Original Article

Prevalence of malocclusion and orthodontic treatment needs among 12-15 years old school children in Patna, Eastern India

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Abstract

Context: The people around the world are concerned about the aesthetic oral-facial structures as it is more important in interpersonal interactions and dictates vocal, physical, and emotional communication. **Aims:** The present study was conducted to assess the severity of malocclusion and orthodontic treatment need among 12-15-year-old school children of Patna, Eastern India. **Settings and Design:** A cross-sectional study design was used to assess the severity of malocclusion using Dental Aesthetic Index (DAI) index among 12-15-year-old school-going children. **Methods and Material:** A specially prepared and pretested format, exclusively designed for recording all the required and relevant general information and other clinical findings was used in the study. The sample size consisted of 902 children from middle schools (Government and Private) in Patna. **Statistical Analysis Used:** Chi-square test was done for the categorical data to compare differences between two independent groups. Data were presented as Mean ± SD and "*P*" value of less than 0.05 was accepted as indicating significance. **Results:** Around 5.3% had a DAI score of ≤25 which signifies that there is "no abnormality or may have minor malocclusion"; 15.3% had a DAI score of 26-30 which signifies that there is "definite malocclusion"; 6% had a DAI score of 31-35 which signifies that there is "severe malocclusion" and 4% had a DAI score of ≥36 which signifies that there is "very severe or handicapping malocclusion". The finding was more commonly seen among 14 years age group. **Conclusions:** It can be concluded from the present study that the prevalence of malocclusion is reasonable high in this part of the region, and it is very important to bring in more awareness at the school level as primary prevention can be the most effective tool in control this menace.

Keywords: DAI Index, malocclusion, school children

Introduction

Growing demands of the global population has unleashed the new era of a better standard of living which is rising exponentially. By the virtue of this emerging trend, the inherent desire to draw social attention is mesmerising the globe.[1] The people of the world are concerned about the oral-facial region mostly because it draws the most attention from other people in interpersonal interactions and it dictates the vocal, physical, and emotional communication.[2] Within that, the tooth component which is also concerned with appearance plays an important role in overall aesthetic value, psychological impact, and social consequences.[3]

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Scientifically, malocclusion can be defined as an occlusion in which there is a mal-relationship between the arches in any of the planes or in which there are anomalies in tooth position, number, form, and developmental position of teeth beyond normal limits.[4] Clinically, it can be manifested in a broad range of variations from a simple rotation of a tooth, a small diastema to more severe forms of crowding, spacing, superior protrusion, and in a combination of several traits.[5]

Malocclusion can occur due to a number of possible causes. Broadly speaking malocclusions are caused by either genetic or by environmental factors. Hereditary has for long been attributed as one of the causes of malocclusion. Another region attributed for genetically determined malocclusion is the racial, ethnic, and regional inter-mixture, which might have led to the uncoordinated inheritance of teeth and jaws. According to Graber *et al.*, heredity plays a significant role in determining the characteristics that led to malocclusion like tooth size, arch pattern, soft tissue peculiarities, some congenital deformities, overall facial asymmetry. Environmental factors like prenatal influences from maternal diet, metabolism, drug induced, possible injury or trauma, infections, and birth injury also play a role in determining the fate of tooth alignment.[6] Predisposing factors like dietary problems, abnormal habits, posture, accident, and trauma also led to an abnormality in teeth arrangement or malocclusion.[7] Whatever may be the etiology of malocclusion, there is a need to find out the cause and to take appropriate prevention and correction steps in achieving goal regarding facial aesthetic and oral health.

Epidemiologically, the prevalence of malocclusion varies from country to country and between different age and sex groups. The need and demand for orthodontic treatment are increasing in most countries.[8] Though a large number of studies on the prevalence of malocclusion in different populations have been published, its prevalence has been the debate for many years. Practically, the problems are encountered due to the fact that malocclusion is not considered as a disease entity but a physical variation which may or may not be associated with pathological conditions. Hence, it has been difficult to obtain the desired international standardization for the registration of malocclusion.[9]

In India, the prevalence of malocclusion among school-going children has been reported in the range of 12.5% to 33.3%.[10] The recognition of malocclusion as an important problem in the public dental health services for children implies a need for rational planning of preventive and therapeutic orthodontic measures. It is necessary to carry out epidemiologic studies of malocclusion in groups of boys and girls at various stages of development and from different geographic areas. Analysis of the prevalence rates of malocclusion in such groups may also contribute to an understanding of the causes of malocclusion.[11]

The Dental Aesthetic Index (DAI) has been used worldwide in several different populations over recent years.[12] However, there are only a few studies to assess the prevalence of malocclusion in India, especially in the state of Bihar. The present study was conducted to assess the severity of malocclusion and orthodontic treatment need in 12-15-year-old school children of Patna, Eastern India.

Subjects and Methods

The present study was conducted to assess the severity of malocclusion and orthodontic treatment needs among school children aged 12-15 year in Patna, Eastern India. Prior to scheduling the survey, official permission was obtained from the Heads of the selected schools and District Education Department. Informed consent was obtained from the subjects parents who participated in the study. The proposed study was reviewed by the Ethical committee of Buddha Institute of Dental Sciences and Hospital, Patna and clearance was obtained. A survey was systematically scheduled to spread over a period of one year. The study design was a descriptive cross-sectional survey.

Calibration of the examiner was done to minimize the intra examiner variability and the kappa score of 0.94 was observed for the recording of DAI scores which reflect a high degree of conformity. A specially prepared and pretested format, exclusively designed for recording all the required and relevant general information and other clinical findings was used in the study. A pilot survey was undertaken to test the feasibility of the study including the assessment for clarity, validity, and applicability of the questionnaire followed by the procedure to be employed for examination and recording of malocclusion.

The sample frame consisted of 350 middle schools (Government and Private) in Patna which was obtained from the District Education Office. The study sample was recruited by a cluster sampling technique. For study purposes, map of Patna city was divided into four zones: North, South, East, and West. In each zone, four schools (two government and two private) were randomly selected in order to have equal representation from each zone. A total of eight government and eight private schools were selected for the study. Out of 16 schools selected, some schools were co-education schools and some were exclusively boys and girls school. A total of 902 study subjects were selected by randomized cluster sampling technique. Sample size was estimated based on the results of pilot study and previous studies.

Inclusion criteria

- All school children aged 12-15 years old attending the selected schools on the day of examination in Patna.

Exclusion criteria

- Any student who was medically compromised was excluded from the study.
- School children who were undergoing orthodontic treatment or had completed orthodontic treatment were excluded from the study.

Examination of the selected students was done by the examiner himself within the premises of the school to which they belong. Examinations were conducted outdoors under available natural daylight with the subjects seated on a chair with a backrest. Type 3 examination method was used to record the findings. The subjects were positioned so as to receive the maximum natural illumination. Artificial illumination was also used at times when required using torchlight. The scores dictated by the examiner were recorded in the proforma by the trained recorder seating close to the examiner so that instructions and codes could be easily heard and the examiner could see that findings were being recorded correctly. A maximum of 35-40 subjects were examined on any given day during the survey period except on weekends. Duration for data collection for each subject ranged for 5-10 minutes.

Dental malocclusion was recorded using DAI (WHO Basic Oral health Survey Methods 1997).[13]

Data were entered in Microsoft excel and analyzed using SPSS (version 16). Chi-square test was done for the categorical data, Mann-Whitney U test was used to compare differences between two independent groups, and Kruskal-Wallis test was done to compare more than two groups but not normally distributed. Data were presented as Mean ± SD, and "*P*" value of less than 0.05 was accepted as indicating significance.

Results

The results obtained were systematically compiled and analyzed and results are presented under various parameters considered under the study. An overall 902 school children aged 12-15 year participated in the study, of which 62% were males and the rest 38% were females. In total, 23.6% belonged to age group 12 year; 21.1% belonged to 13 year age group; 31.4% belonged to 14 year, and 24% belonged to 15 year age group.

Table 1 shows the distribution of missing teeth in maxillary and mandibular arch according to the age of the subjects. An overall 99.8% and 96.7% showed "no" missing teeth in the maxillary arch and mandibular arch, respectively. Only 0.2% and 0.6% showed one missing tooth in both maxillary and mandibular arch, respectively. But in 2.8% of mandibular arch showed two missing teeth and no such observations were noted with maxillary arch. The results were not statistically significant when different age groups were considered with *P* value more than 0.05.

Table 2 shows the age-wise distribution of incisal segments crowding and spacing among the study subjects. An overall 66.9% showed "no" crowding while 17.4% showed one segment crowding and the rest 15.6% showed two segment crowding. An overall 87.5% showed "no" spacing while 8.3% showed one segment spacing and the rest 4.2% showed two segment spacing. The results in both categories were not statistically significant when different age groups were considered with *P* value more than 0.05.

Table 3 shows the distribution of midline diastema among the study subjects. An overall 91% showed no signs of midline diastema, while 1.1% showed 1-mm midline diastema, 6.3% showed 2-mm midline diastema, and the rest 1.6% showed midline diastema which was 3 mm or more. Majority of the affected subjects were again in the age group of 14 years. The

Table 1: The table shows the distribution of missing teeth in maxillary and mandibular arch among school children

Maxillary Arch	Missing teeth (0) *n* (%)	Missing teeth (1) *n* (%)	Total *n* (%)	
	900 (99.8%)	2 (0.2%)	902 (100%)	
Mandibular Arch	Missing teeth (0) *n* (%)	Missing teeth (1) *n* (%)	Missing teeth (2) *n* (%)	Total *n* (%)
	872 (96.7%)	5 (0.6%)	25 (2.8%)	902 (100%)

Table 2: The table shows the age-wise distribution of incisal segments crowding and incisal segment spacing recorded among school children

	Age (Years)	No Crowding *n* (%)	1 Segment Crowding *n* (%)	2 Segment Crowding *n* (%)	Total *n* (%)
Incisal Segments Crowding	12	143 (15.9%)	36 (4%)	34 (3.8%)	213 (23.6%)
	13	130 (14.4%)	31 (3.4%)	29 (3.2)	190 (21.1%)
	14	188 (20.8%)	50 (5.5%)	45 (5%)	283 (31.4)
	15	143 (15.9%)	40 (4.4%)	33 (3.7%)	216 (24%)
	Total	604 (66.9%)	157 (17.4%)	141 (15.6)	902 (100%)

Chi square=0.459, *P*>0.05, df=6 (Non-Significant)

	Age (Years)	No Spacing *n* (%)	1 Segment Spacing *n* (%)	2 Segment Spacing *n* (%)	Total *n* (%)
Incisal Segments Spacing	12	190 (21.1%)	14 (1.6%)	9 (1%)	213 (23.6%)
	13	166 (18.4%)	19 (2.1%)	5 (0.6%)	190 (21.1%)
	14	237 (26.3%)	31 (3.4%)	15 (1.7%)	283 (31.4%)
	15	196 (21.7%)	11 (1.2%)	9 (1%)	216 (24%)
	Total	789 (87.5%)	75 (8.3%)	38 (4.2%)	902 (100%)

Chi square=9.204, *P*>0.05, df=6 (Non-Significant)

results were not statistically significant when different age groups were considered with *P* value more than 0.05.

Table 4 shows the distribution of irregularity in anterior maxillary and mandibular region among the study subjects. Among the anterior maxillary segment, an overall 66.1% had no irregularity and the rest 33.9% had some form of maxillary irregularity. In total, 20% of the subjects had 2-mm irregularity, followed by 7.1% with 3-mm irregularity and the rest 5.8% had irregularity of more than 4 mm. The results were not statistically significant when different age groups were considered with *P* value more than 0.05. Among the anterior mandibular segment, an overall 50.8% had no irregularity and the rest 49.2% had some form

of mandibular irregularity. Around 27.1% of the subjects had 2-mm irregularity, followed by 10.3% with 3-mm irregularity and the rest 8.2% had irregularity of more than 4 mm. The results were not statistically significant when different age groups were considered with *P* value more than 0.05.

Table 5 shows the distribution of overjet among the study subjects. An overall 99% of the subjects had overjet ≥1 mm and only 1% of the subjects had edge to edge bite. The table shows that 2-mm overjet was seen among 81.7% of the subjects, while >3 mm of over-jet was seen among 16.1% and the least of 1.2% had the overjet of 1 mm. The results were not statistically significant when different age groups were considered with *P* value more than 0.05.

Table 3: The table shows the age-wise distribution of midline diastema recorded among school children

Age (Years)	No diastema *n* (%)	1 mm diastema *n* (%)	2 mm diastema *n* (%)	3 mm or more diastema *n* (%)	Total *n* (%)
12	195 (21.6%)	0	13 (1.4%)	5 (0.6%)	213 (23.6%)
13	173 (19.2%)	1 (0.1%)	15 (1.6%)	1 (0.1%)	190 (21.1%)
14	255 (28.3%)	5 (0.6%)	17 (1.9%)	6 (0.7%)	283 (31.4%)
15	198 (22%)	4 (0.4%)	12 (1.3%)	2 (0.2%)	216 (24%)
Total	821 (91%)	10 (1.1%)	57 (6.3%)	14 (1.6%)	902 (100%)

Chi-square=9.462, *P*>0.05, df=9 (Non-significant)

Table 4: The shows the age-wise distribution of anterior maxillary irregularity among school children

Age (Years)	Anterior Maxillary irregularity in mm								Total
	0	1	2	3	4	5	6	7	
12	136 (15.1%)	4 (0.4%)	45 (5%)	18 (2%)	8 (0.9%)	1 (0.1%)	1 (0.1%)	0	213 (23.6%)
13	137 (15.2%)	1 (0.1%)	25 (2.8%)	16 (1.8%)	7 (0.8%)	2 (0.2%)	2 (0.2%)	0	190 (21.1%)
14	181 (20.1%)	3 (0.3%)	71 (7.9%)	12 (1.3%)	13 (1.4%)	0	1 (0.1%)	2 (0.2%)	283 (31.4%)
15	142 (15.7%)	2 (0.2%)	39 (4.3%)	18 (2%)	7 (0.8%)	5 (0.6%)	3 (0.3%)	0	216 (24%)
Total	596 (66.1%)	10 (1.1%)	180 (20%)	64 (7.1%)	35 (3.9%)	8 (0.9%)	7 (0.8%)	2 (0.2%)	902 (100%)

Chi square=31.70, *P*>0.05, df=21 (Non-significant)

Age (Years)	Anterior Mandibular irregularity in mm								Total
	0	1	2	3	4	5	6	7	
12	98 (10.8%)	7 (0.8%)	65 (7.2%)	26 (2.9%)	17 (1.9%)	0	0	0	213 (23.6%)
13	108 (12%)	5 (0.6%)	53 (5.9%)	11 (1.2%)	11 (1.2%)	2 (0.2%)	0	0	190 (21.1%)
14	144 (16%)	9 (1%)	73 (8.1%)	31 (3.4%)	23 (2.6%)	3 (0.3%)	0	0	283 (31.4%)
15	108 (12%)	12 (1.3%)	53 (5.9%)	25 (2.8%)	17 (1.9%)	0	1 (0.1%)	0	216 (24%)
Total	458 (50.8%)	33 (3.7%)	244 (27.1%)	93 (10.3%)	68 (7.5%)	5 (0.6%)	1 (0.1%)	0	902 (100%)

Chi square=20.61, *P*>0.05, df=18 (Non-significant)

Table 5: The table shows the age-wise distribution of over-jet and cross-bite recorded among school children

	Age (Years)	No Over-jet *n* (%)	1 mm Over-jet *n* (%)	2 mm Over-jet *n* (%)	3 mm or more Over-jet *n* (%)	Total *n* (%)
Over-jet	12	4 (0.4%)	2 (0.2%)	162 (18%)	45 (5%)	213 (23.6%)
	13	2 (0.2%)	1 (0.1%)	158 (17.5%)	29 (3.2%)	190 (21.1%)
	14	1 (0.1%)	5 (0.6%)	241 (26.7%)	36 (4%)	283 (31.4%)
	15	2 (0.2%)	3 (0.3%)	176 (19.5%)	35 (3.9%)	216 (24%)
	Total	9 (1%)	11 (1.2%)	737 (81.7%)	145 (16.1%)	902 (100%)

Chi-square=11.22, *P*>0.05, df=9 (Non-significant)

	Age (Years)	No Cross-bite *n* (%)	1 mm Cross-bite *n* (%)	2 mm Cross-bite *n* (%)	3 mm or more Cross-bite *n* (%)	Total *n* (%)
Cross-bite	12	209 (23.2%)	1 (0.1%)	3 (0.3%)	0	213 (23.6%)
	13	189 (21%)	0	1 (0.1%)	0	190 (21.1%
	14	281 (31.2%)	1 (0.1%)	1 (0.1%)	0	283 (31.4%
	15	215 (23.8%)	0	1 (0.1%)	0	216 (24%)
	Total	894 (99.1%)	2 (0.2%)	6 (0.7%)	0	902 (100%)

NA

An overall 99.1% had no cross-bite recorded (0 mm), 0.7% had 2-mm cross-bite, and the rest 0.2% had 1 mm cross-bite. The results were not statistically significant when different age groups were considered with *P* value more than 0.05.

Table 6 shows the distribution of open bite among the study subjects. An overall 99.7% had normal open-bite, while 0.2% had an open-bite of 1 mm and the rest 0.1% had an open-bite of 3 mm or more.

Table 7 shows the distribution of antero-posterior molar relationship among the study subjects. An overall 77% had a normal molar relationship, while 19.5% had half cusp deviation and the rest 3.6% had full cusp deviation. The results were not statistically significant when different age groups were considered with *P* value more than 0.05.

Table 8 shows the distribution of malocclusion and orthodontic treatment needs among the study population according to DAI scores. Around 75.3% had a DAI score of ≤25 which signifies that there is "no abnormality or may have minor malocclusion" and treatment need may involve – "no or slight need". In total, 15.3% have DAI score of 26-30 which signifies that there is "definite mal-occlusion" and treatment need involves "elective care". Around 6% have DAI score of 31-35 which signifies that there is "severe mal-occlusion" and treatment need involves "highly desirable" and 4% have DAI score of ≥36 which signifies that there is "very severe or handicapping mal-occlusion" and treatment need involves "mandatory" requirement.

Discussion

Malocclusion has been shown to affect not only on aesthetic value but also hampers periodontal health, increase the prevalence of dental caries, and cause temporo-mandibular joint problems.[14] It is also associated with impaired masticatory efficiency, abnormalities in speech, pain, and diminished social interaction.[15] Early diagnosis and management of malocclusion form an integral part of primary health care.

Occlusal indices are necessary for research, audit, practice management, and quality assurance in orthodontic treatment. Various indices have been tried for various facets of orthodontic provision but they failed to overcome international acceptance. Among them, the DAI which was introduced by Cons *et al.* (1986) that links clinical and esthetic components has been adopted as a cross-cultural index by the World Health Organization for the assessment of orthodontic treatment need.[16,17] As DAI is more versatile, time saving, and simple to use, it has been used for different communities and populations without requiring any modification.[18,19] A DAI scale that divided the continuous index score defined by the equation into four malocclusion severity levels was established, making it easier to use and encouraging its application in orthodontic care programs or malocclusion prevalence studies.[20-22]

In this study, the universally accepted index, i.e. DAI was used to assess the prevalence of malocclusion and orthodontic treatment needs among 12 to 15 years old school-going children of Patna, Eastern India, as it provides a single score linking the public's perception for dental aesthetics with objective measurements associated with malocclusion.

In the present study, DAI score ranged from 17-55, DAI score of ≤ 25 was seen among 75.3% of the study subjects. Many reports of studies conducted in India and elsewhere are in line with the present study. It can be justified that many cases which are borderline in nature may not seek the dental care and increased awareness can synergize the maintenance the dental occlusion. This warrants no or slight orthodontic care. DAI score 26-30 was seen among 15.3% of the population which are similar to studies of this means that the severity of malocclusion was definite in nature which warrants elective orthodontic care. Most of the dental malocclusion was observed in the age group of 13-14 years. Studies conducted in

Table 6: The table shows the age wise distribution of open-bite recorded among school children				
Age (Years)	No. of Children with 0 mm open-bite *n* (%)	No. of Children with 1 mm open-bite *n* (%)	No. of Children with 2 mm open-bite *n* (%)	No. of Children with 3 mm or more open-bite *n* (%)	Total No. of Children *n* (%)
12	212 (23.4%)	1 (0.1%)	0	0	213 (23.6%)
13	189 (20.7%)	0	0	1 (0.1%)	190 (21.1%)
14	282 (30.9%)	1 (0.1%)	0	0	283 (31.4%)
15	216 (23.7%)	0	0	0	216 (24%)
Total	899 (99.7%)	2 (0.22)	0 (0.0)	1 (0.11)	902 (100%)

Table 7: The table shows the age-wise distribution of antero-posterior molar relation recorded among school children			
Age (Years)	No. of Children with normal molar relation *n* (%)	No. of Children with half cusp deviation *n* (%)	No. of Children with full cusp deviation *n* (%)	Total No. of Children *n* (%)
12	167 (18.5%)	38 (4.2%)	8 (0.9%)	213 (23.6%)
13	137 (15.2%)	46 (5.1%)	7 (0.8%)	190 (21%)
14	218 (24.7%)	57 (6.3%)	8 (0.9%)	283 (31.4%)
15	172 (19.1%)	35 (3.9%)	9 (1%)	216 (24%)
Total	694 (77%)	176 (19.5%)	32 (3.6%)	902 (100%)

Chi square=5.247, *P*>0.05, df=6 (Non-Significant)

Table 8: The table shows the prevalence of malocclusion and orthodontic treatment needs of study population according to DAI scores

No. of children affected *n* (%)	DAI Scores	Severity of Malocclusion	Treatment need
679 (75.3%)	≤ 25	No abnormality or minor malocclusion	No or slight need
138 (15.3%)	26-30	Definite malocclusion	Elective
54 (6%)	31-35	Severe malocclusion	Highly desirable
36 (4%)	≥36	Very severe or handicapping malocclusion	Mandatory
902 (100%)			

different parts of India showed similar results. A study by Bhardwaj *et al.* in Himachal Pradesh school-going children shows 20.42% had malocclusion which required treatment,[23] whereas Chauhan survey in the young population (i.e., 9-12 yrs) showed much lower DAI scores in the same city.[24] In North Karnataka population, a survey was conducted in which the dental health component (DHC) and aesthetic component (AC) of the index of orthodontic treatment need (IOTN) and the index of complexity, outcome, and need (ICON) were assessed. The survey population showed 49.3%, 44.4%, and 7.1% of samples needed definite orthodontic treatment need on basis of DHC, ICON, AC, respectively.[25] In the present study, the mean score of DAI is similar in all age groups. Prevalence of malocclusion has been reported to be high in orphans and disabled students. In a study conducted by Gupta in four orphanage Institutes in Jammu, overall DAI was found to be very high, i.e., 23.92 ± 5.568 and was more seen in girls. Around 79.7% orphans had crowding and 42.2% subjects were having diastema between incisors.[26] In Patna, only 33% of subjects had crowding and about 9% of children had midline diastema which is much less comparing to orphans children of Jammu.

A study conduced by Das *et al.* in Bangalore in young school-going children showed the prevalence of malocclusion as 71%, which is much higher than the present study.[27] Diwan *et al.* in Dehradun's school-going children found an immediate need for orthodontic treatment in 12% cases of children with an increasing pattern of need in increasing age of children.[28] The most prevalent severe occlusal feature in this study was increased overjet (51%) which was consistent with similar other studies.[29] In the present study, a similar trend in the increasing pattern of malocclusion with the increase in age was noted and the most common type of malocclusion was increased overjet. However, Asiry *et al.* reported that crowding was the highest occlusal trait in frequency followed by spacing, increased overjet, and increased overbite.[30]

Conclusion

It can be concluded from the present study that the prevalence of malocclusion is reasonable high in this part of the region and it is very important to bring in more awareness at the school level as primary prevention can be the most effective tool in control this menace. And call for better programs from the concerned authority to deliver the same to make smile beautiful should be the priority.

Conflicts of interest

There are no conflicts of interest.

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