the grading for Dental Health Components of the IOTN index showed that only 20% of all subjects (18.9% males, 21.1% females) were in severe and extreme need of treatment (IOTN grades 4 and 5), whereas 22.4% of subjects (25.2% males, 19.5%



females) were in grade 3 (borderline), and 57.6% of subjects were found to be below grade 1 and 2 (55.9% males, 59.4% females). Similarly, a study conducted on Iranian school children and reported that 36.1% had a definite need for orthodontic treatment, 20.2% borderline need and 43.8% showed slight or no need for treatment.<sup>[39]</sup> In Mysuru district a similar study reveals that among male subjects, 39.9% had little need for orthodontic treatment, whereas 30.6% had a moderate need and 29.6% had a definite need for orthodontic treatment while among girls, 43.6% had little need for orthodontic treatment, whereas 28% had a moderate need and 28.4% had a definite need for the orthodontic treatment.<sup>[40]</sup> In a study in Nalagarh the DHC revealed that Grades 1 and 2 have combined to score as population showing no/slight need (31.6%), Grade 3 having a moderate/borderline need (30.85%), Grades 4 and 5 together showing a definite need (37.55%) for orthodontic treatment.<sup>[41]</sup> Definite treatment need was higher (41.2%) in Albanian population of Tirana.<sup>[38]</sup> Souames et al. in 2006,<sup>[42]</sup> found for the French population an objective need for orthodontic treatment in 21% of the sample (grades 4 and 5). An Italian sample of school children showed percentages of subjects assigned to grade 4 and 5 of the DHC was 27.3%.<sup>[43]</sup> However, IOTN index have a task within the dental specialty and may be used for resource coming up with, however their prognostic worth to observe the long run objective, practical deficits or oral health problems is questionable. IOTN index will need revalidation over time with emerging research findings

## 5. Conclusion

This epidemiological study on malocclusion is useful in providing objective information about the malocclusion, important factors in public health planning upon which various public health strategies could be formulated. A significant problem in epidemiological studies is the lack of uniformity in the measurement criteria between various studies since there is no universally accepted standardized method and it is quite possible that studies in future to be executed in the same area may give different results if there would be use of other methods of measurements. Developed countries are full of basic information needed to improve dental health and orthodontic care but in developing countries like India, this information on the epidemiological status on the prevalence of orthodontic problems is usually lacking and in some remote areas people are totally unaware about the orthodontic condition. So, the presented study is the part of epidemiological survey performed in the Eastern UP population regarding different parameters such as distribution of malocclusion in deciduous, mixed and permanent dentition, orthodontic treatment need and studies to compare with hospital-based epidemiological status of malocclusion to calculate real need of orthodontic care and to enable population to benefit from preventive, interceptive and corrective orthodontic care.

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