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Evaluation Of Orthodontic Treatment Needs Using Indices In Garhwali Population

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Abstract: Malocclusion refers to the misalignment of teeth, which can result from various factors such as genetics or environmental influences like thumb sucking, mouth breathing, over-retained deciduous teeth, early tooth loss, and arch length deficiency. In India, the prevalence of malocclusion ranges between 20% and 43%, making it one of the most common dental issues. Its consequences include functional impairments, such as difficulty in chewing, speech problems, and aesthetic concerns, which can have psychological effects. Malocclusion is also often linked to dental conditions like caries and gingivitis. Proper diagnosis and prevention of malocclusion are crucial, yet there is often a disconnect between the severity of the condition as perceived by individuals and specialists. To address this gap, various orthodontic treatment indices, such as the Index of Orthodontic Treatment Need (IOTN), were developed to provide standardized assessments. Studies on these indices have been conducted in different populations to evaluate their reliability. In a study conducted on 370 Garhwali individuals living around Dehradun, a mild to moderate positive correlation (0.56) was found between the two IOTN components (DHC and AC), indicating a slight variation between actual malocclusion and patients' perception of their treatment needs. The study highlights the need to educate the general population about malocclusion and its impact on both oral and overall health.

Key Words: Malocclusion • Orthodontic treatment indices • Dental health • IOTN correlation • Public awareness on oral health

Introduction

The prevalence of malocclusion varies from country to country and amongst different races, ages and sex groups, its prevalence in India is reported to be between 20–43% (Guo et al 2016). The need for orthodontic treatment is increasing constantly in developing countries like India. Therefore, there is a great need for the rational planning of orthodontic preventive measures on population basis. This stresses the need for more epidemiological studies to gain in depth insights about the prevalence of various types of malocclusions and their treatment needs and also to assess about the resources available for the same (Singh and Sharma 2014).

One of the major problems in assessing the malocclusion is the availability of an acceptable method for recording the occurrence and severity of the orthodontic problem (Burden and Holmes 1994, Gupta and Shrestha 2014). Some patients with severe malocclusion are satisfied or indifferent about their aesthetics, while others with minor irregularities are very much concerned about their aesthetics. That is, the normative and subjective need of the individual can vary in terms of orthodontic treatment. As malocclusion is not a disease, it is defined as the deviation from normal occlusion and it is generally the subjective perception influenced by judgments depending on aesthetic standards of the individual and society (Sharma et al 2017). Thus, orthodontic indices are used in clinical and epidemiological studies of malocclusion.

The Index of Orthodontic Treatment Need (IOTN) as described by Brook and Shaw (1989) and Shaw et al, (1991) and modified by Richmond et al (1994) has been gaining national and international recognition as a method of objectively assessing orthodontic treatment need. The index incorporates a dental health component (DHC) based on the

recommendation of the Swedish Medical Board (Linder-Aronson 1974) and an esthetic component (AC) developed by Evans and Shaw (1987). This index ranks malocclusion in terms of the significance of various occlusal traits for the person's dental health and perceived aesthetic impairment with the intention to identify those persons who would be most likely to benefit from orthodontic treatment. In Garhwal region there was no previous study to investigate the relation between Index of Orthodontic Treatment Need (IOTN) and perception of personal dental appearance. Therefore, this study was carried out to establish the relation between IOTN and perception of personal dental appearance among laymen. The findings from this study would be expected to predict whether IOTN actually reflects the patient's perception of their personal dental appearance

Materials and Methods

An observational cross sectional descriptive study was conducted in premises of Uttaranchal Dental and Medical Research Institute (UDMRI), various private practices and schools in and around Dehradun on subjects belonging to Garhwali population. Since previously no epidemiological study was done in Garhwali population, thereby Garhwali population was selected for this study. Ethical clearance for conducting the study was taken from the Institutional Ethical Committee (IEC/PA-011/2018).

Individuals both males and females between 12-21 years of age, belonging to Garhwali ethnicity, with no previous history of active orthodontic treatment having complete permanent dentition (Except 3rd Molars) were included in the study, whereas Individuals with Prosthesis and grossly decayed teeth were excluded from the study

The study was conducted in UDMRI by means of school and Dental camps amongst Garhwali population. A total of 1200 individuals were surveyed out of which 830 samples did not fall in the inclusion criteria due to different ethnicity, missing teeth etc. A written consent was signed by the participants/parents. The subjects who participated in the study were asked questions regarding their age, sex and dental history. Then an intra oral checkup was done based on criteria of IOTN and alginate impressions of maxillary and mandibular arches and intra oral frontal photograph of 370 individuals were taken. Frontal intraoral photographs in centric occlusion were taken digitally using DSLR camera (Canon T3i). The Questionnaire was written in English and sectioned into three parts: The first part consisted of basic information including age and gender. The second section comprised of 10 photographs of anterior teeth displaying various kinds of malocclusion and individuals were asked to indicate which picture mostly resembles to their own dentition. (Figure 1). The last section was for observer's use to assess and select correct grading of malocclusion according to the DHC chart.

The DHC of IOTN has five grades: Grades 1 and 2 represent no/little need for treatment, Grade 3 represents borderline need for treatment, and Grades 4 and 5 represents high priority for treatment. While recording DHC, the observer recorded ten features of malocclusion which were Overjet, anterior crossbite, overbite, open bite, lateral crossbite, displacement of teeth, impeded eruption of teeth, clefts of lip and/or palate, Class II and Class III buccal occlusion, and hypodontia. The acronym "MOCDO" (missing, overjet, crossbite, displacement, and overbite) means that missing teeth and overjet, including reverse overjet, have the highest priority in the assessment of treatment need. In the case of two or more occlusal anomalies the observer followed the hierarchical scale of anomalies. The AC is designed to complement the DHC by recording the severity of malocclusion in the anterior esthetic zone, with Grade 1 being no esthetic need through Grade 10, great esthetic needs for treatment. The AC scores were recorded by the patient's self-assessment.

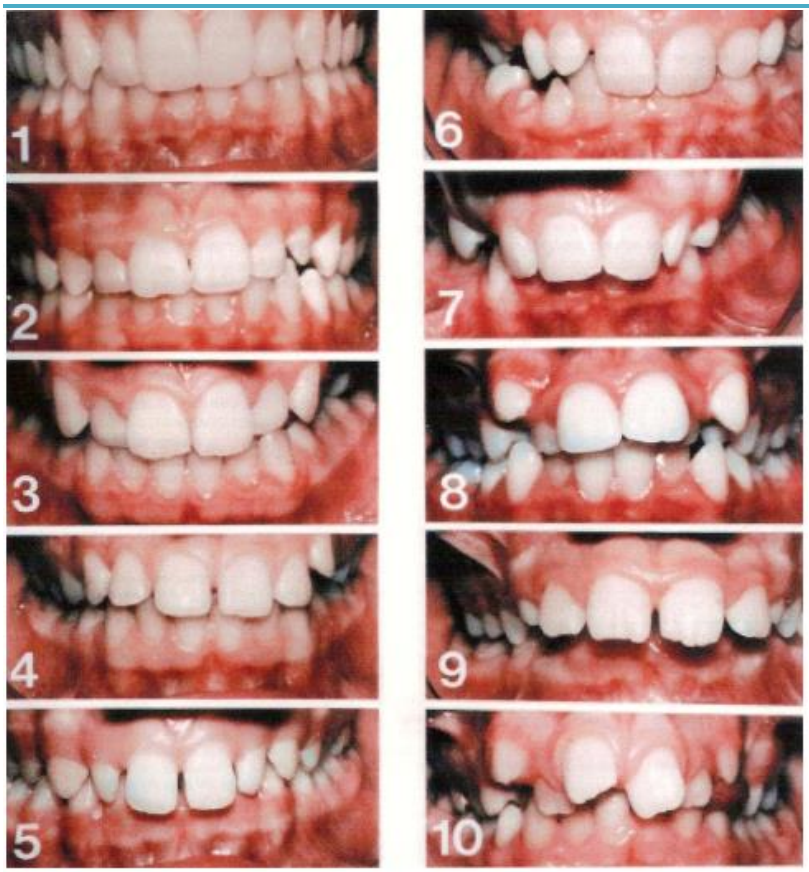

Figure 1. Figure showing the Aesthetic component (AC) (Brook 1989)

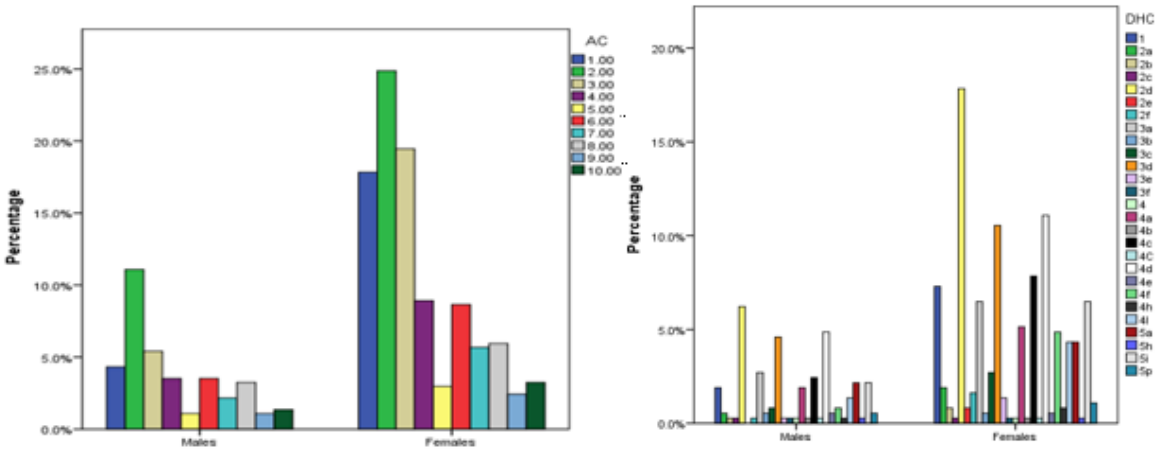

Fig 2: Gender distribution of AC & DHC grades of IOTN in study population

Results

This cross sectional, descriptive study was undertaken to assess the presence and severity of orthodontic treatment needs in a sample of 370 individuals with a mean age of 17.53 + 3.19 years. Re-examination of 40 samples of the participants was done after four days to evaluate intra-examiner reliability. The intra examiner agreement was 0.93

for DHC and 0.76 for AC component. This study did not show any significant difference between genders for malocclusion, though females had a slightly higher prevalence of malocclusion. (Table 1, Fig 2 & Table 2, Fig 3).

Table 1: Gender distribution of AC grades of IOTN in study population

Groups	AC	Boys	Girls	Total
No/Slightneed	1	16(4.3%)	50 (13.5%)	66(17.8%)
	2	41 (11.1%)	51 (13.8%)	92(24.9%)
	3	20 (5.4%)	52 (14.1%)	72 (19.5%)
	4	13 (3.5%)	20 (5.4%)	33 (8.9%)
Moderate/Borderline need	5	4 (1.1%)	7 (1.9%)	11 (3.0%)
	6	13 (3.5%)	19 (5.1%)	32 (8.6%)
	7	8 (2.2%)	13 (3.5%)	21 (5.7%)
Great need	8	12 (3.2%)	10 (2.7%)	22 (5.9%)
	9	4 (1.1%)	5 (1.4%)	9 (2.4%)
	10	5 (1.4%)	7 (1.9%)	12 (3.2%)
	Total	136 (36.8%)	234 (63.2%)	370 (100%)

Chi Square test = 13.026; p value = 0.161(NS)

Table 2: Gender distribution of DHC grades of IOTN in studypopulation

Groups	DHC	Boys	Girls	Total
No/Littleneed	1	7 (1.9%)	20 (5.4%)	27(7.3%)
	2a	2 (0.5%)	5 (1.4%)	7 (1.9%)
	2b	1 (0.3%)	2 (0.5%)	3 (0.8%)
	2c	1 (0.3%)	0 (0.0%)	1 (0.3%)
	2d	23 (6.2%)	43 (11.6%)	66 (17.8%)
	2e	0 (0.0%)	3 (0.8%)	3 (0.8%)
	2f	1 (0.3%)	5 (1.4%)	6 (1.6%)
Moderate/Borderline need	3a	10 (2.7%)	14 (3.8%)	24 (6.5%)
	3b	2(0.5%)	0 (0.0%)	2 (0.5%)
	3c	3 (0.8%)	7 (1.9%)	10 (2.7%)
	3d	17 (4.6%)	22 (5.9%)	39 (10.5%)
	3e	1 (0.3%)	4 (1.1%)	5 (1.4%)
	3f	1 (0.3%)	0 (0.0%)	1 (0.3%)
	4	1 (0.3%)	0 (0.0%)	1 (0.3%)
	4a	7 (1.9%)	12(3.2%)	195.1%)
	4b	1 (0.3%)	0 (0.0%)	1 (0.3%)
	4c	9 (2.4%)	20 (5.4%)	29(7.8%)

	4C	1 (0.3%)	0 (0.0%)	1 (0.3%)
	4d	18 (4.9%)	23(6.2%)	41(11.1%)
	4e	2 (0.5%)	0(0.0%)	2(0.5%)
	4f	3(0.8%)	15 (4.1%)	18 (4.9%)
	4h	1 (0.3%)	2 (0.5%)	3 (0.8%)
	4f	5 (1.4%)	11 (3.0%)	16 (4.3%)
Great need	5a	8 (2.2%)	8 (2.2%)	16 (4.3%)
	5h	1 (0.3%)	0 (0.0%)	1 (0.3%)
	5i	8 (2.2 %)	16 (4.3%)	24 (6.5%)
	5p	2(0.5%)	2 (0.5%)	4(1.1%)

Chi square statistic = 29.795; p = 0.276 (NS)

The molar relation of the study population was studied and the gender distribution among the molar relations were also analysed. (Table 3)

Table 3: Gender distribution of molar relation of IOTN in study population

Molar relation	Males	Females	Total
Class I	83 (22.4%)	143(38.6%)	226(61.1%)
Class II	15 (4.1%)	32 (8.6%)	47 (12.7%)
Class III	5 (1.4%)	1 (0.3%)	6 (1.6%)
Subdivision	33 (8.9%)	58 (15.7%)	91 (24.6%)
Total	136 (36.8%)	234 (63.2%)	370 (100%)

Chi square statistic = 6.083; p = 0.108 (NS)

With respect to the occlusal findings, Class I molar relation was found in 61.1% of the sample population, Class II molar relation in 12.7% and Class III in 1.6% and subdivision in 24.6%. A correlation of 0.592 was noted between the DHC and AC gradings of IOTN index which was significant at p<0.001. (Table 4)

Table 4: Correlation of AC and DHC components in the studypopulation

		AC	DHC
	Correlation Coefficient	1.000	.592**
AC	Sig. (2-tailed)	.	.000
	N	370	370
Spearman's rho	CorrelationCoefficient	.592**	1.000
DHC	Sig. (2-tailed)	.000	.
	N	370	372

at the 0**. Correlation is significant.01 level (2-tailed).

Discussion

Malocclusion has a large impact on both individuals and society in terms of discomfort, quality of life, and social and functional limitations (Dan et al 2023). Environmental, genetic or a combination of both the factors, along with various local factors such as adverse oral habits and anomalies in number, form, and developmental position of teeth can cause malocclusion. Malocclusion has shown to affect periodontal health, increase in the prevalence of

dental caries, and may also cause temporomandibular joint problems. (Singh et al 2017)

Epidemiological studies in India are more in need as it is the second highest populated country in the world (Athuluru 2016). Hence, it is important to identify those people who have orthodontic problems to prioritize them for proper treatment. Currently, there are no research studies about IOTN in connection with the Garhwali population.

In 1989 Brook and Shaw developed an index with two components to record orthodontic treatment priority (IOTN). The first of these components records need for treatment on dental health and functional grounds, the second component records the aesthetic impairment. This was one of the first index which involved both objective and subjective assessment, and gave both these assessments an appropriate weightage.

This cross sectional, descriptive study was undertaken to evaluate the presence, as well as the severity of orthodontic treatment needs in a sample of 370 individuals (740 upper and lower casts) with a mean age of 17.53 + 3.19 years. The data was normally distributed for gender and AC and DHC grades in the study population.

Re-examination of 40 samples of the participants was done after four days to evaluate intra-examiner reliability. The study results showed good validity of occlusion assessment based on the intra- examiner agreement scores. The intra examiner agreement was 0.93 for DHC and 0.76 for AC component. These findings were in concordance with the study of (Üçüncü and Ertugay 2001) who reported Kappa values of 0·91 and 0·78 for the DHC and AC respectively. Our study results had slightly better reliability coefficient for DHC component when compared to the study of Burden et al (1994) who found Kappa values of 0.73 and 0.77 for DHC and AC component. Similar results were reported by Burden and Holmes (1994) with values of 0.75 and 0.71 Kappa coefficients for DHC and AC respectively.

In previous studies, doubts were expressed about the 'validity' of the indices used. (Foster, 1980). The current study did not show any significant difference between genders for malocclusion, though females had a slightly higher prevalence of malocclusion. (Table1 and Table 2). Several researchers have studied the distribution with respect to males and females for severity & treatment need. This is similar to the study of Üçüncü and Ertugay 2001 which did not exhibit any significant difference between the IOTN values of boys and girls. Our study results contradict the findings of Burden et al (1994) and Hedayati (2007) who reported higher incidence of malocclusion in females.

The present study showed the following result 12.2% of greater need in the study population, 57% in borderline need and 30.8% of no need for DHC grade. Similar findings were found by the Brook and Shaw (1989) found that, the DHC proportions in 333 school children aged 11–12 years old had 30·1 per cent for no need or little treatment need but a slightly higher range of 32·7 per cent for great need. Our study findings showed a lesser amount of great need segment even when compared to other studies such as Burden and Holmes (1994) reporting 21–24 per cent of their population in the great need segment when DHC was assessed for 1829 school children; So and Tang (1993) in their examination of 100 dental students in University of Hong Kong reported 52 per cent great need.

In contrast, the study of Üçüncü and Ertugay 2001 showed that rating for the DHC of IOTN for the referred population were 83·2 per cent in great need for treatment, 12·0 per cent in moderate need for treatment and 4·8 per cent in slight or no need for treatment. Again, higher need was reported by Firestone et al 1999 showing 81.6% treatment need in 95 referred patients who were 12 years.

The highest level of traits that were seen was 17.8% in 2d which denotes contact point displacement of more than 1 but less or equal to 2 mm, 11.1% in 4d which denotes severe contact point displacement of more than 4 mm. 6.5 % in 5i which denotes impeded eruption of teeth (with exception of third molar).

The malocclusion prevalence of AC grade in IOTN

in the present study showed 11.62% requiring greater need for treatment, 17.29% in need of borderline and 71.08% needing no treatment. This finding suggests a low level of greater need in our study population. The study of Üçüncü and Ertugay 2001 has a close match with our study with the aesthetic component of IOTN showing 4·8 per cent of school population showed great need for treatment. Contradictory results were seen in the study of Richmond et al (1994) done on 1025 children, which showed great need in 47.0% and no need in only 12% of their population.

A possible reason as to why the IOTN-AC index prescribes a lower prevalence of orthodontic treatment need than other occlusal indices may relate to the fact that it reflects how an individual perceives his/her malocclusion. Furthermore, it is not uncommon that a lower than expected prevalence of orthodontic treatment need is prescribed when IOTN-AC is adopted to determine orthodontic treatment need as there is considerable debate about the appropriateness of the cut- off points for the index in prescribing treatment need.

The aesthetic component of IOTN seeks to quantify the likely socio-psychological effects of each child's malocclusion. Although the aesthetic component is assessed independently of the dental health component, results showed that most of the children with poor dental aesthetics who were also considered to be in need of treatment on dental health grounds. This is not altogether surprising as many children with an unattractive arrangement of their teeth are likely to have discrepancies, which also have dental health implications.

The most difficult decision about treatment are those that have to be made for borderline malocclusion with aesthetic implications. Therefore, it might happen that the cut off point for no need and moderate grades (Grades 4and 5) was chosen differently in the study of Üçüncü and Ertugay 2001 and also Stenvik et al (1997) which determined that the cut-off points for aesthetic treatment need in moderate borderline grade was used differently. The occlusal findings of our study revealed, Class I molar relation was found in 61.1% of the sample population, Class II molar relation in 12.7% and Class III in 1.6% and subdivision in 24.6%. Bilgic et al (2015) reported Class I malocclusion in 34.9% in their study which was much lesser than our study. Lauc (2003) and Josefsson et al (2007) for a Swedish population, found that Class II malocclusion was greater than 45% , and explained this figure by a genetic influence on the incidence of Class II malocclusions. On comparing Garhwali population with Himachal population (Singh et al 2016) it was found that DHC results showed 31.6% little need for orthodontic treatment , 30.85% moderate need and a great need was estimated at 37.55%. AC results showed that little need for orthodontic treatment was in 86.15%, moderate need in 8.90%, and great need in 4.95%. Whereas in South Indian population (Kaur et al 2013) in Karnataka 87.79% of population had malocclusion out of which 89.45% had class I, 8.37% had class II, and 2.14% had class III malocclusion

A correlation of 0.592 was noted between the DHC and AC gradings of IOTN index which was significant at $p<0.001$. This suggests that a moderate correlation existed between the two components of the malocclusion index suggesting that the aesthetic perspective of the patient moderately matched with the felt needs of the dentist. From the above findings, it can be suggested that IOTN provides a valid screening method to determine priority for orthodontic treatment. Priority of orthodontic care through national health care plans in European countries has been a prime factor behind the development of indices, such as the IOTN.

Although the results of our study cannot be generalized to the community at large because of smaller sample size, it does provide sufficient information to justify the need for future studies on orthodontic treatment need in large samples to be conducted within the population. The high level of definite objective treatment need based on dental health issues despite the readily available

orthodontic care within the community from which the sample was derived warrants further assessment and evaluation of the provision and utilization of orthodontic care in the community.

Conclusion

The present study indicated a moderate prevalence of malocclusion in terms of severity & treatment need using the IOTN. The study also establishes a reliable base line data regarding prevalence, distribution and severity of malocclusion to meet the treatment needs in Garhwali population. The following conclusions were drawn from the present study

- the prevalence of different malocclusion as follows: Class I- 61.1%, Class II- 12.7%, Class III- 1.6%, Sub division 24.6%.
- In our study, sample showed 30.8% requiring no need for treatment, 57.0 requiring borderline and 12.2% in greater need of orthodontic treatment as per the DHC of IOTN.
- The AC component of IOTN showed no need in 71.08%, borderline need in 17.29% and great need in 11.62% of the population. A correlation of 0.592 was noted between the DHC and AC gradings of IOTN index which was significant at $p<0.001$.
- There seems to be a considerable discrepancy in the proportion of individuals needing orthodontic treatment on esthetic and dental health grounds. It indicates a general lack of awareness amongst the laymen about the gravity of their existing malocclusion. This can be because of their weak oral health knowledge.
- Females reported a higher perception toward the malocclusion (higher AC grades) on esthetic grounds when compared to the males. this showed that the females are more concerned about the esthetics or appearance of their teeth as compared to the males.

  In India with a vast ethnic and cultural heritage, where there is a wide range of prevalence of malocclusion, further epidemiological studies of this nature with a larger sample size are needed to analyze the demand for orthodontic treatment.

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