Original Article

Assessment of malocclusion severity and orthodontic treatment needs in 12–15-year-old school children of Namakkal District, Tamil Nadu, using Dental Aesthetic Index

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ABSTRACT

Objectives: The present study was aimed to assess the severity of malocclusion and orthodontic treatment needs among 12–15-year-old schoolchildren in rural area of Namakkal district, Tamil Nadu, India, using the Dental Aesthetic Index (DAI). **Materials and Methods:** A cross-sectional study was conducted among a sample of 1078 schoolchildren (12–15 years of age) who were selected by two-stage cluster sampling technique. Severity of malocclusion and orthodontic treatment needs were assessed according to the DAI using a specially designed survey pro forma with the aid of the WHO's Oral Health Survey: Basic Methods. Based on the distribution of data, analysis of variance and unpaired student *t*-test were used. **Results:** Out of the total of 1078 children examined, 528 (49%) were males and 550 (57%) were females. The results indicate that 82.74% of the schoolchildren were found with little or no malocclusion requiring no orthodontic treatment. The gender-wise distribution of DAI score among children aged 12 years had significant difference between males (20.43 ± 3.67) and females (21.62 ± 4.335) (P = 0.015) and children aged 15 years also showed highly significant difference among gender (P = 0.000). **Conclusion:** Malocclusion not only impacts the appearance of the person but also affects the self-esteem and psychological well-being. This is the first step in understanding the treatment need so that further steps can be taken in preventive and interceptive care.

KEYWORDS: 12–15-years-old schoolchildren, Dental Aesthetic Index, severity of malocclusion, treatment needs

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Introduction

Malocclusion is one of the common problems seen in all parts of the world and varies according to genetics, environment, and race. Malocclusion can be defined as an occlusion in which there is a malrelationship between the dental arches in any of the planes or in which there are anomalies in tooth position beyond the normal limits. It causes the impairment of oral health, function, and esthetics and also affects the psychology of an individual according to his/her perception.

Increased concern for dental appearance during adolescence has been observed. Dentists predict that

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the strongest motivator for orthodontic treatment is the psychological component of malocclusion. The measurement of malocclusion as a public problem is extremely difficult since most orthodontic treatment is undertaken for esthetic reasons and is very difficult to estimate the extent to which malposed teeth constitute to a psychological hazard. The uptake of orthodontic treatment is influenced by the desire to look attractive, self-perception and self-esteem of dental appearance.[1,2] The benefits of taking orthodontic treatment are for prevention of tissue damage and correction of esthetic component and to improve the physical function. Keeping in view, the WHO has recommended Dental Aesthetic Index (DAI) as a method of assessing the dentofacial anomalies.[3,4] DAI is a cross-cultural index focused on socially defined dental esthetics. The DAI has been studied worldwide in several different populations over the recent years, but it has been sparingly used to estimate the prevalence of malocclusion in India, especially in Tamil Nadu.

Very few studies have been conducted to assess the prevalence of malocclusion and orthodontic treatment needs among schoolchildren in rural India and none in this area. Hence, the present study was designed.

Thus, the aim of the study was to assess the severity of malocclusion and orthodontic treatment needs and variation with respect to age and gender among 12–15-year-old schoolchildren in rural area of Namakkal district, Tamil Nadu, India, using the DAI.

Materials and Methods

The present cross-sectional study was conducted in the rural area of Namakkal district of Tamil Nadu, a southern state in India. A random and representative sample of 1078 schoolchildren (12–15 years of age) were selected by multistage cluster sampling technique. The power of the study was set as 80% with design effect of two. At the first stage, schools were randomly selected among a list of secondary schools obtained from the office of Namakkal District Education Office. Then, a proportion of students based on ascertained age groups within each chosen school was randomly selected. Finally, 1078 children (528 males and 551 females) were selected from eight different schools. This age group was chosen because 12–15 years is the age when malocclusion is expressed completely. Thus, the assessment of dentofacial anomalies is often significant at this age and the early intervention is also possible. Students who were using an orthodontic appliance or reported a previous history of any kind of orthodontic treatment, who were uncooperative for oral examination, were excluded. Furthermore, children with clefts and with systemic diseases were also excluded from the study.

Initially, a pilot study was carried out involving thirty school students to assess the reliability of the examiner. Ethical clearance was obtained from the Institutional Ethics Committee, prior to the commencement of study. The present study was approved and supported as an Indian Council of Medical Research (Short Term Student 2013 project) project. Oral examination was performed by two examiners using the community periodontal index probe, metal millimeter ruler, and mouth mirror under natural daylight.

Severity of malocclusion and orthodontic treatment needs were assessed according to the ten components of DAI using a specially designed survey pro forma with the aid of the WHO's Oral Health Survey: Basic Methods (1997).[5,6] The training and calibration of the examiners was carried out using the data collection sheet (consisting of demographic data and DAI) on fifty students in one of these schools with a prior notification and consent from the head of the school. The inter-examiner agreement for application of DAI was established as 0.90.

The severity of malocclusion and treatment needs among students were classified and interpreted on the basis of DAI scores as stated below.[4,5]

1. <26: little or no treatment need
2. 26–30: treatment elective
3. 31–35: treatment highly desirable
4. >35: treatment mandatory.

Children requiring immediate treatment were referred to the nearest dental college.

The collected data were subjected to statistical analysis using Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA, Version 17.0 for Windows). The data obtained were assessed for normality by Shapiro–Wilks test. Based on the type and distribution, analysis of variance (ANOVA) test was used for comparison of mean DAI scores between the age groups. The unpaired Student's *t*-test was used to compare the relationship of mean DAI scores among sex groups in 12, 13, 14, and 15 years. All statistical tests were performed at a significance level of $\alpha = 0.05$.

Results

Of the 1078 children examined, 528 (49%) were males and 550 (57%) were females. Age- and gender-wise distribution of study population is shown in Table 1. Gender-wise distribution of DAI and orthodontic treatment needs are shown in Table 2. The comparison

Table 1: Age- and gender-wise distribution of the study population

Age (years)	Male, *n* (%)	Female, *n* (%)
12	132 (12.2)	142 (13.1)
13	142 (13.2)	137 (12.7)
14	138 (12.8)	142 (13.3)
15	116 (10.8)	129 (12.0)

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of mean DAI scores among age groups was found to be statistically insignificant (P = 0.084) using one-way ANOVA with Tukey's honestly significant difference test [Table 3]. *post hoc* test showed that there was significant difference between DAI score of children in 12 and 15 years' age group (P = 0.001). By comparing the gender-wise distribution of DAI score among the five age groups, children aged 12 years had significant difference between genders (P = 0.015) and children aged 15 years also showed highly significant difference among genders (P = 0.000) [Table 4].

Discussion

The present study was taken up with the objective of assessment of malocclusion severity and orthodontic treatment needs in 12–15-year-old schoolchildren of Namakkal district, Tamil Nadu, using DAI. A review conducted on malocclusion studies in India revealed wide variation in the prevalence in different parts of the country which can be attributed to the lack of uniformity in data collection and variations in the indices used for assessing the severity of malocclusion.

In this study, it was found that in 12 years there was a statistically significant difference in the mean DAI score among males and females and highly significant difference in 15 years. Studies worldwide showed no statistical significance among genders.[7,8] Since our study is showing significant results, more studies are required to explore the causative factors.

The results of the study indicate that 82.74% of the schoolchildren were found with little or no malocclusion requiring no orthodontic treatment, this is quite high compared to other studies conducted among 12–13-year-old Malaysian schoolchildren (62.6%)[9] and 12–18-year-old Nigerian secondary schoolchildren (77.4%), Davangere (80.1%) and slowly lower than the study conducted among children in hilly areas of Himachal Pradesh (87.5%).[10] The results were compared with the study conducted in Chennai where 37.5% of the study population had definite-to-severe malocclusion, whereas at Davangere, it was 19.9%, study at hilly regions of Himachal Pradesh was 11.1% and our study shows 17.3% of students to have definite-to-severe malocclusion. The students with definite-to-severe malocclusion were less than that of

Table 2: Gender-wise distribution of Dental Aesthetic Index and orthodontic treatment needs

Gender	DAI score				Mean±SD
	No/slight need (*n*)	Elective treatment (*n*)	Highly desirable (*n*)	Mandatory treatment (*n*)	
Male	429	67	23	9	21.88±4.817
Female	463	60	23	4	21.28±4.428

DAI=Dental Aesthetic Index; SD=Standard deviation

Table 3: Comparison of age-wise distribution of Dental Aesthetic Index scores and orthodontic treatment needs

Age (years)	DAI score				Mean±SD	One-way ANOVA	
	No/slight need, *n* (%)	Elective treatment, *n* (%)	Highly desirable, *n* (%)	Mandatory treatment, *n* (%)		*F*	*P*
12	235 (86.08)	28 (10.25)	9 (3.29)	1 (0.36)	21.05±4.064	2.223	0.084 (NS)
13	238 (85.300	27 (9.67)	9 (3.22)	5 (1.79)	21.60±4.451		
14	216 (76.96)	47 (16.72)	14 (4.98)	4 (1.42)	22.06±5.085		
15	203 (82.85)	25 (10.20)	14 (5.71)	3 (1.22)	21.59±4.836		

*P≤0.05. NS=Not significant; SD=Standard deviation; ANOVA=Analysis of variance; DAI=Dental Aesthetic Index

Table 4: Gender-wise distribution of Dental Aesthetic Index scores and orthodontic treatment needs among each group

Age (years)	Gender	DAI score				Unpaired Student's *t*-test	
		No/slight need, *n* (%)	Elective treatment, *n* (%)	Highly desirable, *n* (%)	Mandatory treatment, *n* (%)	Mean±SD	*P*
12	Male	117 (88.63)	11 (8.33)	4 (3.03)	0	20.43±3.67	0.015*
	Female	118 (83.68)	17 (12.05)	5 (3.54)	1 (0.72)	21.62±4.335	
13	Male	118 (83.09)	16 (11.26)	4 (2.81)	4 (2.81)	22.04±4.849	0.094
	Female	120 (87.59)	11 (8.02)	5 (3.64)	5 (3.54)	21.15±3.963	
14	Male	107 (77.53)	24 (17.39)	4 (2.89)	3 (2.17)	22.25±5.348	0.544
	Female	109 (76.22)	23 (16.08)	10 (.99)	1 (69)	21.88±4.83	
15	Male	87 (75.21)	16 (13.67)	11 (9.40)	2 (1.70)	22.92±4.94	0.001*
	Female	116 (89.92)	9 (6.97)	3 (2.32)	1 (0.77)	20.4±4.431	

*P≤0.05 was statistically significant. DAI=Dental Aesthetic Index; SD=Standard deviation

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Chennai and Davangere, but slightly higher than the hilly areas of Himachal Pradesh.[8,10]

Results showed that only 14% among 12-year-old and 17.1% of 15-year-old children required treatment for malocclusion which showed that the prevalence of malocclusion was found to be low in the present study. Thus, this finding showed no significant difference with the results of the National Oral Health Survey in which the prevalence of malocclusion was reported to be 27.4% and 25.4% among 12- and 15-year-old children, respectively.[11]

The reason for the difference in the DAI scores could be due to inherited differences in tooth size and arch size, since DAI includes measurements of most relevant orthodontic traits such as anterior crowding that affects dental esthetics.

When interpreting the results, it should be noted that in the study population, none of the children have been orthodontically treated. In most epidemiological studies, individuals with previous or current history of orthodontic treatment are systemically excluded from the sample. This leads to underestimation of the real treatment need of population being studied, a fact that needs to be taken into account when making comparisons.

Although the prevalence and severity of malocclusion has been assessed in this study, the individual components attributing to the DAI scores have not been studied. Further studies are required to analyze the components – missing teeth, over jet, open bite, etc., and their impact on treatment. The DAI is easy to assess malocclusion, but it does not take into account buccal cross bite, posterior open bite, midline discrepancies, or deep overbite, since these may have considerable impact on treatment complexity and therefore weaken the index.

The present study used dentofacial anomalies with the criteria of DAI for assessing the malocclusion severity and orthodontic treatment needs. The advantage of the DAI is that perceptions of esthetics are linked with anatomical trait measurements by regression, analysis to produce a single score, obviating the need for true separate instruments that cannot be combined as in the Index of Orthodontic Treatment Needs. We recommend the use of this index in all epidemiological studies on malocclusion, at least for the simple reason of having international uniformity in data collection which facilitates the comparison of data obtained worldwide.[9,12-14]

Conclusion

From the results of the study, it can be concluded that 898 (82.7%) schoolchildren had no or little malocclusion requiring little or no orthodontic treatment need and 186 (17.3%) schoolchildren had malocclusion from definite-to-handicapping malocclusion requiring definite-to-mandatory orthodontic treatment need. Hence, the treatment need was found to be low in the study population.

Results also suggest a statistically significant difference in the mean DAI scores among males and females in 12 and 15-year-old children. The index used in this study does not measure posterior open bite, buccal crossbite, midline discrepancies, and deep bite, which may also have substantial impact on treatment intricacy. Further studies in the future can help in exploring more.

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Conflicts of interest

There are no conflicts of interest.

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