ECRONICON OPEN ACCESS

EC DENTAL SCIENCE
Research Article

Assessment of Orthodontic Treatment Needs Among School Going Children Using Index of Orthodontic Treatment Need (IOTN) in Indore (Central India), Madhya Pradesh, India

Aman Sachdeva[1], Shweta Raghav[2], Kamalshikha Baheti[3], Meer Juned Ali[4] and Munish Goel[5]

[1]*Reader, Department of Orthodontics, Darshan Dental College, Udaipur, Rajasthan, India*

[2]*Reader, Department of Orthodontics, College of Dental Sciences and Hospital, Rau, Indore, Madhya Pradesh, India*

[3]*Reader, Department of Orthodontics, College of Dental Sciences and Hospital, Rau, Indore, Madhya Pradesh, India*

[4]*Senior Lecturer, Department of Orthodontics, College of Dental Sciences and Hospital, Rau, Indore, Madhya Pradesh, India*

[5]*Professor, Department of Conservative Dentistry, Himachal Dental College, Sundernagar, Himachal Pradesh, India*

***Corresponding Author**: Dr. Sachdeva A, Department of Orthodontics, Darshan Dental College, Udaipur, Rajasthan, India.

Received: July 13, 2016; **Published:** August 10, 2016

Abstract

Background: Oral health is an integral part of general health. Orthodontic treatment needs are increasing day by day as a consequence of changing life style pattern and increased demand for a better personality. As orthodontic treatment is more effective if diagnosed and performed in early stages of life, hence current study attempted to assess orthodontic treatment need amongst school going children.

Objective: The study aimed to evaluate the orthodontic treatment need in school going children in Indore (Central India), Madhya Pradesh, India, to assess the malocclusion traits, concern towards Dental Health and individual aesthetic perception compared to orthodontist's opinion.

Materials and Methods: The study was carried out on 1822 (985 boys and 837 girls) school going children, aged 11-15 years, from 1st September 2015 to 31st December 2015. Type III examination was conducted and the assessment of malocclusion was done according to the Dental Health Component (DHC) and Aesthetic Component (AC) of Index of Orthodontic Treatment Need (IOTN) as defined by Brook and Shaw, with slight modification for AC assessment.

Results: Statistical Analysis revealed only 14.5% children had no treatment need while 85.5% presented malocclusion with variation in treatment needs. There was insignificant sex difference for aesthetic perception among the children. Distribution of children as attractive or less attractive was done according to the Examiner. 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.

Conclusion: The need for orthodontic treatment among children of Central India is comparable to other populations. 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.

Keywords: *Orthodontic; Children; IOTN; Index of 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]. Oral health is an integral part of general health [2]. Healthy mouth enables an individual to eat, speak and socialize without active disease or discomfort

and contributes to the general well-being. It is concerned with maintaining the health of craniofacial complex, the teeth and gums as well as the tissue of the face and head that surrounds the mouth [3].

Dentofacial appearance has a lot to do with the way the people are perceived in the society [4]. 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 dentofacial aesthetics, mandibular function or speech and Psychosocial health of an individual [5]. Adolescents with significant dentofacial in harmonies are considered at risk for negative self-esteem and social maladjustments [6].

In general, malocclusion is defined as an irregularity of the teeth or a molar relationship of the dental arches beyond the accepted range of normal [3]. 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 [7]. 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 [8] and need of the Orthodontic treatment so that individuals with greatest treatment need can be assigned priority when Orthodontic sources are limited. Various treatment need indices that have been introduced include HLD Index, Treatment Priority Index, Handicapping Malocclusion Assessment Record, Occlusal Index, etc. [9].

However, in order to overcome drawbacks of previous indices, Index of Orthodontic Treatment Priority was introduced by Brook and Shaw in 1989. They later renamed it as- 'Index of Orthodontic Treatment Need' [10]. The index defines specific, distinct categories of treatment need, whilst including a measure of function [11]. The IOTN is essentially a method of defining the severity of occlusal traits that may constitute a threat to the longevity of dentition [12]. 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) [12].

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 [7]. 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 [7]. 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 [8]. The IOTN has been gaining international recognition as a method of objectively assessing treatment need [13]. The demand for orthodontic treatment is increasing in most of the countries including India. Therefore, rational planning of orthodontic preventive measures on population basis is essential. Thus, the 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 [8]; thereby, benefitting local health authorities to plan their budget.

Aims and Objectives

The present study aimed to

- The need for orthodontic treatment in school going children aged 11-15 yrs.
- Assess the different malocclusion traits and to find the prevalence of same.
- Find out individual (male and female) perception and concern towards Dental Health.
- Compare Orthodontist's perception on aesthetic with patient's /individual perception.
- Find the correlation between DHC and AC.

Material and Methods

The present study was conducted in the Department of Orthodontics and Dentofacial Orthopedics, College of Dental Sciences & Hospital, Rau, Indore (Central India). A simple random sample of 1822 school going children aged 11-15 years (985 boys and 837 girls) formed the sample for the study. The study was conducted from 1st September 2015 to 31st December 2015 as per schedule in the schools. Prior permissions were taken from Heads of the concerned Schools to conduct the oral examination. To avoid any ethical conflict identities of the children were not revealed in the study. Ethical clearance from ethical committee of College of Dental Sciences & Hospital, Rau, Indore was taken prior to the study.

Inclusion Criteria: All children aged 11-15 yrs who had not undergone orthodontic treatment and who agreed to take part in the study were examined. Mean age of the males in sample was 13.37 yrs and for females were 13.21 yrs.

In order to avoid any bias, the monitoring of total evaluation system was done under one person only. To check the reproducibility and reliability of the Index, same orthodontist re-examined 100 children at an interval of 15 days. A presentation was done in school to show all the children to make them aware of the dental diseases and the need for dental health maintenance. Type III Examination, as recommended by the American Dental Association [14], which includes inspection using a mirror and probe, done under good illumination was conducted. The examination was performed under natural light using disposable gloves, tongue blade and mouth mirrors. A periodontal probe was used for millimeter measurement. 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, Cross bite, 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 [7]. 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 for an individual [9].

Assessment of AC

Each child was shown the set of illustrated photographs used originally by Brook and Shaw [7] (This set of photographs was originally the SCAN Index - Standardized Continuum of Aesthetic Need- that was utilized by Evans and Shaw in 1987 [15]). 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

The data obtained was analyzed using SPSS package. Chi-square Test using "P" value 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. "P" < 0.05 was considered as statistically significant and "P" values > 0.01 were considered statistically highly significant. Intra- and inter-examiner reliability for DHC and AC were evaluated using Kappa Analysis Ƙ (In accordance with Landis and Koch, 1977) [7]. Correlation between DHC and AC was found using 'Spearman Correlation Coefficient' (ρ).

Results

DHC grades indicate that out of 1822 children, 14.5% has no need for Orthodontic treatment whereas 85.5% had need for Orthodontic treatment. Severity of malocclusion and range of treatment need varied. 23.36% children had mild need for Orthodontic treatment, 40.08% children had moderate treatment need which formed the highest proportion of DHC distribution, 12.91% had great need of treatment and 9.15% children had very great need for Orthodontic treatment (Figure 1). Overall, Orthodontic treatment need in males was 57.5% that was greater than 33.85% 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, Table 1).

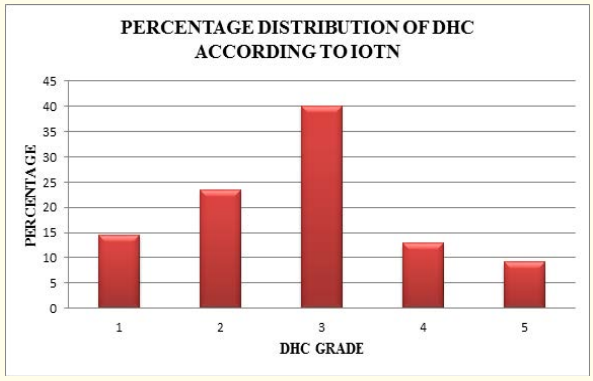

Figure 1: *Percentage distribution of DHC according to IOTN.*

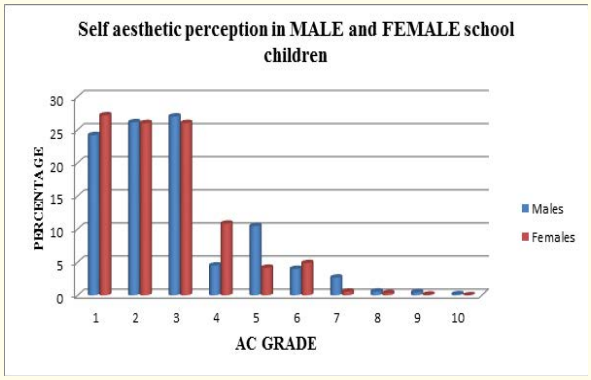

Figure 2: *Difference in aesthetic perception between males and females.*

AC Grade	Percentage	
	Males	Females
1	24.18%	27.17%
2	26.13%	26%
3	27%	26.01%
4	4.5%	10.82%
5	10.45%	4.15%

6	3.98%	4.86%
7	2.67%	0.56%
8	0.58%	0.33%
9	0.45%	0.1%
10	0.16%	0%

Table 1: *Difference in aesthetic perception between males and females.*

**Statistically there was insignificant sex difference in aesthetic perception by patient.*

The Orthodontist graded patients to less attractive side of scale compared to self assessment made by children (Figure 3, Table 2). Statistical analysis using Chi square test (p = 0.447 > 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 1822 children, only 11.88% children presented normal molar Class I with facial balanced occlusion while 88.12% presented malocclusion. 69.72% presented Angle's Class I malocclusion, 18.82% Angle's Class II malocclusion while only 0.42% presented Angle's Class III malocclusion (Figure 4). Using 'Chi-square Test', it was found that 'Chi-square Test', x2 =17.60. 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.

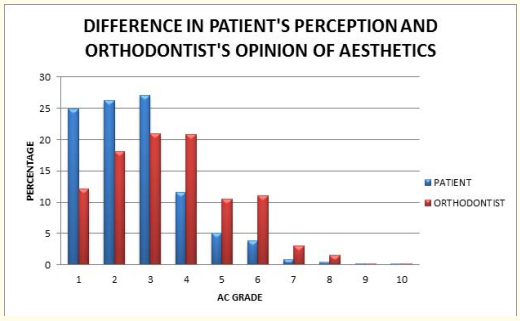

Figure 3: *Difference in patient's aesthetic perception and orthodontist's opinion of aesthetics.*

AC Grade	Percentage	
	Patient's Aesthetic Perception	**Orthodontist's Opinion of Aesthetics**
1	24.85%	12.11%
2	26.19%	18.09%
3	27%	21%
4	11.55%	20.8%
5	5.09%	10.5%
6	3.81%	11.04%
7	0.88%	3.04%
8	0.4%	1.53%
9	0.17%	0.1%
10	0.06%	0.09%

Table 2: *Difference in patient's aesthetic perception and orthodontist's opinion of aesthetics.*

**Statistical analysis using Chi square test (p = 0.447 > 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.*

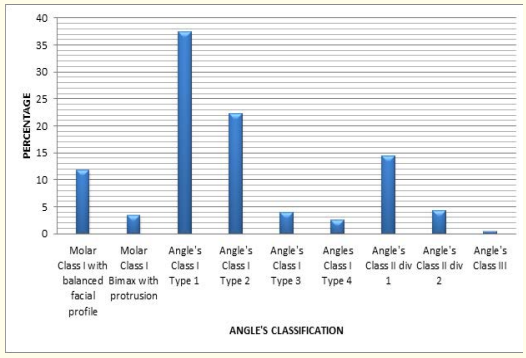

Figure 4: Distribution of malocclusion among school children.

The most common malocclusion anomaly present in population in decreasing order of occurrence is Crowding > Increased overjet > Increased overbite > Spacing > Anterior cross bite > Retained deciduous teeth > Posterior cross bite > Open bite > Missing teeth > Peg lateral > Supernumerary teeth > Cleft lip and cleft palate (Figure 5, Table 3).

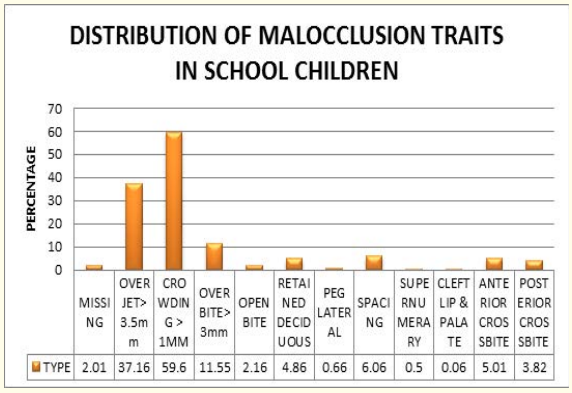

Figure 5: *Distribution of malocclusion traits among school children.*

Angle's Classification	Percentage of Children
Molar Class I with Balanced Facial Profile	11.88%
Molar Class I Bimax with Protrusion	3.5%
Angle's Class I Type 1	37.4%
Angle's Class I Type 2	22.28%
Angle's Class I Type 3	4.01%
Angle's Class I Type 4	2.53%
Angle's Class II Div. 1	14.5%
Angle's Class II Div. 2	4.32%
Angle's Class III	0.42%

Table 3: *Distribution of malocclusion among school children.*

**'Chi-square Test', it was found that 'Chi-square Test', x2 =17.60. 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.*

Reproducibility of The Index- The intra-examiner agreement for DHC ranged from a kappa value of '0.871' 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 0.765 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 0.660 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 0.538 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: 0.801 implies High Correlation between DHC and examiner's aesthetic opinion for children (Table 4).

		Dental Health Component					
Treatment Need		No Need	Little Need	Moderate Need	Great Need	Very Great Need	Total
Orthodontist Aesthetic Opinion	Grade 1	198	10	6	1	2	217
	Grade 2	56	184	53	8	14	315
	Grade 3	6	103	222	21	15	367
	Grade 4	3	94	190	10	34	331
	Grade 5	1	10	91	33	38	173
	Grade 6		18	126	68	33	245
	Grade 7		6	38	48	5	97
	Grade 8			5	30	6	41
	Grade 9				15	10	25
	Grade 10				2	9	11
	Total	264	425	731	236	166	1822

Table 4: *Inter-relation between DHC & Orthodontist's aesthetic opinion.*

**Spearman correlation value, ρ: 0.801 implies High Correlation between DHC and examiner's aesthetic opinion for children.*

Discussion

Many epidemiological studies have been conducted worldwide utilizing various indices for quantifying the extent of malocclusion. 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 [15]. 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 [17,18]. Children between 11- 15 yrs of age were chosen for the study because this represents the early permanent dentition stage which exhibits the characteristics reflected in AC photographs. 1822 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 Indore children.

Dental Health Component (DHC) – The Functional Component: Distribution of DHC grades shows marked variation in treatment need. While 14.5% children have no treatment need, major proportion of population (84.5%) has treatment needed. Maximum number of children (40.08%) 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 12.91% had great need of treatment, 9.15% children presented very great need for treatment. Hence, one-fourth of population had definite treatment need (Grade 4 + 5 = 22.06%) and should be prioritized for Orthodontic services. Amongst the whole, only 11.88% children had ideal facial balanced occlusion. This percentage is quite close to no treatment need (14.5%) 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, cross bite 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 [10,19-21]. Also, Intra-examiner reproducibility for DHC was in almost perfect agreement (K = 0.871) while inter-examiner agreement was substantial (K = 0.660). 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 [1,9,10].

In the present study, 88.12% children presented with malocclusion. Distribution of malocclusion in population showed that maximum number of children i.e. 69.72% presented with Angle's Class I malocclusion, 18.82% presented with Angle's Class II malocclusion 0.42% presented with Angle's Class III malocclusions. The distribution of malocclusion traits (anomalies) in the population showed that 59.6% children presented with crowding followed by increased overjet (22.28%) 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 [5,6,22]. 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 15 yrs age group followed by in 14 year age group, 13 yrs 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 24.95% children graded themselves most attractive i.e. they had no treatment need (AC Grade 1). 53.67% children reflected little need (AC Grade 2+3) for treatment, 12.13% reflected moderate treatment need (AC Grade 4), 8.41% children presented great treatment needs (AC Grade 5+6+7) and 0.84% children had very great treatment need (AC Grade 8+9+10). Slightly more number of males expressed desire for treatment (74.5%) compared to females (70.24%). 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 [23]. 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 [18,24,25]. 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 [7]. 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 sociopsychological 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 [25]. 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. Using Kappa analysis, intra-examiner reproducibility for AC was found substantial (K = 0.765) whereas the inter-examiner agreement was moderate (K = 0.538). This shows that AC of IOTN is fairly reliable and reproducible. The results are in accordance with the studies of other researchers [1,27,28]. 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 over jets [28]. Also, there could be difference in individual perception of aesthetics [24]. Overall it took only 2.30 - 3 min for recording malocclusion traits to assess the score for an individual which shows the index is less time consuming [30] 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 Central India school going children. Based on Dental Health Component of IOTN, 23.36% had little need of Orthodontic treatment and 40.08% had moderate need whereas 22.06% had great need.
- 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 54.16% was observed between Orthodontist's opinion and children perception for aesthetics.
- Orthodontic treatment need in males was 57.5% that was greater than 33.85% in females.
- Out of 1822 children, 88.12% presented malocclusion whereas only 11.88% children presented normal molar Class I with facial balanced Occlusion. 69.72% children presented Angle's Class I malocclusion, 18.82% Angle's Class II malocclusion while only 0.42% 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.

Bibliography

1. Ngom PI., *et al.* "Orthodontic treatment need and demand in Senegalese school children aged 12-13 years". *Angle Orthodontist* 77.2 (2007): 323-330.
2. Dunning JM. "Principles of Dental Public Health". 4th edn, Cambridge Harvard University Press (1986).
3. Yewe Dyer M. "The definition of Oral health". *British Dental Journal* 174.7 (1993): 224-225.
4. Samire B. "Textbook of Orthodontics, Harcourt (India) Pvt. Ltd: Philadelphia W.B. Saunders (2001).
5. Kharbanda OP. "What is the prevalence of malocclusion in India? Do we know Orthodontic treatment needs of our country". *Journal of Indian Orthodontic Society* 32 (1999): 33-41.
6. Jenny J. "A social perspective on need and demand for orthodontic treatment". *International Dental Journal* 25.4 (1975): 248-256.
7. Brook PH and Shaw WC. "The development of an index for Orthodontic treatment priority". *European Journal of Orthodontics* 11.3 (1989): 309-320.
8. De Oleveira. "The planning, contracting and monitoring of Orthodontic services, and the use of the IOTN index: a survey of consultants in dental public health in the United Kingdom". *British Dental Journal* 195.12 (2003): 704-706.
9. Arora N. "Can ICON replace PAR and IOTN?: A comparative evaluation of three occlusal indices (PAR, IOTN and ICON) based on the treatment need of Indian Population". *Journal of Indian Orthodontic Society* 42 (2008): 25-31.

10. Peter E and Valoathan A. "IOTN and PAR Index: Comparison and uses". *Journal of Indian Orthodontic Society* 30 (1997): 85-89.

11. Cooper S., *et al.* "The reliability of the Index of Orthodontic Treatment Need over time". *British Journal of Orthodontics* 27.1 (2000): 47-53.

12. Hamdan AH. "The relationship between patient, parent and clinician perceived need and normative Orthodontic treatment need". *European Journal of Orthodontics* 26.3 (2004): 265-271.

13. Ucuncu N and Ertugay E. "The use of the Index of Orthodontic Treatment need (IOTN) in a school population and referred population". *Journal of Orthodontics* 28.1 (2001): 45-52.

14. Thilender B., *et al.* "Prevalence of malocclusion and Orthodontic treatment need in children and adolescent in Bogota, Columbia. An epidemiological survey related to different stages of dental development". *European Journal of Orthodontics* 23.2 (2001): 153-167.

15. Evans R and Shaw WC. "Preliminary evaluation of an illustrated scale for rating dental attractiveness. European". *Journal of Orthodontics* 9.1 (1987): 314-318.

16. Bowden DEJ and Davies AP. "Inter-and intra-examiner variability in assessment of Orthodontic treatment need". *Community Dentistry and Oral Epidemiology* 3.4 (1975): 198-200.

17. So LLY and Tang ELK. "A comparative study using the Occlusal Index and the Index of Orthodontic Treatment Need". *The Angle Orthodontist* 63.1 (1993): 57-64.

18. Hetherington I and White DA. "The diagnostic accuracy and reproducibility of school dental screening using an index of treatment need". *Community Dental Health* 21.2 (2004): 170-174.

19. Birkeland K., *et al.* "Orthodontic concern among 11-year-old children and their parents compared with Orthodontic Treatment need assessed by Index of Orthodontic treatment need". *American Journal of Orthodontics and Dentofacial Orthopedics* 110.2 (1996): 197-205.

20. Cooper S., *et al.* "The reliability of the Index of Orthodontic Treatment Need over time". *Journal of Orthodontics* 27.1 (2000): 47-53.

21. Soumese M., *et al.* "Orthodontic treatment need in French school children: An epidemiological study using the Index of Orthodontic Treatment Need". *European Journal of Orthodontics* 28.6 (2006): 605-609.

22. Thilander B., *et al.* "Prevalence of malocclusion and Orthodontic treatment need in children and adolescents in Bagota, Colombia. An epidemiological study related to different stages of dental development". *European Journal of Orthodontics* 28.2 (2001): 153-167.

23. Al-Sarheed M., *et al.* "Orthodontic treatment need and self perception of 11-16 yr old Saudi Arabian children with sensory impairment attending special schools". *Journal of Orthodontics* 30.1 (2003): 39-44.

24. Soh J and Sandham A. "Orthodontic treatment need in Asian adult males". *Angle Orthodontics* 74.6 (2004): 769-773.

25. Stenvik A., *et al.* "Lay attitudes to dental appearance and need for Orthodontic treatment". *European Journal of Orthodontics* 19.3 (1997): 271-277.

26. Hedayati Z., *et al.* "The use of index of Orthodontic treatment need in an Iranian population". *Journal of Indian Society of Pedodontics and Preventive Dentistry* 25.1 (2007): 10-14.

27. Ajayi EO. "Orthodontic treatment need in Nigerian children". *Community Dental Health* 25.2 (2008): 126-128.

28. Ucunucu N and Ertugay E. "The use of the Index of Orthodontic Treatment need (IOTN) in a school population and referred population". *Journal of Orthodontics* 28.1 (2001): 45-52.

29. Buchanan LB., *et al.* "A comparison of the Index of Orthodontic Treatment Need applied clinically and to diagnostic records". *British Journal of Orthodontics* 21.2 (1994): 185-188.

30. Ovsenik M and Primzoic J. "Evaluation of 3 occlusal indexes: Eismann index, Eismann-Farcnik index, and index of Orthodontic treatment need". *American Journal of Orthodontics and Dentofacial Orthopedics* 131.4 (2007): 496-503.

Volume 4 Issue 6 August 2016
© All rights reserved by Aman Sachdeva., *et al.*