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ORIGINAL ARTICLE

Prevalence of Need of Orthodontic Treatment in 7–16-Year-Old School Children in Udaipur City, India

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ABSTRACT

Objective: The study aimed to estimate the need of orthodontic treatment in 7-16-year-old school children in Udaipur city, India.

Methods: This cross sectional study enrolled 1029 subjects (661 males and 368 females) belonging to Udaipur city, Rajasthan, India. Subjects who had not undergone orthodontic treatment were randomly selected. The need for orthodontic treatment was assessed using the Dental Health Component of the Index of Orthodontic Treatment Need (IOTN) by the same calibrated examiner. Collected data were quantitatively analyzed, and the difference pertaining to prevalence between males and females was measured using the chi-square test.

Results: A Grade 1 IOTN score was observed in 48.4% of the population. Grade 2 was observed in 22.9% of the population. A significant difference was noted for the prevalence of Grades 1, 2, and 3 between male and female children, with male children showing greater prevalence of malocclusion grades. Grades 4 and 5, which were noted less frequently, did not show a significant difference with respect to sex.

Conclusion: A higher percentage of the sample required moderate orthodontic treatment. This necessitates proper education and motivation to undergo orthodontic treatment.

Keywords: Dental health component, IOTN, malocclusion, orthodontic treatment need

INTRODUCTION

Malocclusion per se is not a life-threatening condition (1,2). However, the negative psychological impact of having a malocclusion can be a serious threat for the very quality of life a person should cherish (3-5). The literature is explicit with respect to the reports on the psychological issues faced by people with malocclusion (1-8). Besides the psychological issues, malocclusion can be the cause of abnormal oropharyngeal functions (6). Timely orthodontic treatment for the correction of malocclusion can prevent the exaggeration of the psychological as well as functional abnormalities of the oral cavity (7,8).

Many researchers have proposed different indices to record the malocclusion status and need of orthodontic treatment in community-based studies (9-11). The most popular among these is the Index of Orthodontic Treatment Need (IOTN), which was proposed by Brook and Shaw (1989) (12). Various studies have used this index for measuring the degree of malocclusion and the need of orthodontic treatment in different population sectors. The Mewar region falls under the western province of India. The population here is mixed due to the overlapping of the ethnic groups of Rajasthan, Gujarat, Haryana, and Madhya Pradesh, India. Owing to interethnic marriages, one can expect a high rate of malocclusion due to differences in the genetic disposition. However, there is a gap in the literature when it comes to studies on the malocclusion status and need of orthodontic treatment in people belonging to Mewar. The current article aimed to study the prevalence of malocclusion and need of orthodontic treatment in school children aged 7-16 years belonging to Mewar using IOTN.

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METHODS

The study sample comprised 1029 patients (661 males and 368 females) aged 7–16 years from seven different schools in the Mewar region of Rajasthan, India. The subjects were selected in a random order, and a multistage sampling design was executed. The study was undertaken after the approval by the ethiccal committee of Darshan Dental College and Hospital, Udaipur. Examinations were conducted with permission from the education authorities and the principals of the respective schools and after obtaining informed consent from parents of the participating children. Children of the Mewar ethnicity without a previous experience of orthodontic treatment with a fully erupted first molar in permanent dentition were selected. If the child showed a mixed dentition stage, the presence of a deciduous canine and a deciduous second molar was must. Subjects who did not belong to Mewar and had craniofacial anomalies were excluded from the study. The examination was performed by a single calibrated examiner. An American Dental Association (ADA) type III examination pattern, which included simple inspection under adequate light without a radiographic examination, was followed for examining all the children. All the children were examined in the medical room of the school using mouth mirror, probe, millimeter ruler, and compass while they were seated on a stool or a chair using natural light; if the natural light was insufficient, artificial light from a torch was utilized. A separate registration chart was designed to record the personal data of the subjects and to document the findings. The need of orthodontic treatment was assessed for each subject using the Dental Health Component (DHC) of IOTN, wherein Grades 1 and 2 indicated no need of treatment to little need of treatment, Grade 3 indicated moderate need of treatment, and Grades 4 and 5 indicated definitive (high or very high) need of treatment (Table 1) (12).

For the calibration of the examiner, 10 children from the sample were randomly selected, and the recording of the data was repeated after a period of 1 week; the data were subjected to kappa statistics, which accounted for 90%. Quantitative statistics were assessed for all the measurements using Statistical Package for Social Sciences, version 21 (IBM Corp.; Armonk, NY, USA). Sex-and age-based differences were determined using the chi-square test, and significance was set at a p value of 0.05.

RESULTS

Demographic data of the sample are depicted in Table 2. The sample comprised 1029 children aged 7-16 years. There were 661 males and 368 females in the sample.

The IOTN grades for the overall population are depicted in Table 3. A definitive treatment need (Grades 5 and 4) was prevalent in 184 subjects, of which Grade 4 was noted in 133 children (12.9%) and Grade 5 in 51 children (5.0%). Grade 3, which corresponds to a moderate treatment need, was prevalent in 111 subjects (10.8%). Approximately 22.9% (236) of the children had little need of orthodontic treatment (Grade 2). The prevalence of no need of orthodontic treatment (Grade 1) was seen 48.8% of the overall population.

The sex-based differences in the IOTN grades are represented in Table 4. Grade 4 was prevalent in 13.6% of the females, which was higher than its prevalence in males. However, the difference noted was insignificant. The prevalence of Grade 5 was similar in both male and female children (5% and 4.9%, respectively). A significant statistical difference was found between sexes for Grades 1 (0.000), 2 (0.000), and 3 (0.004) DHC of IOTN. The male children showed a higher prevalence of malocclusion grades.

Table 1. Grades of the dental health component (DHC) of the Index of Orthodontic Treatment Need (IOTN)

Grade 5	Very great	Defects of cleft lip and/or palate; increased overjet >9 mm; reverse overjet >3.5 mm with reported masticatory or speech difficulties; impeded eruption of teeth (with the exception of third molars) due to crowding, displacement, the presence of supernumerary teeth, retained primary teeth, and any other pathological causes; extensive hypodontia with restorative implication (more than one tooth missing in any quadrant) requiring prerestorative orthodontics
Grade 4	Great	Increased overjet >6 mm but ≤9 mm; reverse overjet >3.5 mm with no reported masticatory or speech difficulties; reverse overjet >1 mm but ≤3.5 mm with reported masticatoryor speech difficulties; anterior or posterior cross bites with greater than 2 mm displacement between retruded contact position and intercuspal position; posterior lingual cross bites with no occlusal contact in one or both buccal segments; severe displacement or teeth>4 mm; extreme lateral oranterior open bite>4 mm; increased and complete overbite causing notable indentation on the palate or labial gingivae; patient referred by colleague for collaborative care, e.g., periodontal, restorative, or Temporomandibular joint considerations; less-extensive hypodontia requiring prerestorative orthodontics or orthodontic space closure to obviate the need for a prosthesis (not more than one tooth missing in any quadrant)
Grade 3	Moderate	Increased overjet >3.5 mm but ≤6 mm with incompetent lips at rest; reverse overjet >1 mm but ≤3.5 mm; increased and complete overbite with gingival contact but without indentations or signs of trauma; anterior or posterior crossbites with ≤2 mm but >1 mm displacement between retruded contact position and intercuspal position; moderate lateral or anterior open bite >2 mm but ≤4 mm; moderate displacement of teeth >2 mm but ≤4 mm
Grade 2	Little	Increased overjet >3.5 mm but ≤6 mm with competent lips at rest; reverse overjet >0 mm but ≤1 mm; increased overbite >3.5 mm with no gingival contact; anterior or posterior crossbites with ≤1 mm displacement between retruded contact position and intercuspal position; small lateral or anterior open bites >1 mm but ≤2 mm; prenormal or postnormal occlusions with no other anomalies; mild displacement of teeth >1 mm but ≤2 mm
Grade 1	None	Other variation in occlusion, including displacement ≤1 mm

Table 2. Sample composition (n=1029) based on age and sex

	Total Sample			Composition		
	M	F	M+F	Gender		Age
Age (Years)	n	n	n	M%	F%	M+F %
7	22	8	30	3.3	2.2	2.9
8	14	14	28	2.1	3.8	2.7
9	18	11	29	2.7	3.0	2.8
10	44	23	67	6.7	6.2	6.5
11	43	19	62	6.5	5.2	6.0
12	94	48	142	14.2	13.0	13.8
13	79	61	140	12.0	16.6	13.6
14	101	79	180	15.3	21.5	17.5
15	150	74	224	22.7	20.1	21.8
16	96	31	127	14.5	8.4	12.3
Total	661	368	1029	100.0	100.0	100.0

M: male; F: female; n: sample size, %: percentage

Table 3. DHC of IOTN: prevalence in the total sample (n=1029)

IOTN Grade	Number	Percentage
1	498	48.4
2	236	22.9
3	111	10.8
4	133	12.9
5	51	5.0
Total	1029	100.0

DHC: Dental Healt Component; IOTN: Index of Orthodontic Treatment Need; n: sample size

Table 4. DHC of IOTN frequencies based on sex

			Chi-Square Test	
IOTN	M n (%)	F n (%)	Chi-Square	p
1	324 (49.0)	174 (47.3)	45.181	0.000**
2	150 (22.7)	86 (23.4)	17.356	0.000**
3	71 (10.7)	40 (10.9)	8.858	0.004**
4	83 (12.6)	50 (13.6)	8.188	0.005*
5	33 (5.0)	18 (4.9)	4.412	0.033*

DHC: Dental Healt Component; IOTN: Index of Orthodontic Treatment Need; M: male; F: female; n: sample size; %: percentage, *Non-Significant **Significant

Table 5 shows the age-based prevalence rates of the IOTN grades. No significant difference with respect to the same grade in different age groups was noted, whereas a highly significant statistical difference with respect to different grades among all the age groups (<0.001) was noted. The prevalence of Grade 4 was high in 15-year-old children (24.1%), followed by that in 13-year-old children (18%). Grade 5 was more prevalent in 15-year-old children (35.3%), followed by 16-year-old children (17.6%). However, no significant difference between different age groups for the same grade was observed.

DISCUSSION

Dental Health Component of IOTN is universally acclaimed for determining the need of orthodontic treatment. Researches around the world have used IOTN to determine the need of malocclusion treatment in different population groups (13-30). DHC of IOTN is considered as an objective and synthetic method of verifying the malocclusion status and need of orthodontic treatment. The present study utilized DHC of IOTN to evaluate the need of orthodontic treatment in the current group of children.

In an exclusive study on the orthodontic treatment in school adolescents of Dubai City, it was found that children belonging to India had a higher need of orthodontic treatment compared with those belonging to UAE, Iran, Syria, and Yemen. On the contrary, the results of the current study showed an objective definitive need of treatment (Grades 5 and 4) in only 184 subjects (17.89%). Grade 5 was observed in 51 subjects (5.0%) and Grade 4 in 133 subjects (12.9%). The results of our study were in agreement with the reports of the previous studies of the similar nature comprising different population groups (15,16,21,23,24,27,30). In contrast, the lesser prevalence of Grade 4 (6.4%) and Grade 5 (2.6%) was reported in Iranian school children (19).

Nevertheless, there are other studies on different ethnic groups, which show a higher prevalence of the definitive need of treatment, ranging between 38% and 59% (14,17,18,22,25,26,28). In one of the studies on Pakistani children, the prevalence of definitive treatment need was 76% which was much higher than the findings of the current population (22). The comparison of the need of orthodontic treatment across ethnicities is a cumbersome process because the concept of treatment need in itself is relative (11).

Moderate need of treatment (Grade 3) was observed in 111 subjects (10.8%) in our study, whereas in the previous study on the premature born Swedish children aged 8–10 years, it was observed in only 5.5% of the studied population (20). The prevalence of moderate need of treatment ranged approximately from 15.6% to as high as 38.8% in different population groups (14-21,22-26,28-30).

The difference noted in different population groups can be attributed to the basic genetic difference among ethnicities. Factors such as globalization, migration of the population, and inter-racial and intercontinental marriages might have played role in either triggering or lowering the malocclusion status of a particular population. Other major causes can be the measuring or recording error by the examiner or poor calibration of the examiner.

A sex-based comparison showed statistically significant differences for Grades 1, 2, and 3 of DHC. The prevalence of these grades was higher in males than in females. This finding is supported by the reports of the earlier researches (19,23,27). Other studies of similar nature found no variation between the male and female children for the different IOTN grades, thereby opposing the view of gender bias (13,16,18,21,22,24-26,28,30).

The chosen age for this particular study group was 7–16 years because the children are aware of their appearance at this age. No significant statistical difference was noted for the age-based comparison of DHC grades of IOTN in the current sample. The

Table 5. DHC of IOTN frequencies based on age

IOTN	1 n (%)	2 n (%)	3 n (%)	4 n (%)	5 n (%)	Total n (%)	p
7 Years	21 (4.2)	5 (2.1)	2 (1.8)	1 (0.8)	1 (2.0)	30 (2.9)	<0.001 (HS)
8 Years	10 (2.0)	9 (3.8)	6 (5.4)	2 (1.5)	1 (2.0)	28 (2.7)	<0.001 (HS)
9 Years	14 (2.8)	8 (3.4)	3 (2.7)	2 (1.5)	2 (3.9)	29 (2.8)	<0.001 (HS)
10 Years	26 (5.2)	19 (8.1)	12 (10.8)	6 (4.5)	4 (7.8)	67 (6.5)	<0.001 (HS)
11 Years	31 (6.2)	13 (5.5)	8 (7.2)	8 (6.0)	2 (3.9)	62 (6.0)	<0.001 (HS)
12 Years	64 (12.9)	39 (16.5)	17 (15.3)	17 (12.8)	5 (9.8)	142 (13.8)	<0.001 (HS)
13 Years	63 (12.7)	31 (13.1)	19 (17.1)	24 (18.0)	3 (5.9)	140 (13.6)	<0.001 (HS)
14 Years	96 (19.3)	41 (17.4)	15 (13.5)	22 (16.5)	6 (11.8)	180 (17.5)	<0.001 (HS)
15 Years	107 (21.5)	49 (20.8)	18 (16.2)	32 (24.1)	18 (35.3)	224 (21.8)	<0.001 (HS)
16 Years	66 (13.3)	22 (9.3)	11 (9.9)	19 (14.3)	9 (17.6)	127 (12.3)	<0.001 (HS)
Total	498 (100.0)	236 (100.0)	111 (100.0)	133 (100.0)	51 (100.0)	1029 (100.0)	
p Value	0.14 (NS)	0.56 (NS)	0.19 (NS)	0.49 (NS)	0.29 (NS)		

IOTN: Index of Orthodontic Treatment Need; n: sample size; HS: highly significant; NS: non-significant; DHC: Dental Healt Component

findings of our study are well-supported by similar results of different studies of similar nature (15,16,21,22). Nevertheless, a highly significant statistical difference was noted for different grades for the same age group, with Grades 1 and 3 being most commonly prevalent for the all the age groups. The highest prevalence of Grade 5 was seen in 15-year-old children. The lack of correlation between the dental, chronological, and skeletal age is a hindrance in assessing the unmet orthodontic treatment needs (14). There are reports in the earlier literature that the 16-year-old children (41.5%) were more desirous of taking the orthodontic treatment in comparison with 12-year-old children (27.6%) (27). There are certain limitations of this study: the distribution of the sample based on age was not uniform in the current sample; this might have led to the insignificant difference between the age groups for the same IOTN grade. The study only considered the dental component of IOTN; the data could have been more reliable if the study would have considered the esthetic component of IOTN determined by the examiner, as recommended in a previous study (31). Future population studies on malocclusion traits and need of orthodontic treatment in adults of both sexes are highly recommended.

CONCLUSION

Moderate to handicapping malocclusion (Grades 3, 4, and 5) with the definitive need of orthodontic treatment was detected in 295 subjects (28.7%) among the overall population. However, the majority (734; 71.3%) of the children were categorized as requiring no or little orthodontic treatment (Grades 1 and 2). The study warrants the need for conducting regular dental education camps to spread the awareness pertaining to the deleterious effects of malocclusion and simultaneous encouragement to opt for the orthodontic treatment for relieving malocclusion.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Darshan Dental College and Hospital.

Informed Consent: Written informed consent was obtained from parents of the patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - P.V., T.S.; Design - T.S., P.V.; Supervision - D.B.; Resources - P.V.; Materials - P.V., D.B.; Data Collection and/or Processing - P.V., D.B.; Analysis and/or Interpretation - T.S.; Literature Search - P.V., T.S.; Writing Manuscript - T.S.; Critical Review - D.B., P.V.; Other - D.B.

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