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RESEARCH ARTICLE

Prevalence of malocclusion in relation to area of residence among 13-15 years old Government and Private school children in Bhopal district, Madhya Pradesh, India.

Dr. Ruchika Gupta, Dr. Chandrashekar BR, Dr. Pankaj Goel, Dr. Vrinda Saxena, Dr. Rahul Ganavadiya and Dr. Neha Verma

Post graduate student, Department of Public Health Dentistry, People's Dental Academy, Bhanpur, Bhopal.

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*Corresponding Author

Dr. Ruchika Gupta,

Abstract

Background: The published literature on the prevalence of malocclusion among school going children in Madhya Pradesh in relation to socio-economic status and area of residence was nonexistent. **Objective:** To assess the prevalence of malocclusion in relation to area of residence among the government and private school children in Bhopal district, Madhya Pradesh using dental aesthetic index (DAI). **Study design and setting:** The study was cross sectional and conducted among 13 – 15 years old school children selected from the government and private schools of rural and urban areas in Bhopal district, Madhya Pradesh, India. **Methodology:** A pilot study was done on a convenient sample of twenty students. The sample size was estimated based on the risk difference in the malocclusion prevalence between rural and urban children using n. Master software. A multistage cluster sampling was used for selection of study participants. The eligible children aged 13 – 15 years, fulfilling the inclusion and exclusion criteria were selected from four government and private schools in the rural and urban areas of Bhopal district. The clinical oral examination of the participants was carried out by a trained and calibrated investigator using a mouth mirror and Community Periodontal Index (CPI) probe under natural day light. The severity of malocclusion was assessed using DAI. The data was analyzed using SPSS version 20. The prevalence and severity of malocclusion between different categories was compared using Chi – square test. **Results:** A total of 549 school children were examined in the present study. The prevalence of malocclusion (DAI score > 25) among the study population was 21.5%. The prevalence and severity and hence, the treatment need was higher among 13 years old children compared to other age groups ($p = 0.001$). The prevalence of malocclusion was higher among male children (24.2%) compared to females (19%). There was no statistically significant difference in the prevalence and severity of malocclusion in relation to type of schooling ($p = 0.368$) and area of residence ($p = 0.580$). **Conclusion:** The high prevalence of malocclusion among younger children require thorough assessment as lack of early intervention in certain cases may lead to gross malocclusion at later stages.

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INTRODUCTION

Malocclusion is one of the most common dental problems in mankind, together with dental caries, gingival disease and dental fluorosis. Malocclusion is not only a single entity but rather a collation of situations each in itself constituting a problem and any of the situations are complicated by a multiplicity of genetic and environmental

causes¹. There are ethnic, geographical variations in the prevalence of malocclusion. It is more prevalent in whites than in blacks, more in developed countries than in third world countries; more in urban areas than in rural children.¹ It is defined as an occlusion in which there is a mal relationship between the arches in any of the planes of spaces or in which there are anomalies in tooth position beyond normal limits.² Genetic, environmental, or a combination of both factors, along with various local factors such as adverse oral habits and anomalies in number, form, and developmental position of teeth can cause malocclusion.

The literature suggest the prevalence of malocclusion in India to vary from 20- 43%.¹ The isolated studies carried out in Punjab, Delhi, Trivandrum and Bangalore suggest that about 30% school going children suffer from some degree of malocclusion and half of these require comprehensive orthodontic treatment.³ The results obtained from these studies have shown wide variations in prevalence and distribution of malocclusion and one of the major factors for this widespread variation was lack of consensus on the index to be applied for assessing malocclusion.⁴ The variations in the prevalence rates between different regions and countries may also be due to variations in ethnicity, nutritional status, religious beliefs, and dietary habits. Hence, it is important to determine the prevalence of malocclusion and its occurrence and distribution in a community to facilitate planning orthodontic treatment. The lack of early care in developing malocclusion may have far reaching consequences as public equates good dental appearance with success in many pursuits. Besides, maloccluded teeth can cause psychosocial problems related to impaired dentofacial aesthetics, disturbances of oral function, such as mastication, swallowing and speech, and greater susceptibility to trauma and periodontal disease². The published literature on the prevalence of malocclusion among school going children in Madhya Pradesh in relation to socio-economic status and area of residence was nonexistent. Hence, the present study assessed prevalence of malocclusion in relation to area of residence among the government and private school children in Bhopal district, Madhya Pradesh using dental aesthetic index (DAI)⁵.

Material and Methods:

The study was cross sectional and conducted among 13 – 15 years old school children selected from the government and private schools of rural and urban areas in Bhopal district, Madhya Pradesh, India. The permission to conduct the research was obtained from the concerned school head masters and ethical clearance was obtained from the Institution ethics committee. The training and calibration of the investigator was done on a group of ten volunteers having different severity of malocclusion. The investigator assessed the severity of malocclusion using DAI. The intra-examiner reliability score was determined by computing the kappa co-efficient value for DAI which was 0.825. A close ended multiple choice questionnaire was prepared following a thorough review by subject experts. The questionnaire collected information on demographic details, oral hygiene practices, dietary habits, dental history and parafunctional habits.

Pilot testing and sample size estimation: A pilot study was conducted on a convenient sample of twenty students from rural and urban schools of Bhopal district. The questionnaire and data collection sheet were used for collecting the desired information and malocclusion severity respectively. The prevalence of malocclusion among rural and urban children was found to be 40% and 25% respectively. The sample size was estimated to be 543 based on risk difference between two proportions using *n* Master software.

Selection of schools: A multi stage cluster sampling was used for selection of schools. Two out of fourteen zones were selected by simple random sampling from Bhopal city. All the localities within these selected zones were listed and then, one locality was selected from each zone again by simple random sampling technique. The list of all government and private higher secondary schools in these selected localities was prepared and subsequently, one government and one private school from each locality were selected. Likewise, the list of government and private schools in the two tehsils of Bhopal district was prepared and one government and one private higher secondary school from each tehsil were selected. In this way, eight schools (four government and four private) were selected from urban and rural areas of Bhopal district.

Selection of eligible children: All children aged 13 -15 years in the schools selected were interviewed to collect the desired information by a trained assistant along with an initial screening by the investigator. Subsequently, The list of children having permanent dentition, free from supernumerary teeth, high frenal attachments, who are permanent residents in the concerned area, willing to participate, without history of orthodontic treatment, parafunctional habits was prepared. The further selection of children from this list was made using systematic random sampling.

Assessment of malocclusion: The clinical oral examination of the selected children was done on a plastic chair under natural day light using a mouth mirror and Community Periodontal Index (CPI) probe. The autoclaved sets of instruments were used for oral examination of children. The malocclusion was assessed using Dentofacial anomalies (DAI) as described by World Health Organization 1997⁵. Based on the DAI score, each study participant was assigned to one of the severity grades of malocclusion. The occlusal traits assessed in DAI, the regression equation for computing DAI score, severity of malocclusion and treatment need as per DAI score is specified in table 1. The

prevalence and severity of malocclusion between different categories was compared using Pearson's Chi-square test. The statistical significance was fixed at 0.05.

Results:

A total of 549 school children aged 13 – 15 years were examined in the present study. The age and gender distribution of the study participants in relation to area of residence and type of schooling is presented in tables 2 and 3 respectively.

Malocclusion in relation to age: The overall prevalence of malocclusion (DAI score > 25) among the study population was 21.5%. The prevalence of definite, severe and very severe malocclusion was 14.8%, 2.9% and 3.8% respectively. The treatment need for the children in these categories was elective, highly desirable and mandatory respectively. The prevalence of malocclusion among 13 years, 14 years and 15 years children was 28.7%, 18.9% and 16.2% respectively. The prevalence and severity as well as the treatment need was higher among 13 years old children compared to other age groups ($p = 0.001$, Table 4).

Malocclusion in relation to gender: The prevalence of malocclusion was significantly higher among male children (24.2%) compared to their female counterparts (19%). This gender difference in the prevalence and severity of malocclusion was statistically significant ($p = 0.038$, Table 5).

Malocclusion in relation to type of schooling: The prevalence of definite, severe and very severe malocclusion among children from government school was 16.3%, 3.7% and 3.4% respectively. The prevalence of definite, severe and very severe malocclusion among children from private schools was 12.9%, 2% and 4.3% respectively. The difference in the prevalence and severity of malocclusion between the children from government and private schools was not statistically significant ($p = 0.368$, Table 6).

Malocclusion in relation to area of residence: Among children from rural areas, 76.7% of the children were free from malocclusion while 15.2%, 3.7% and 4.4% of the children had definite, severe and very severe malocclusion. Among children from urban areas, 80.3% of the children were free from malocclusion while 14.3%, 2.2% and 3.2% of the children had definite, severe and very severe malocclusion. The difference in the prevalence and severity of malocclusion between the children from rural and urban schools was not statistically significant ($p = 0.580$, Table 7).

Table 1: Occlusal traits assessed in DAI, regression equation for computing DAI, severity of malocclusion and treatment need as per DAI score.

Occlusal traits assessed in DAI	Missing incisors canines and premolar teeth, Crowding in the incisal segments, Spacing in the incisal segments, Diastema in mm, Largest anterior maxillary irregularity in mm, Largest anterior mandibular irregularity in mm, anterior maxillary overjet in mm, anterior mandibular overjet in mm, Vertical anterior openbite in mm, antero-posterior molar.	
Regression equation to compute DAI score	Missing teeth X 6+Crowding in the incisal segments+Spacing in the incisal segments+Diastema in mm X 3+Largest anterior maxillary irregularity in mm+Largest anterior mandibular irregularity in mm+anterior maxillary overjet in mm X 2+anterior mandibular overjet in mm X 4+Vertical anterior openbite in mm X 4+antero-posterior molar relation X 3+13	
DAI score	Malocclusion severity	Treatment need
< 25	No malocclusion or minor malocclusion	No or slight need
26 – 30	Definite malocclusion	Elective
31 – 35	Severe Malocclusion	Highly desirable
36 and above	Very severe or Handicapping malocclusion	Mandatory

Table 2: Age distribution of the study population in relation to area of residence and type of school

Age groups	Rural			Urban			Total (Area and type of school combined) N (%)
	Govt.	Private	Total	Govt.	Private	Total	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
13 years	32* (24.8)	51* (36.2)	83 (30.7)	70* (42.4)	42* (36.8)	112 (40.1)	195 (35.5)
14 years	29*	54* (38.3)	83 (30.7)	49* (29.7)	37* (32.5)	86 (30.8)	169 (30.8)

	(22.5)						
15 years	68* (52.7)	36* (25.5)	104 (38.5)	46* (27.9)	35* (30.7)	81 (29)	185 (33.7)
Total	129 (100)	141 (100)	270 (100)	165* (100)	114* (100)	279 (100)	549 (100)
Statistical inference	X ² value: 21.234 df: 2 p value:0.001			X ² value: 0.875 df: 2 p value:0.646			*X ² value: 30.692 df: 6 p value:0.001

Table 3: Gender distribution of the study population in relation to area of residence and type of school

Gender groups	Rural			Urban			Total (Area and type of school combined)
	Govt.	Private	Total	Govt.	Private	Total	
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Males	52* (40.3)	71* (50.4)	123 (45.6)	85* (51.5)	52* (45.6)	137 (49.1)	260 (47.4)
Females	77* (59.7)	70* (49.6)	147 (54.4)	80* (48.5)	62* (54.4)	142 (50.9)	289 (52.6)
Total	129 (100)	141 (100)	270 (100)	165 (100)	114 (100)	279 (100)	549 (100)
Statistical inference	X ² value: 2.740 df: 1 p value:0.098			X ² value: 0.939 df: 1 p value:0.332			*X ² value: 4.361 df: 3 p value:0.225

Table 4: Prevalence and severity of malocclusion in relation to age among the study participants.

Severity of malocclusion	13 years	14 years	15 years	Total
	N (%)	N (%)	N (%)	N (%)
No malocclusion	139 (32.3) (71.3)	137 (31.8) (81.1)	155 (36.0) (83.8)	431 (100) (78.5)
Definite malocclusion	32 (39.5) (16.4)	28 (34.6) (16.6)	21 (25.9) (11.4)	81 (100) (14.8)
Severe malocclusion	13 (81.2) (6.7)	2 (12.5) (1.2)	1 (6.2) (0.5)	16 (100) (2.9)
Very severe malocclusion	11 (52.4) (5.6)	2 (9.5) (1.2)	8 (38.1) (4.3)	21 (100) (3.8)
Total	195 (35.5) (100)	169 (30.8) (100)	185 (33.7) (100)	549 (100) (100)
Statistical inference	X ² value: 23.905 df: 6 p value:0.001			

Table 5: Prevalence and severity of malocclusion in relation to gender among the study participants

Severity of malocclusion	Males	Females	Total
	N (%)	N (%)	N (%)
No malocclusion	197 (45.7) (75.8)	234 (54.3) (81.0)	431 (100) (78.5)
Definite malocclusion	41 (50.6) (15.8)	40 (49.4) (13.8)	81 (100) (14.8)
Severe malocclusion	6 (37.5) (2.3)	10 (62.5) (3.5)	16 (100) (2.9)
Very severe malocclusion	16 (76.2) (6.2)	5 (23.8) (1.7)	21 (100) (3.8)
Total	260 (47.4)	289 (52.6)	549 (100)

	(100)	(100)	(100)
Statistical inference	X ² value: 8.442 df: 3 p value:0.038		

Table 6: Prevalence and severity of malocclusion in relation to type of school (SES) among the study participants

Severity of malocclusion	Government	Private	Total
	N (%)	N (%)	N (%)
No malocclusion	225 (52.5) (76.5)	206 (47.8) (80.8)	431 (100) (78.5)
Definite malocclusion	48 (59.3) (16.3)	33 (40.7) (12.9)	81 (100) (14.8)
Severe malocclusion	11 (68.8) (3.7)	5 (31.2) (2.0)	16 (100) (2.9)
Very severe malocclusion	10 (47.6) (3.4)	11 (52.4) (4.3)	21 (100) (3.8)
Total	294 (53.6) (100)	255 (46.4) (100)	549 (100) (100)
Statistical inference	X ² value: 3.158 df: 3 p value:0.368		

Table 7: Prevalence and severity of malocclusion in relation to area of residence among the study participants

Severity of malocclusion	Rural	Urban	Total
	N (%)	N (%)	N (%)
No malocclusion	207 (48.0) (76.7)	224 (52.0) (80.3)	431 (100) (78.5)
Definite malocclusion	41 (50.6) (15.2)	40 (49.4) (14.3)	81 (100) (14.8)
Severe malocclusion	10 (62.5) (3.7)	6 (37.5) (2.2)	16 (100) (2.9)
Very severe malocclusion	12 (57.1) (4.4)	9 (42.9) (3.2)	21 (100) (3.8)
Total	270 (49.2) (100)	279 (50.8) (100)	549 (100) (100)
Statistical inference	X ² value: 1.964 df: 3 p value:0.580		

Discussion:

Maloccluded teeth can cause psychosocial problems owing to an increased concern about dental appearance during childhood and adolescence to early adulthood. The early intervention can negate the development of handicapping malocclusion and associated psychological distress. It is vital to know the prevalence and severity of malocclusion as well as its distribution. This will facilitate planning orthodontic services to the needy population at an early stage. The various studies conducted in different parts of the country have found widespread variations in the prevalence and severity of malocclusion^{1,2}. This could also be due to lack of consensus on the index to be used for assessing malocclusion. Owing to the nature of malocclusion, there are many limitations that affect the objectives of any assessment method that may be adopted. In the work carried out so far, it has been assumed that the primary purpose of an assessment of malocclusion is to provide data useful for group study, even though the index may not be sufficiently sensitive for selecting cases for treatment. The present study was conducted among the children from higher secondary schools aged 13 – 15 years using DAI. The DAI is based on a social acceptability scale of occlusal conditions⁶. The DAI looks into the aesthetic aspects of occlusion and it links clinical and aesthetic components, mathematically, to produce a single score. This score reflects the malocclusion severity. By using cut-off points, index was subsequently used to determine the need for orthodontic treatment. The DAI highlights the importance of

physical attractiveness and by considering societal defined norms for dental appearance, it recognizes conditions that are potentially psycho-socially handicapping.⁶

The present study was conducted among the children from higher secondary schools aged 13 – 15 years using Dental Aesthetic index. Under normal circumstances, the chronology of human dentition reflects that most permanent teeth except third molars will erupt at around 12 years of age⁷. The study was conducted in higher secondary schools housing children in grades eight to ten. The selection of children aged 13 years or more as lower limit was to reduce the possibilities of mixed dentition among the selected children. Very few children in higher secondary schools were aged 16 years or more. Moreover, 15 years is one of the index ages for basic oral health surveys. The possibility of getting higher number of children with permanent dentition from the secondary schools made us select children in the age range of 13 to 15 years in the present study. The overall prevalence of malocclusion among the study population was 21.5% (DAI score > 25). National Oral Health Survey and Fluoride mapping in India found the prevalence of malocclusion among 15 years old children in Madhya Pradesh to be 37.3%.⁸ The low prevalence of malocclusion in the present study compared to this study may be due to socio-demographic differences in the study populations being investigated. A study by Shivakumar KM et al (2009)⁹ found the prevalence of malocclusion among 12 – 15 years old children in Davanagere city, Karnataka, India to be 19.9%. Another study by Bhaskaradoss JK et al (2013)¹⁰ found only 15% of the 11 – 15 years old children to have DAI score of more than 25. The prevalence of malocclusion in the present study is comparable to the findings of these studies and others¹¹.

The prevalence of malocclusion was significantly higher among 13 years old children compared their elderly counterparts. Shailee F et al (2013)¹² in their study on oral health status and treatment needs among 12 and 15 years old children found the prevalence of malocclusion to be higher among 12 years children (58.1%) compared 15 years children (53.5%). The higher prevalence of malocclusion among younger children in the present study was consistent with the results of this study. The permanent teeth after their eruption into the oral cavity may take some time to come into proper occlusion. The higher prevalence among younger children may be attributed to lack of complete alignment following their eruption at this point in time which improves with time. The results were in agreement with a study by Ciuffolo et al (2005)¹³ who found 13 year old children to have higher prevalence of malocclusion compared older children.

The prevalence of malocclusion was significantly higher among male children compared to females. Higher prevalence of malocclusion among males compared to females may be attributed to poor oral hygiene practices which in turn might have lead to premature loss of deciduous teeth. The results were in agreement with findings of a study by Shivakumar KM et al (2009)⁹. However, the results were in contrast to the findings of Shailee F et al (2013)¹² who found no significant gender differences in malocclusion and Chandra Shekar et al (2013)¹⁴ who found a higher prevalence of malocclusion among females (23.9%) compared to males (13.5%). A study by Tak M et al (2013)¹⁵ on the prevalence and orthodontic treatment needs among 12 -15 years old school children in Udaipur found a higher prevalence of malocclusion among males (38.7%) compared to female children (26.3%). The authors quoted that the reason for this was not understood, but attributed it to the fact that male growth starts later and does not reach maximum at the age range of the study population. The gender distribution of malocclusion in the present study was in agreement with the findings of this study and others^{25,37}.

The children for the present study were selected from government and private schools in rural and urban areas. Literature suggests government schools to house children mostly from lower socio economic background in comparison with private schools²⁹. Private schools house children from upper socio economic classes¹². In view of the complexities involved in collecting the detailed information on education, income and occupation from the parents rather than children and the differing scales for assessing socio economic status in rural and urban areas in India, we used type of schooling as a proxy for SES in the present study. There was no statistically significant difference in the prevalence of malocclusion between the children from government and private schools. The prevalence among government school children was 23.5% and among private school children, it was 19.2%. A study by Pruneda JFM et al (2012)¹⁶ on a group of university students found no significant difference in the prevalence of malocclusion in relation to socio-economic status. The authors concluded that socioeconomic status was not a factor associated to the frequency of dental occlusion classification in that population, but attributed it to other factors such as cultural and educational factors that need to be evaluated. These results were consistent with the findings of our study. Another study by Siddegowda R et al (2012)¹⁷ estimated the prevalence of malocclusion among school children in Karnataka based on the socio-economic backgrounds. The study found no significant difference in the prevalence of class I, Class II and Class III malocclusion among the children from low, middle and high socio economic status. The authors attributed the lack of difference to the increase in the literacy rate and better job opportunities which would have people to lead a better life and meet their basic requirements. These results were in agreement with our study findings. The socio-economic status was considered to play a major role as the parents'

financial situation determined the need for treatment of malocclusion. Earlier, it was also presumed that the prevalence of malocclusion was more in low and middle SES children compared high SES children. This was attributed to the concept that children from high SES could easily afford for orthodontic treatment compared to children from low and middle SES. However, the trend is changing, the increasing literacy and developing economy with uniform eating patterns has reduced the difference in the prevalence rates of malocclusion between children of different SES groups.

The dietary habits, oral hygiene practices etc can act as predisposing factors for dental caries that may lead to premature loss of teeth which in turn can act as predisposing factor for malocclusion. The rapid spread of urban culture, lifestyle, eating patterns into rural areas has resulted in no significant difference with regard to these factors between children residing in urban and rural areas. The exclusion of children with high frenal attachment, parafunctional habits, history of orthodontic treatment and positive family history for malocclusion along with no significant difference with respect to dietary habits, oral hygiene practices and history of carious extraction between children from urban and rural areas might be the reason for not finding a significant difference in malocclusion between rural and urban areas. Chandra shekar et al (2013)¹⁴ found a higher prevalence of malocclusion among children in urban areas (22.9%) compared to children in rural areas (15.5%). Our findings were contradictory to the findings of this study. The requirement of selecting the children from private schools even in rural areas might have resulted in selection of schools from peri-urban areas rather than strictly rural areas where private schools are mostly non-existent. The definition of rural areas in a strict sense might have been violated in the present study and hence, the comparison made could ideally be said to have been made between urban and peri-urban areas rather than between rural and urban areas. This also may be a reason for not finding a significant difference in the prevalence and severity of malocclusion in relation to area of residence.

Conclusions:

Based on the results of the present study, the following conclusions are drawn

- ❖ The prevalence of malocclusion among the study population was 21.5%.
- ❖ The prevalence of definite, severe and very severe malocclusion was 14.8%, 2.9% and 3.8% respectively.
- ❖ The study found the prevalence of malocclusion to be significantly higher among younger children compared to their older counterparts.
- ❖ The prevalence was higher among male children compared female children
- ❖ There was no significant difference in the prevalence and severity of malocclusion in relation to SES and area of residence.

The high prevalence of malocclusion among younger children require thorough assessment as lack of early intervention in certain cases may lead to gross malocclusion at later stages. The cross sectional nature of study, the smaller sample size and the selection of children from peri-urban areas rather than strictly rural areas call for further studies to validate the results of present study.

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