IOTN – A Tool to Prioritize Treatment Need in Children and Plan Dental Health Services

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Abstract

Aims: The study aimed to evaluate the orthodontic treatment need in school going children in Moradabad, North India, to assess the malocclusion traits, concern towards Dental Health and individual aesthetic perception compared to orthodontist's opinion.

Methods: 5232 children, aged 11-14yrs formed the sample. The Dental Health Component (DHC) and Aesthetic Component (AC) were recorded as defined by Brook and Shaw, with slight modification for AC assessment.

Results: Statistical analysis revealed that only 12.5% children had no treatment need while 87.5% presented malocclusion with varying treatment needs. There was insignificant sex difference for aesthetic perception. Examiner graded children less attractive than children. Class I was the most common malocclusion and crowding was the most common malocclusion trait. High intra-examiner and substantial inter-examiner agreements were observed for DHC and substantial intra- examiner and moderate inter-examiner agreements for AC.

Conclusions: It can be concluded from the present study that, IOTN is a reliable epidemiologic tool to benefit local health services in planning their budget, and improve focus of services by inducing greater uniformity and standardization in the assessment of Orthodontic treatment need.

Key Words: IOTN, Index of Orthodontic Treatment Need, Dental Health Component (DHC), Aesthetic Component (AC)

Introduction

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity [1]. Malocclusion is the second commonest dental anomaly. It may be handicapping to the functional needs and interfering with the well being of the person by adversely affecting dento-facial aesthetics, mandibular function or speech and psychosocial, health of an individual [2]. The main benefit to the patient of Orthodontic treatment may be in improved aesthetics and social-psychological well-being, and additionally, the effect this may have on attitudes to dental health [3]. For Orthodontic treatment to become an integral part of oral health care programs, basic information on treatment needs is required [1]. Hence, many indices have been developed with the intention of categorizing them into various groups according to severity of malocclusion [4] and need of the Orthodontic treatment so that individuals with greatest treatment need can be assigned priority when Orthodontic sources are limited [3]. Various treatment need indices that have been introduced include- HLD Index, Treatment Priority Index, Handicapping Malocclusion Assessment Record, Occlusal Index, etc., [5]. However, in order to overcome drawbacks of previous indices, a spark was ignited by introduction of Index of Orthodontic Treatment Priority by Brook and Shaw in 1989. They later renamed it as- 'Index of Orthodontic Treatment Need' [6]. The index defines specific, distinct categories of treatment need, whilst including a measure of function [7]. The IOTN is essentially a method of defining the severity of occlusal traits that may constitute a threat to the longevity of dentition [8]. These traits are then allocated into grades, which define the priority of treatment need. The index incorporates both the Dental Health Component (DHC) and the Aesthetic Component (AC) [8].

The DHC represents biological or anatomical aspects of IOTN that record need for treatment on dental health and functional grounds.

The AC measures aesthetic impairment and justifies treatment on social-psychological grounds [3]. Thus, it ranks malocclusion in terms of the significance of various occlusal traits for the person's dental health and perceived aesthetic impairment with the intention of identifying those persons who would be most likely to benefit from Orthodontic treatment [3]. The use of such an index allows improved focusing of services and has the potential to induce greater uniformity throughout the profession and standardization in the assessment of Orthodontic treatment need [4]. The IOTN has been gaining international recognition as a method of objectively assessing treatment need [9].

Hence, present study is an attempt to use IOTN as a comprehensive approach to allow selective distribution of resources so that the treatment could be provided at a high standard, and to protect children from the risks of unnecessary treatment within a finite framework [4]; thereby, benefitting local health authorities to plan their budget.

Aims and Objectives

- To assess the malocclusion traits.
- To find out individual (male, female) Aesthetic perception and concern towards Dental Health.
- To compare Orthodontist's perception on aesthetics with patient's perception.
- To find correlation between DHC and AC.

Material and Methods

The present study was conducted in the Department of Orthodontics and Dentofacial Orthopedics, Kothiwal Dental College and Research Center, Moradabad, Uttar Pradesh, North India. 5232 school going children aged 11-14 yrs (males-3360, females-1872) formed the

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core of sample. Prior permission was taken from school authorities to conduct the oral examination. Identities of the children were not revealed in the study to avoid any ethic conflict. Mean age of the males in sample was 13.34 yrs. and for females were 13.27 yrs. Patients undergoing Orthodontic treatment were excluded from the study. To avoid any bias, only one person monitored the total evaluation system. However, in order to ensure reproducibility and reliability of the index, same orthodontist re-screened hundred children at an interval of 15 days and another orthodontist also screened same hundred children after 15 days. A 'power point presentation' was shown to all the school children to apprise them of Dental diseases and dental health maintenance. Examination was done in bright day light with the help of mouth mirror, fine explorer and a half millimeter ruler while using disposable gloves. Both Dental Health Component (DHC) and Aesthetic Component (AC) were recorded to assess treatment needs based on IOTN.

Assessment of DHC

Dental Health Component was recorded by examining following occlusal traits – MOCDO i.e.,

Missing teeth,
Overjet,
Crossbite,
Displacement,
Overbite.

All five grades of DHC were defined as per the following Performa (used originally by Brook and Shaw). The Grading was done according to 'Dental Health Component' originally used in the study for development of Index of Orthodontic Treatment Need [3].

The five grades for DHC were –

Grade 1: No need for Orthodontic treatment.

Grade 2: Little need for Orthodontic treatment.

Grade 3: Moderate need for Orthodontic treatment.

Grade 4: Great need for Orthodontic treatment.

Grade 5: Very great need for Orthodontic treatment.

The severe most malocclusion trait decided the grade for DHC of IOTN for an individual [5]

Assessment of AC

Each child was shown the set of illustrated photographs used originally by Brook and Shaw [3] (This set of photographs was originally the SCAN Index - Standardized Continuum of Aesthetic Need- that was utilized by Evans and Shaw in 1987 [10]). All children were told to compare their dental appearance to these standard photographs and grade their aesthetics to the nearest resembling photograph. Grading was done as per the score given by child.

Orthodontist's opinion for child's aesthetics was also recorded. However, against the original ten point scoring from '0.5 to 5' in SCAN Index, the scale was modified to ten point scoring from Grade 1 (most attractive) to Grade 10 (least attractive') for ease of recording and tabulation. Correlation between functional components of oral health (DHC) and Orthodontist's aesthetic opinion (Orthodontist AC) was also evaluated.

Statistical analysis

Chi-square Test was used to evaluate - Difference in aesthetic perception between male and female children, Orthodontist's aesthetic opinion for male and female children, Difference in Orthodontist's opinion and children's perception for aesthetics, Distribution of Angle's malocclusion among male and female children. Using Kappa Analysis K (In accordance with Landis and Koch, 1977) [3] – Intra- and inter-examiner reliability for DHC and AC were evaluated. Using 'Spearman Correlation Coefficient' (ρ), Correlation between DHC and AC was found.

Results

DHC grades indicate that out of 5232 children, 12.5% had no need for Orthodontic treatment whereas 87.5% had need of Orthodontic treatment. Severity of malocclusion and range of treatment need varied. 26.38% children had mild need for Orthodontic treatment. 41.02% children had moderate treatment need which formed the highest proportion of DHC distribution, 11.81% had great need of treatment and 8.29% children had very great need for treatment (*Figure 1*). Overall, Orthodontic treatment need in males was 56.55% that was greater than 30.94% in females.

Overall females graded themselves to more attractive side of the scale than males. However, statistically there was insignificant sex difference in aesthetic perception by patient (*Figure 2*).

The Orthodontist graded patients to less attractive side of scale compared to self assessment made by children (*Figure 3*). Statistical analysis using Chi square test (p=0.477>0.05) shows that there is insignificant relation between Orthodontist's opinion and children's self perception for aesthetics i.e both were independent to each other.

Out of 5232 children, only 10.28% children presented normal molar Class I with facial balanced occlusion while 89.72% presented malocclusion. 71.1% presented Angle's Class I malocclusion, 17.91% Angle's Class II malocclusion while only 0.71% presented Angle's Class III malocclusion (*Figure 4*). Using 'Chi-square Test', it was found that 'Chi-square Test', x^2=18.80. Since p>0.05, statistically there was significant difference in distribution of malocclusion among males and females with males exhibiting more severe malocclusions than females.

The most common malocclusion anomaly present in population in decreasing order of occurrence is-

Crowding>Increased overjet>Increased overbite>Retained deciduous teeth>Spacing>Anterior crossbite>Posterior crossbite>Missing teeth>Open bite>Peg lateral>Supernumerary teeth>Cleft lip and cleft palate (*Figure 5*).

Reproducibility of The Index- The intra-examiner agreement for DHC ranged from a kappa value of '0.891' that indicates 'almost perfect' (high) agreement between the 1st and 2nd readings for AC by the same examiner. The intra-examiner agreement for AC ranged from a kappa value of 0.793 that indicates 'substantial agreement' between the 1st and 2nd readings for AC by the same examiner. The inter-examiner agreement for DHC presented Kappa value of 0.680 that indicates 'substantial agreement' between the DHC readings of two examiners at two different examinations. The inter-examiner agreement for AC presented Kappa value of 0.586 that indicates 'moderate agreement' between the AC readings of two examiners at two different occasions.

Inter-relation between DHC and orthodontist's aesthetic opinion: Spearman correlation value, ρ: 0.751 implies High Correlation between DHC and examiner's aesthetic opinion for children (*Figure 6*).

Discussion

The assessment of treatment need is important in order to provide information on work load, encourage rational decision making on manpower needs, the design of treatment facilities and further training of public health dentists and ancillary personnel [11].
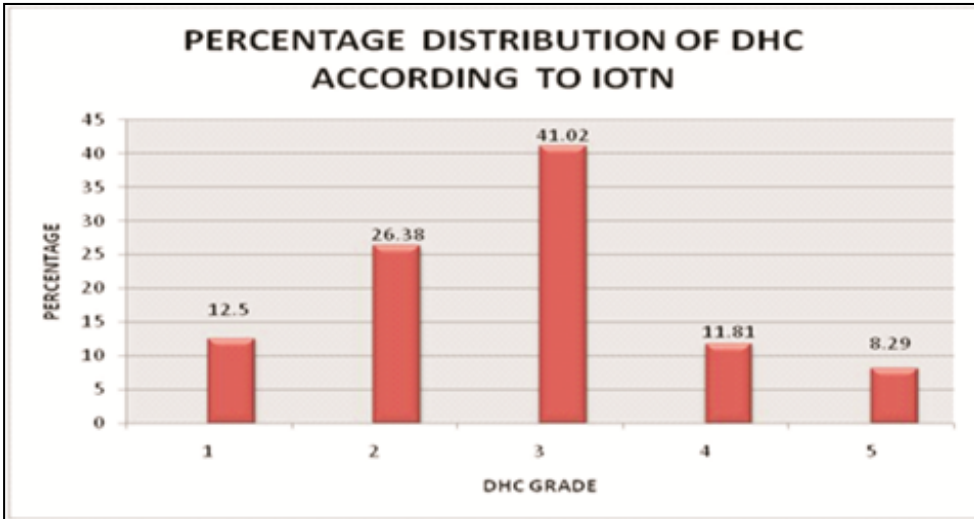
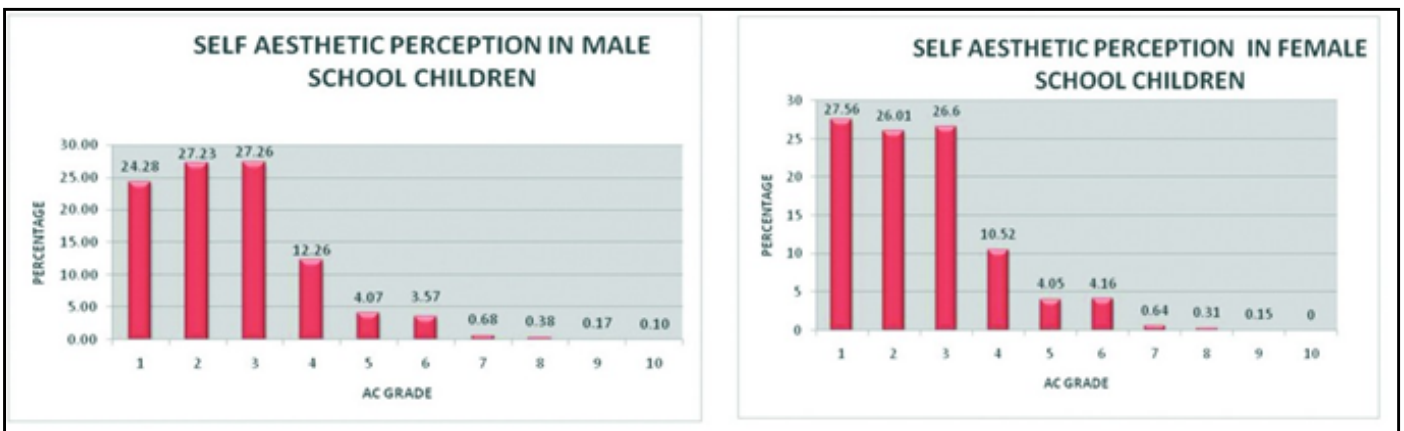*Figure 1. Percentage distribution of DHC according to IOTN.*

Figure 2. Difference in aesthetic perception between males and females.
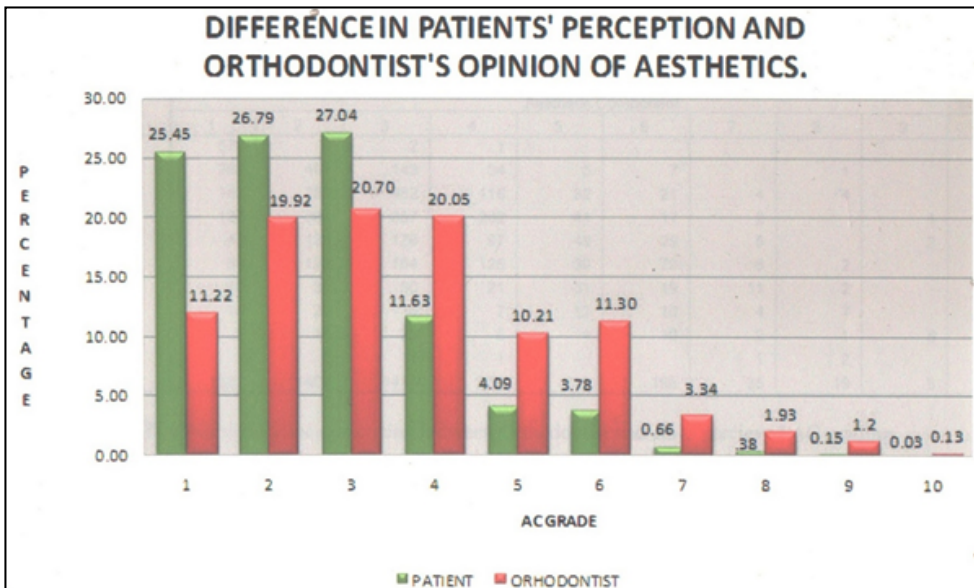

Figure 3. Difference in patient's aesthetic perception and orthodontist's opinion of aesthetics.

The present epidemiologic study, using Index of Orthodontic Treatment Need (IOTN), was done on school going children because it is a simple and quick method and has been found appropriate for use in school screening programmes [12,13]. Children between 11-14yrs of age were chosen for the study because this represents the early permanent dentition stage which exhibits the characteristics reflected in AC photographs. 5232 school children constituted the core sample of the study. Such a large sample was surveyed to ensure

greater representation of population and hence, accuracy in assessing treatment need of Moradabad children.

Dental Health Component (DHC) - The Functional Component

Distribution of DHC grades shows marked variation in treatment need. While 12.5% children have no treatment need, major proportion of population (87.5%) has treatment needed. Maximum number of
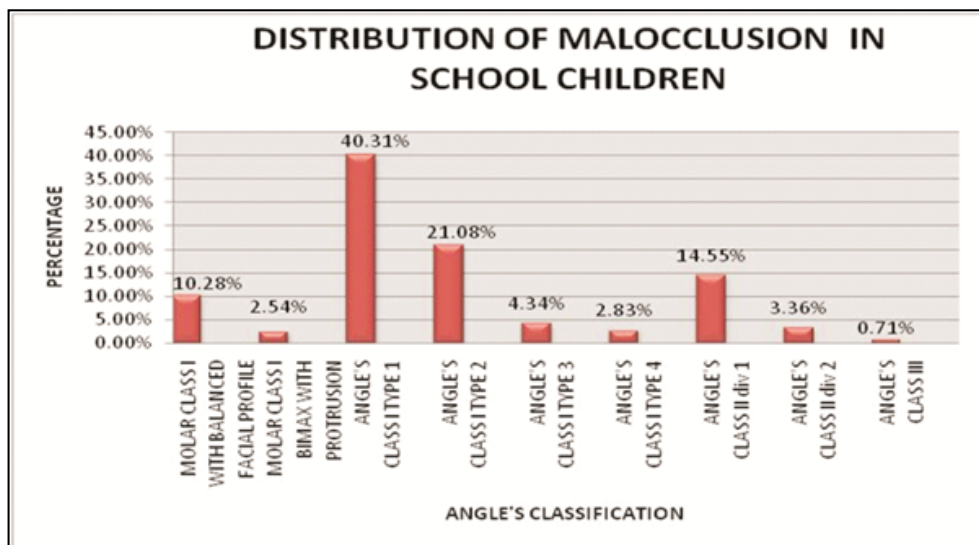
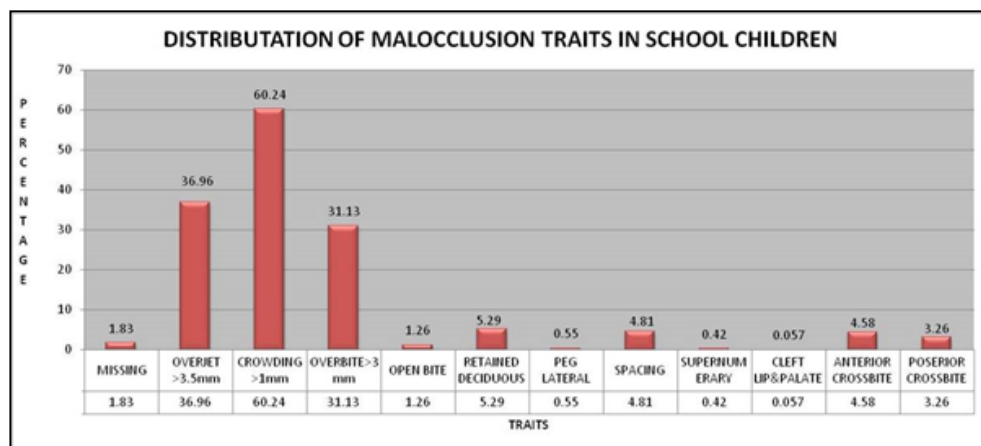**Figure 4.** *Distribution of malocclusion in school children.*

Figure 5. *Distribution of malocclusion traits in school children.*

TREATMENT NEED ⟶		DENTAL HEALTH COMPONENT					
		NO NEED	LITTLE NEED	MODERATE NEED	GREAT NEED	VERY GREAT NEED	TOTAL
ORTHODONTIST AESTHETIC OPINION	GRADE 1	573	8	4	1	1	587
	GRADE 2	76	846	58	7	55	1042
	GRADE 3	4	238	732	54	55	1083
	GRADE 4	1	253	705	26	64	1049
	GRADE 5		13	338	97	86	534
	GRADE 6		22	272	188	109	591
	GRADE 7			36	125	14	175
	GRADE 8				78	23	101
	GRADE 9			1	39	23	63
	GRADE 10				3	4	7
	TOTAL	654	1380	2146	618	434	5232

Figure 6. *Inter-relation between dhc & orthodontist's aesthetic opinion.*

children (41.02%) reflected moderate treatment need. These are the children who are at borderline and according to IOTN, they can be instituted treatment when resources are available. While 11.81% had great need of treatment, 8.29% children presented very great need for treatment. Hence, one-fifth of population had definite treatment need (Grade 4 +5=20.10%) and should be prioritized for Orthodontic services.

Amongst the whole, only 10.28% children had ideal facial balanced occlusion. This percentage is quite close to no treatment need (12.5%) for DHC distribution. This difference in no treatment need category and ideal facial balanced occlusion can be attributed to presence of other anomalies along with ideal class I molar relationship like presence of supernumerary teeth, spacing, peg lateral, crossbite etc. This shows that DHC is a reliable tool for assessing Orthodontic treatment need based on functional components of oral health in school screening programmes. The results are in accordance with studies by other researchers. [6,14-16] Also, Intra-examiner reproducibility for DHC was in almost perfect agreement (K=0.891) while inter-examiner agreement was substantial (K=0.680). Hence, DHC of IOTN was found to have good reproducibility and reliability for intra- and inter-examinations. These results are also supported by other studies. [1,5,6]

In the present study, 89.72% children presented with malocclusion. Distribution of malocclusion in population showed that maximum number of children i.e. 71.1% presented with Angle's Class I malocclusion, 17.91% presented with Angle's Class II malocclusion 0.71% presented with Angle's Class III malocclusions. The distribution of malocclusion traits (anomalies) in the population showed that 60.24% children presented with crowding followed by increased overjet (21.08%) that correspond to high incidences of Class I Type 1 and Class I Type 2 (respectively) The increased incidence of crowding and increased overjet in the population can be attributed to decreasing jaw size with evolution due to shift of diet from coarse to soft. These results are in accordance with the results of studies by other researchers [2,3,17]. With advancing age, there was an increase in incidence of malocclusion and number of anomalies i.e., maximum number of children presenting with a particular malocclusion or anomaly were observed in 14yrs age group followed by in 13yrs age group, 12yrs age group and then in 11 yrs age group. These results can be attributed to malocclusion severity due to no Orthodontic intervention at early age.

Aesthetic component

Overall aesthetic perception by children reflected that 25.45% children graded themselves most attractive i.e. they had no treatment need (AC Grade 1). 53.87% children reflected little need (AC Grade 2+3) for treatment, 11.63% reflected moderate treatment need (AC Grade 4), 8.51% children presented great treatment needs (AC Grade 5+6+7) and 0.54% children had very great treatment need (AC Grade 8+9+10).

Slightly more number of males expressed desire for treatment (75.2%) compared to females (72.4%). These values are in accordance with the aesthetic perceptions of children i.e., males who graded themselves less attractive expressed greater desire for treatment contrary to females who graded themselves more attractive and expressed comparatively less desire for treatment. This clearly exhibits differences in self-esteem of children in relation to their aesthetic perception. The results are similar to another study [18]. However, statistically, insignificant sex differences were observed for aesthetic perception between males and females. Contrary to self-perception by children, examiner's aesthetic opinion for children overall graded them to less attractive side of scale. The results correspond to the other studies which report that children are less critical in their aesthetic judgments as compared to adults [14,19,20]. This can be attributed to high self-esteem of children who tend to over-rate their dental attractiveness. While Orthodontist can judge child without any bias, the child may be self- biased in rating his/her own aesthetics. Children may not find photographs and their dentition too displeasing in comparison to Orthodontist [3]. Hence, Orthodontist's opinion is more valid and reliable to judge child's treatment needs against child perception of aesthetics. However, statistically, there was insignificant sex difference in examiner's opinion of aesthetics for children.

The aesthetic component of IOTN quantifies the likely socio-psychological effects of malocclusion on child. Although the aesthetic component is assessed independently of the dental health component, results showed that most of the children with poor dental aesthetics were also considered to be in need of treatment on dental health grounds e.g., children in no treatment need category in DHC were graded between AC Grades 1-4. Great and Very great treatment needs of DHC correspond to the AC grades extending up to grades 8, 9

and 10). Children who were scored as needing treatment on aesthetic grounds, but not on dental health grounds, mostly comprised children with dentition which were considered to have unattractive aesthetics, but which were not considered to have dental health implication by IOTN, e.g., generalized spacing [21]. In contrast, there were many children who were categorized in the treatment need category although their aesthetic impairment did not fall into the most severe grades. This reflects the fact that many occlusal traits such as ectopic teeth, deep traumatic overbites or cross bites have dental health implications, but do not attract a high aesthetic component score [21]. Using Kappa analysis, intra-examiner reproducibility for AC was found substantial (K=0.793) whereas the inter-examiner agreement was moderate (K=0.586). This shows that AC of IOTN is fairly reliable and reproducible. The results are in accordance with the studies of other researchers [1,22,23]. The difference in inter-examination reproducibility could be attributed to difference in scoring AC in accordance with the photographs, since photographs present only a 2-dimensional representation of a 3-dimensional object that reduces the prominence of anterior crowding and overjets [24]. Also, there could be difference in individual perception of aesthetics [24]. Overall it took only 1.30 - 2min for recording malocclusion traits to assess the score for an individual which shows the index is less time consuming [25] and suitable for mass screening. Hence, IOTN can be considered as a reliable epidemiologic tool capable to assess individual's Orthodontic treatment needs in less time, thereby, managing manpower and effectively using the available resources.

Conclusion

Based on the results obtained, following conclusions can be drawn –
- High incidence of malocclusion was observed in North Indian school going children. Based on Dental Health Component of IOTN, 26.38% had little need of Orthodontic treatment and 41.02% had moderate need whereas 20.11% had great need.
- Orthodontic treatment need in males was 56.55% that was greater than 30.94% in females.
- Orthodontist graded children to less attractive side of scale in comparison to children themselves. Accordingly, Orthodontist categorized more children to require Orthodontic treatment. A disagreement of 54.88% was observed between Orthodontist's opinion and children perception for aesthetics.
- Out of 5232 children, 89.72% presented malocclusion whereas only 10.28% children presented normal molar Class I with facial balanced Occlusion. 71.1% children presented Angle's Class I malocclusion, 17.91% Angle's Class II malocclusion while only 0.71% presented Angle's Class III malocclusion.
- Crowding was the most common malocclusion trait present among school going children.
- Both Dental Health and Aesthetic Component of IOTN were found to be fairly reproducible and highly correlated to each other as an epidemiologic tool which can be effectively advocated as a tool to assess Orthodontic treatment needs for population.
- School Dental Health Programmes can be considered as the need of the population to bring about awareness of Orthodontic and aesthetic problems to foothold malocclusion as an entity at an early age.

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