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Prevalence of orthodontic treatment entails utilizing index of orthodontic treatment need among school children in Belgaum city

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Abstract---Background: Appraisal of distribution of malocclusion in childhood can facilitate efforts to prevent such a disorder and its consequences. This study was undertaken to assess the need for orthodontic treatment among 12–15-year-old school children of Belgaum city. Materials and Methods: In this cross-sectional study, 250 students randomly selected were examined. The examinations were carried out using the dental health (DHC) and aesthetic components (AC) of the Index of Orthodontic Treatment Need (IOTN) to measure the need for orthodontic treatment. Results: Study showed that among 250 children examined 134 (53.6%) males and 116 (46.4%) female's participants in the study. Orthodontic treatment need was discovered to be greater among males than females. Frequency of

grade 5 treatment need was 11.9% and 7.8% among males and females respectively. Age wise distribution showed highest orthodontic treatment need among 12 years old children, however, maximum subjects (38.2%) had slight need. In spite of high frequency of definite need (22.2%) among 15 years old children, the overall need for treatment was lowest. Illustrated Index of Orthodontic Treatment Need (IOTN) results (%) considering the Aesthetic Component (AC) and Dental Health Component (DHC) together. There were 24.8% subjects with definite need of treatment. No significant age and gender differences were noted; however, the age wise distribution elicited a decrease in treatment need with age and a higher need among males. Conclusion: This research establishes baseline data on the necessity for orthodontic treatment among a 12–15-year-old school children of Belgaum city which is important for planning public orthodontic and dental services.

Keywords---Orthodontic treatment need, malocclusion, school children.

Introduction

Malocclusion is characterized as a deviation from normal dental alignment or a misalignment of the dental arches.^[1] Despite the fact that malocclusion is not life-threatening,^[2] it can be considered as a public health problem due to its high prevalence and prevention and treatment possibilities.^[3] Malocclusions are the third most common oral pathology among global dental public health issues, trailing tooth decay and periodontal diseases.^[4]

Orofacial adaptability to various etiological factors results in malocclusions,^[4] which have a variety of consequences, including psychosocial issues related to impaired dentofacial aesthetics, oral function disturbances such as mastication, swallowing, and speech, and increased susceptibility to trauma and periodontal disease.^[1]

In recent years, there has been a lot of focus on determining the severity and incidence of malocclusions as well as the necessity for orthodontic treatment all over the world. The role of hereditary variables in the aetiology of malocclusions has been diminished, given that many malocclusions have a post-natal genesis, linked to non-nutritive or nutritive sucking behaviors at an early age and traumas.^[5-9] Moreover, the expanded opportunities in orthodontic treatment demand more careful individual evaluation of treatment needs and standardized criteria for their assessment. Indeed, it has been noted that a large proportion of children are improperly recommended for orthodontic treatment, highlighting the importance of using an index to assess orthodontic therapy objectively or normatively.^[10]

Planning orthodontic care in a public health system necessitates knowledge of the child population's orthodontic treatment needs. Brook and Shaw (1989) established the Index of Orthodontic Treatment Need (IOTN), which is now widely

used in the United Kingdom and Europe.^[11] It has proven to be an accurate, reliable, and rapid index for determining the need for orthodontic treatment (Burden and Holmes, 1994).^[12]

In order to identify individuals who would benefit the most from orthodontic treatment, the IOTN defines malocclusions based on the presence of specific occlusal traits that are deemed crucial for dental health and aesthetics. An Aesthetic Component (AC) with ten severity levels and a Dental Health Component (DHC) with five severity levels make up this index. Although the two components cannot be combined into a single score, they can be combined to define the patient as having "orthodontic treatment requirement, Yes or No," as modified by Burden *et al.* (2001).^[13]

According to World Health Organization (WHO), the main oral diseases should be subjected to periodic epidemiological surveys. The epidemiological data on orthodontic treatment need is of relevance for dental public health programs, clinical treatment, prioritization of treatment screening, resource planning and third-party funding.^[4] The evaluation of malocclusion distribution in children can aid attempts to prevent the disorder and its effects, as well as lessen the complexity of costly orthodontic treatment.

Owing to the above-mentioned issues and a scarcity of information regarding orthodontic treatment need prevalence in this part of India, this study was taken up to assess the prevalence of orthodontic treatment needs in 12-15 years old school children of Belgaum city, Karnataka, India. The objective of the study was to assess the need of orthodontic treatment need on the basis of IOTN, to assess the most common deviation for malocclusion and to assess the differences in treatment need proportions by age or gender.

Materials and Methods

This study executes across-sectional study design and had been carried out in accordance with the STROBE guidelines to collect prevalent data using index of orthodontic treatment need among school children in Belgaum city, Karnataka. This cross-sectional survey was conducted from January to March 2022 over the duration of 3 months, following the ethical principles enshrined in Declaration of Helsinki 1975 and its editions. The study protocol was reviewed by the Ethical Committee of KLE's V.K Institute of Dental sciences and Hospital, Belgaum. An official permission was obtained from the District Education Officer, District Education Office [Primary and middle; Secondary], Belgaum.

Written informed consent was obtained before the start of the examinations. Children who had completed chronological age of 12-15 years and those children along with parents willing to participate were included in the study. Children with mixed dentition, craniofacial anomalies (clefts and syndromes) and those children or their parents who were not willing to participate were excluded from study.

The examiner was standardized and calibrated prior to the start of the study, first by practicing the examination on a group of 10 individuals with a wide range of

disease conditions, and subsequently on 20 subjects twice on consecutive days. This was done to ensure that the codes and criteria for the various diseases and conditions to be monitored and documented were all interpreted, understood, and used consistently. The examiner was trained by a faculty member to minimize the errors and doubts. The intra examiner reliability was assessed using weighted Kappa statistics, which was 84% for IOTN.

A Pilot study was carried out on 50 students to determine the feasibility of the study. The time required for examination of each subject and the practicability of the Index of orthodontic treatment need (IOTN) was assessed during the examination. Prevalence of definite malocclusion according to Index of orthodontic treatment need was found to be 36%. Depending on this prevalence of pilot study, the sample size was determined by using the following formula $n = \frac{4pq}{d^2}$ where, p = prevalence 36%, q = 1- p , 64% d = error (10% of p) 3.1, the sample size was estimated to be 250.

Before the instigation of the study, a list of middle and high schools (Government and private) of Belgaum city was obtained from District Education Office, Belgaum, Karnataka. The list obtained comprised of total 202 schools (72 Government and 130 private) in Belgaum city. From the list of 202 middle and high schools, 10 schools were selected using two stage sampling technique. Eligible children were selected by means of simple random sampling from the lists obtained from school records. A total of 25 children were selected from each school to reach a sample size of 250.

A survey proforma consisted of two sections regarding general information about demographic data including name, age and sex, father's education and occupation, name and address of the school. Clinical parameter which is Index of orthodontic treatment need is recorded in later part of survey. A survey was systematically scheduled to cover all the selected schools according to the convenience of the school authorities. A detailed monthly schedule was prepared well in advance in harmony with the authorities of respective schools. A maximum of 25 subjects was examined each day. The examination for malocclusion was made on the selected children according to the Index of orthodontic treatment need (IOTN) and was carried out at the classroom or outside in the corridor in the school premises with the aid of a mouth mirror and CPI (Community Periodontal Index) probe under adequate natural day light (Type III examination) as described in WHO Oral Health Survey Basic Methods 1997. Assessment of all the filled proformas was done on the same day, for the completeness and accuracy of recordings. Collected data was entered in MS Excel and analysed using IBM-SPSS® Statistics-Version 21 (USA: IBM Corp.). Descriptive statistics was applied for the frequency distribution and percentage. Chi-square test for the association between the study variables. The statistical significance was set at $p \leq 0.05$ for all the tests.

Results

Table 1 shows the distribution of study subjects by age and gender. A total of 250 children [males: 134 (53.6%) and females: 116 (46.4%)] participated in the survey. Among all, 68 (27.2%) were 12 years old (37 males, 31 females), 67 (26.8%) were

13 years old (35 males, 32 females), 61 (24.4%) were 14 years old (33 males, 28 females) and 54 (21.6%) were 15 years old children (29 males, 25 females).

Table 2 depicts no significant age and gender variance in the dental health component of IOTN. Eighteen percent of the study population evidenced no need for orthodontic treatment. Maximum subjects (33.2%) had slight need for treatment. Age wise distribution showed highest orthodontic treatment need among 12 years old children, however, maximum subjects (38.2%) had slight need. In spite of high frequency of definite need (22.2%) among fifteen years old children, the overall need for treatment was lowest. Orthodontic treatment need was found to be greater among males than females. Frequency of grade 5 treatment need was 11.9% and 7.8% among males and females respectively.

Table 3 shows distribution of aesthetic Component of IOTN among study subjects by age and gender. According to aesthetic component, majority (55.2%) of the participants illustrated no need for orthodontic treatment. There was greater frequency of moderate need (27.6%) than definite need (17.2%) among the study subjects. Treatment need was higher in younger age groups and male subjects as compared to older age groups and females respectively, however the differences were statistically non-significant. Definite treatment needs for 12 years and 15 years old subjects were 17.6% and 9.3% respectively.

Table 4 illustrated Index of Orthodontic Treatment Need (IOTN) results (%) considering the Aesthetic Component (AC) and Dental Health Component (DHC) together. There were 24.8% subjects with definite need of treatment. No significant age and gender differences were noted; however, the age wise distribution elicited a decrease in treatment need with age and a higher need among males.

Table 5 shows prevalence of malocclusions according to the level of orthodontic treatment need. The frequency of increased overjet (42.8%) was found to be highest among the study subjects followed by teeth displacements (25.2%). Partially erupted teeth (1.6%) demonstrated lowest prevalence. The prevalence of impeded eruption of teeth, increased overjet, crossbites, displacement of teeth, partial eruption and hypodontia were significantly greater among subjects with definite need for treatment than among those with no need for treatment. Although non-significant, the prevalence of all other malocclusions was also higher among those with definite need.

Discussion

The present cross-sectional study was accomplished to assess the prevalence of malocclusion among 12–15-year-old schoolchildren of Belgaum, Karnataka, India. The perspicacity of augmented body image during adolescence elucidates the relevance of age group studied in the present investigation. Moreover, this age group was chosen because the subjects would be in a late mixed dentition or permanent dentition stage, but major orthodontic treatment would not have commenced. Since malocclusion is considered a public health problem [24], the evaluation of orthodontic treatment need is indispensable for planning an orthodontic care service to be inculcated in public health agenda of the

communities. Considering the international acceptance of the Index of Orthodontic Treatment Need (IOTN) in recent years^[25,26] and a dearth of literature in this part of India, the present investigation was taken up.

In the present study, according to the dental Health Component, 82% of the study subject portrayed orthodontic treatment need. The finding is in collaboration with results obtained among Senegalese children,^[27] Italian children,^[28] Caribbean children^[29] and Spanish children of the same age group.^[30] Definite need (24.8%) was comparable to Spanish^[30] and French schoolchildren,^[31] but was lower than that obtained among schoolchildren of Tirana^[32] and Japan^[33]. Definite need as assessed by aesthetic component was found to be 17.2% which is analogous to those obtained among Jordanian schoolchildren^[34] and children of Western Sahara^[35]. As compared to Dental Health component, Aesthetic component showed a lesser proportion of population with treatment need [overall (44.8%) and definite (17.2%)] in the present study which is comparable to previous studies.^[30,36] The divergence in the results of two components may be because the Aesthetic Component appraises the individual's own perception of the aesthetic appearance of their teeth, whereas the Dental Health Component is an objective study of the occlusal characteristics. Burden *et al.*, (2001) devised the modified IOTN, taking the two components together, classifying the subject as having a treatment need when an IOTN DHC score is 4 or more and/or the AC score is 8 or more which appears more apposite and hence was included in the present study.^[37] Taking the two components together (modified IOTN), the treatment need (24.8%) is very similar to French^[31] and UK school children^[38] and but lesser than the findings among Jordanian population.^[39] Non-significant differences among different age and gender groups predicted in the present study is analogous to previous research.^[30,31]

The high prevalence of crowding (42.8%), increased overjet (21.6%) and displacements (25.2%) is analogous to that obtained among southern Italian school children.^[28] The prevalence of population with increased overbite (14.8%) in the present study was found to be higher and lower than that obtained among Japanese^[33] and southern Italian^[28] children respectively. Reverse overjet showed a prevalence of 13.6% which was higher as compared to Japanese and south Indian children.^[40] Crossbite showed a very rare prevalence (4%) in comparison to other populations.^[28,41] These frequency variations are possibly due to ethnically different groups, age groups of the individuals evaluated, and variation in assessment criteria. The significant variations of impeded eruption of teeth, increased overjet, crossbites, displacement of teeth, partial eruption and hypodontia among subjects with definite and no need for treatment is comparable to Brazilian schoolchildren.^[36]

Our study has several study limitations. First, some study subjects had mixed dentition (deciduous second molar) because the study population was 12 to 15 years old. Second, the prevalence of malocclusion might be underestimated because we excluded students who had received orthodontic treatment. Third, the DHC score is based on a grade assigned to the single "worst" occlusal characteristic, making it a simple and reliable indicator to employ, but it ignores the cumulative effect of a number of minor occlusal aberrations. As a result, in some cases, the severity of malocclusion may be underestimated.^[31] Finally, there

is an imperative need for more extensive longitudinal studies addressing the etiological factors in various populations to implement Mc Kinlay's upstream approach of healthcare.

Conclusion

In conclusion, our results have shown that a high proportion of children need orthodontic treatment and the Efforts to promote assessment of malocclusions and orthodontic treatment need are strongly needed and usefulness of IOTN should be assessed in further research. The present study provides baseline information to underpin the implementation of school based oral health promotion programs. To meet the orthodontic treatment needs, the Public Health Dentistry and Orthodontic Departments of dental colleges should undertake imperative steps in the initiation and implementation of a comprehensive agenda. There is also a need to inculcate the orthodontic services in the current public health policies to fill the lacunae. A sustained effort of the public private collaboration resulting in a creative synergy capitalizing on the talent and resources of each partner can have a beneficial role.

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Table 1: Distribution of study subjects by age and gender.

Age (Years)	Gender n (%)		Total n (%)
	Male	Female	
12	37 (14.8)	31 (12.4)	68 (27.2)
13	35 (14.0)	32 (12.8)	67 (26.8)
14	33 (13.2)	28 (11.2)	61 (24.4)
15	29 (11.6)	25 (10.0)	54 (21.6)
Total	134 (53.6)	116 (46.4)	250 (100)

Table 2: Dental Health Component of IOTN among study subjects by age and gender

Variable	Dental Health Component of IOTN n (%)					p- value
	Grade 1 (No need)	Grade 2 (Slight need)	Grade 3 (Borderline need)	Grade 4 (Need treatment)	Grade 5 (Need treatment)	
Age (Years)						
12	4 (5.9)	26 (38.2)	18 (26.5)	14 (20.6)	6 (8.8)	0.56
13	10 (14.9)	22 (32.8)	20 (29.9)	10 (14.9)	5 (7.5)	
14	12 (19.7)	21 (34.4)	13 (21.3)	8 (13.1)	7 (11.5)	
15	19 (35.2)	14 (25.9)	9 (16.7)	5 (9.3)	7 (12.9)	
Gender						
Male	5 (3.7)	58 (43.3)	35 (26.1)	20 (14.9)	16 (11.9)	0.88
Female	40 (34.5)	25 (21.5)	25 (21.5)	17 (14.7)	9 (7.8)	
Total	45 (18.0)	83 (33.2)	60 (24.0)	37 (14.8)	25 (10)	

*All values are expressed as the frequency with percentages (in parentheses); The statistical test used: Chi square test; *Statistically significant $p \leq 0.05$, **Highly significant $p \leq 0.001$.*

Table 3: Aesthetic Component of IOTN among study subjects by age and gender.

Variable	Aesthetic Component of IOTN n (%)			p- value
	Grade 1-4 (No need)	Grade 5-7 (Moderate need)	Grade 8-10 (Definite need)	
Age (Years)				
12	26 (38.2)	30 (44.1)	12 (17.6)	0.77
13	28 (41.8)	25 (37.3)	14 (20.9)	
14	39 (63.9)	10 (16.4)	12 (19.7)	
15	45 (83.3)	4 (7.4)	5 (9.3)	
Gender				
Male	71 (52.9)	41 (30.6)	22 (16.4)	0.51
Female	67 (57.8)	28 (24.1)	21 (18.1)	
Total	138 (55.2)	69 (27.6)	43 (17.2)	

All values are expressed as the frequency with percentages (in parentheses); The statistical test used: Chi square test; *Statistically significant $p \leq 0.05$, **Highly significant $p \leq 0.001$.

Table 4: Index of Orthodontic Treatment Need (IOTN) results (%) considering the Aesthetic Component (AC) and Dental Health Component (DHC) together (Burden *et al.*, 1999)

Variable	No need IOTN DHC <4 and IOTN AC <8 n (%)	Definite need IOTN DHC ≥ 4 and/or IOTN AC ≥ 8 n (%)	p- value
Age (Years)			
12	42 (61.8)	26 (38.2)	0.61
13	46 (68.7)	21 (31.3)	
14	52 (85.2)	9 (14.8)	
15	48 (88.9)	6 (11.1)	
Gender			
Male	98 (73.1)	36 (26.9)	0.34
Female	90 (77.6)	26 (22.4)	
Total	188 (75.2)	62 (24.8)	

All values are expressed as the frequency with percentages (in parentheses); The statistical test used: Chi square test; *Statistically significant $p \leq 0.05$, **Highly significant $p \leq 0.001$.

Table 5: Prevalence of malocclusions according to the level of orthodontic treatment need

Variable	Total n (%)	No need IOTN DHC <4 and IOTN AC <8 n (%)	Definite need. IOTN DHC ≥ 4 and/or IOTN AC ≥ 8 n (%)	p- value
Impeded eruption of teeth*	20 (8.0)	15 (7.9)	5 (8.1)	0.02
Increased overjet*	107 (42.8)	45 (23.9)	62 (100)	0.04
Reverse overjet	34 (13.6)	15 (7.9)	19 (30.6)	0.67
Crowding	54 (21.6)	12 (6.4)	42 (67.7)	0.81
Open bite	6 (2.4)	2 (1.1)	4 (6.5)	0.9
Increased overbite	37 (14.8)	20 (10.6)	17 (27.4)	0.11
Crossbites*	10 (4.0)	4 (2.1)	6 (9.7)	0.05
Displacement*	63 (25.2)	31 (16.5)	32 (51.6)	0.03
Partially erupted*	4 (1.6)	0	4 (6.5)	0.01
Supernumerary	15 (6.0)	7 (3.7)	8 (12.9)	0.22
Hypodontia*	18 (7.2)	8 (4.3)	10 (16.1)	0.04

All values are expressed as the frequency with percentages (in parentheses); The statistical test used: Chi square test; *Statistically significant $p \leq 0.05$, **Highly significant $p \leq 0.001$.