Assessment of Severity and Treatment Using Occlusal and Index of Orthodontic Treatment Need (IOTN) Indices in Haldia Population- A Short Study

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Abstract

Background:-Both qualitative and quantitative methods of recording malocclusions are important for epidemiologists and for planning the provision of orthodontic treatment for a definite population. Several quantitative systems have been used to measure the severity of treatment need etc with the help of indices. Occlusal index (OI) and index of orthodontic treatment need (IOTN) are advantageous as they are simple and accurate for measuring malocclusion for a given population. **Aim:-** To assess the objective and subjective levels of severity and orthodontic treatment need in Haldia population using Occlusal and IOTN indices. **Materials and method:-** A total of 200 patients, more than thirteen years of age, from the out-patient department of Orthodontics and Dentofacial orthopaedics, Haldia Institute of Dental Sciences and Research, Haldia were included in the present study for orthodontic treatment. All the subjects were made to sit on a dental chair and frontofacial intraoral photographs were taken with relaxed perioral musculature, and impressions were made with alginate impression material. Ocllusal index (OI) and index of orthodontic treatment need (IOTN) were applied to assess the findings. **Results:-**OI classification showed Good occlusions 7.5%, No treatments 17.5%, Minor treatment 45.0%, Definite treatment 27.0% and Worst occlusions 3.0%. IOTN-DHC index showed the findings to be None of 8.2%, Little treatment 22.9%, Moderate 47.5, Great treatment 56.55% and Very great 27.0%. The Aesthetic Component (AC) with gender with requirements based on AC score showed Little or No treatment in 30.0 % cases, Moderate and Border line treatment in 63.5% and Treatment required was for 11.0%. cases. Spearman's rho Correlations with OI, DHC and AC showed high association at 5% level of significance. Cohen's Kappa statistic for Inter rater agreement reliability and highly statistically significance at 5 % level. **Conclusion:-** The study recognized a dependable baseline information in terms of frequency, distribution and severity of malocclusion to answer the treatment requirements within the local population.

Key words:-Aesthetic component, Dental health components, Index of orthodontic treatment need, Occlusal index

Introduction

Malocclusion, signifies a deviation from the normal or ideal occlusion, occurs in most of the population with greatdisparities among vivid population. This disease state is a continuous spectrum of occlusion dissimilarity, withinnumerable combinations, and is a problem that produces a specificdisplay of occlusion among the various population groups. Several methods are available that has been adopted to record or measure malocclusion for documentation of the prevalence and severity of malocclusion in population groups.[1]

Early methods of recording malocclusions were qualitative and used for epidemiological studies. It was realized that qualitative methods of classification are not suitable for measuring the severity and treatment need. Quantitative Methods of recording and measuring occlusal features are important for epidemiologists and for those planning the provision of orthodontic services in a certain community.[2] The major defect in this concept was that it was not easy to define normality, because there always existed degrees of natural variation among individuals of a population.[3]Thus, several quantitative systems to evaluate malocclusion for measuring severity treatment need, treatment complexity, and treatment outcome have been developed within last several years, with the name of indices. Indices are systems of procedures that generate and summarize data about the malocclusions and quantify them in to a numeric value.[4] The Occlusal Index (OI), proposed by Summers in 1971, comprise of nine characteristics, that are measured for patients in both mixed and permanent dentition.[5]It was proposed that occlusal disorders might consist of either a basic defect or a symptom of developmental change, but for an index to be effectiveand valid over a period of time, it must focus on, and be sensitive to the basic defect and not the symptoms as a result. An index should be valid over time and the scoring for the occlusal condition should either remain the same or increase with time, representing that the disorder is the same or getting worse. The score should not decrease with time, as this would indicate that the occlusal disorder is self-correcting.[5]

An index with two components to record orthodontic treatment priority or index of orthodontic treatment need (IOTN) was developed in 1989 by Peter H. Brook and William C.Shaw. The first of these elements'measures the need for treatment on dental health and functional grounds andthe second component measures the aesthetic weakening. This index involved both objective and subjective assessment and specified appropriate weight. Hence, these indices have been establishedto categorize malocclusion into various groups, and score them for severity to consider the respective individuals with greatest scores for orthodontic treatment.[6]

These indices are advantageous as they are simple and accurate for measuring malocclusion for a given population. Even if these indices are developed from two different populations, they have been applied extensively for quantifying malocclusions for severity and treatment need in any part of the world. Hence, the present study was undertaken with the aim to assess the objective and subjective levels of severity and orthodontic treatment need in Haldia population using Occlusal and IOTN indices.

Materials and Method

This present research is a descriptive study documenting the occlusal traits in all three planes of space of the sample population. A total of 200 patients from the out-patient department of Orthodontics and Dentofacial orthopaedics, Haldia Institute of Dental Sciences and Research, Haldia, West Bengal, were included in the present study for orthodontic treatment. The study was approved by the institutional ethical committee.The subjects selected in the study were all more than thirteen years of age. This age group was selected owing to the full complement of the adult dentition that was expected in the mouth. All the subjects were made to sit on a dental chair and frontofacial intraoral

photographs were taken with relaxed perioral musculature, and impressions were made with alginate impression material.

Statistical Analysis

The data collected for each patient were entered on the scoring sheet and quantified according to the respective indices.

Evaluation of Severity Using Occlusal Index

Dental Age:-The first step in Occlusal Index (OI) is to classifying the occlusion into a dental age. The present study comprised of Dental age VI, which begins when all permanent canines and bicuspids are in occlusion, and is characterized by the presence of the completed permanent dentition (second molars may or may not have erupted).

Molar Relation:-The second step in occlusal index was scoring of molar relation (with respect to mesial and distal relation, flush terminal (Figure 1).[7]
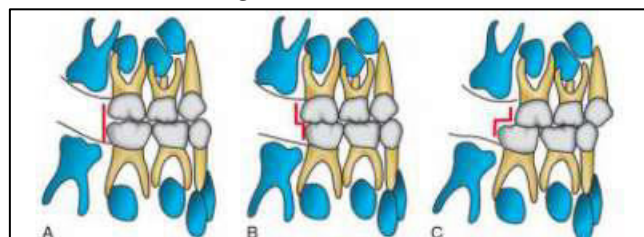

Figure 1:- Molar Relation[7]

Measurement Of Overbite:-Overbite is scored as the vertical distance from the incisal edge of the maxillary central incisor to the incisal edge of the mandibular central incisor when the jaws are in "centric occlusion (Figure 2).

Measurement Of Overjet:-Itis scored as the horizontal distance from the labial surface of the maxillary central incisor to the labial surface of the mandibular central incisor in millimeters. According to the variations in millimeter, scores may be positive, zero, or negative (Figure 2).[8]
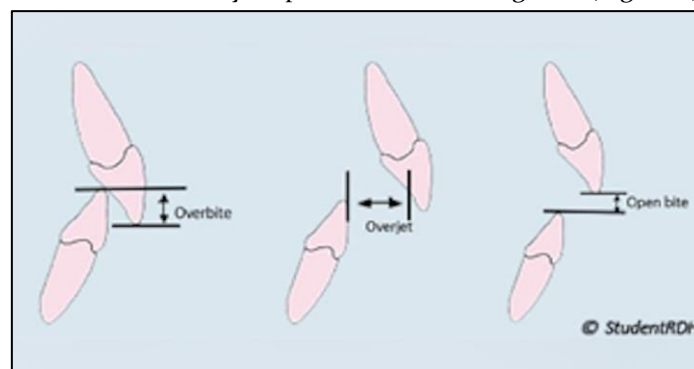

Figure 2:-Measurement Of Overbite, Overjet[8]

Measurement Of Posterior Cross-Bite:-According to summers Cross-bite may be dental, functional, or osseous. Therefore, for posterior cross-bite to be an indicator of the osseous relation, it must be differentiated from other types of cross-bite (Figure 3).[8]
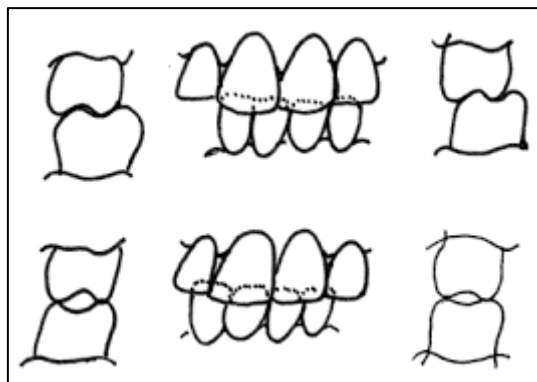
Figure 3:-Measurement Of Posterior Cross-Bite[8]

Measurement of Posterior Open Bite:-Posterior open-bite identified as the lack of occlusal contact between any opposing posterior teeth (posterior teeth include the deciduous canines and molars, and the permanent canines, premolars, and molars) with the jaws in "centric occlusion." Posterior open-bite may be unilateral or bilateral and may accompany an anterior open-bite (negative overbite). Posterior open-bite is scored as either present or not present and, if present, as either unilateral or bilateral. Generally, two or more adjacent posterior teeth will be in open-bite (Figure 4).[9]
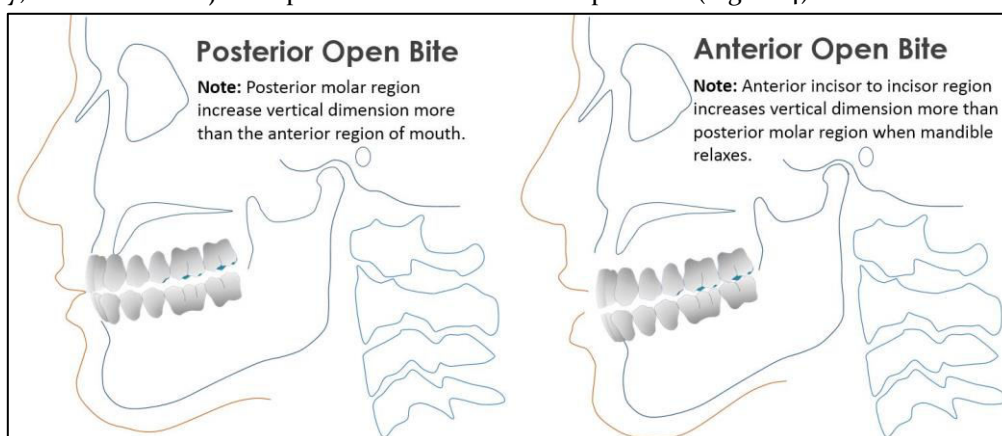

Figure 4:-Posterior Open Bite[9]

Measurement Of Tooth Displacement:-Thetooth displacement includes mesiodistal, labiolingual disharmony of the tooth from normal arch alignment.The scoring of tooth displacement in the permanent dentition can be categorized in to two degrees of displacement. Premolars and molars are not scored for rotation in the occlusal index. A tooth may be in normal arch alignment buccolingually, but, because of space deficiency, it may be blocked by the adjacent teeth and fail to erupt completely. A tooth in this situation is sometimes referred to as being in *infraversion* and is scored as "1.5 to 2.0 mm. deviation."

Measurement Of Midline Relationship

*Diastema:-*A midline diastema is defined as the space, in millimeters, between the two maxillary central incisors, either deciduous or permanent, which have erupted into occlusion. When the diastema equals or exceeds 2 mm., it is given a weight in the occlusal index.

Measurement Of Jaw Deviation:-Midline jaw deviation is measured as the distance, in millimeters, between the midpoint of the two maxillary central incisors and the midpoint of the two mandibular central incisors in the horizontal (occlusal) plane when the teeth are in centric occlusion. If any central incisor is missing, the procedure is not recorded. Jaw deviations of 3 mm. or more are given a weight in the occlusal index

Measurement Of Missing Permanent Teeth:-Only missing maxillary incisor teeth which have not been replaced by a prosthesis are scored. Here, the number of missing maxillary incisors were recorded.

Calculating Method For Occlusal Index

After obtaining the data from the above-mentioned measurements, the individual calculating form was available according to the Dental Age 6. The OI contains two divisions and seven syndromes as was proposed by Summers CJ (1971).[5]

Interpretation Of Occlusal Index Scores

The subjective classification can be categorized in the following classes:

i.   **Good occlusions**- Scores in between 0.0 to 2.5, no evidence of an occlusal disorder.

ii. **No treatment**- scores in between 2.6 to 4.5, Slight deviations in the occlusion, but no treatment indicated at this time.

iii. **Minor treatment**- scores in between 4.6to 7.0, Minor deviations in the occlusion which could be remedied by simple treatment (that is, space regainers or removable appliances).

iv. **Definite treatment** - score in between 7.0 to 11.0, Major deviations in the occlusion which could be remedied by major treatment (that is, treatment which would include banding of many teeth).

v.   **Worst occlusions** - scores in between 11.1 to 16.0, Major deviations in the occlusion which could be remedied by major treatment; these occlusions were highly disfiguring to the patient and would probably rank first in treatment priority

Evaluation Of Treatment Need Using IOTN Index

IOTN index proposes to recognize those individuals who would most probably benefit from orthodontic treatment and consists of two components:-the Aesthetic (AC) and Dental health components(DHC), thus ranking malocclusion in ascending priority according to aesthetic considerations and dental health implication.

Results

A total of 200 subjects were assessed for severity and treatment need using OI,DHC (IOTN), and AC (IOTN) indices. There were 78 male and 122 female samples as apart of the study. Normality tests were performed using spearmen correlation. To check for normal distribution ofsample size. The results indicate two of the above three variable showed significancevalue of less than 0.05. The results obtained from occlusal index indicates that 44 samples came under the category of "little or no treatment", 90 samples requiring "moderate and border line treatment" and the remaining 66 samples for greater treatment need. When assessed by the IOTN- DHC, 34 subjects fell into grades 1or 2, indicating their treatment need was either none or little. The total number of subjects with IOTN grades of 3 indicating moderate treatment need was 60. Among 200 samples IOTN puts very great treatment needed for 106 subjects. The scores ranging from 1 to 5 with the mean value of 4. Subjective assessment was done with the help of IOTN- AC and the results showed that 51 samples under the category of little or no treatment,127 samples requiring moderate and borderline treatment and the remaining 22 requiring very great treatment need. The scores ranging from 2 to 10 with the mean value of 5. Correlation test was performed with the help of Spearman's rho correlation method, and concluded to have moderate level of correlation between the three variables.

Table 1 represents thatOcclusal Index (OI) with gender classification and requirement based on OI classification in total Good occlusions 7.5%, No treatments 17.5%, Minor treatment 45.0%, Definite treatment 27.0% and Worst occlusions 3.0%. among male is Good occlusions 2.7%, No treatments 14.1%,

Minor treatment 44.9%, Definite treatment 29.5% and Worst occlusions 3.8% and female is Good occlusions 9.8%, No treatments 12.3%, Minor treatment 45.1%, Definite treatment 30.3% and Worst occlusions 2.5%. Table 2 represents that (IOTN) DHC Index with gender classification and requirements based DHC classified. In total None is 8.2%, Little treatment 22.9%, Moderate 47.5, Great treatment 56.55% and Very great 27.0%. Among male is None 5.1%, Little treatment 17.9%, Moderate 25.6% Great treatment 30.7 and Very great 17.9%. Among female is None 4.9%,Little treatment 11.4% Moderate 31.1% Great treatment 36.9% and Very great 15.6%. Table 3 represents that Aesthetic Component(AC) with gender with requirements based on AC score. Among total in Little or No treatment is 30.0 %, Moderate and Border line treatment is 63.5% and Treatment required is 11.0%. Among male is Little or No treatment is 38.4% Moderate and Border line treatment is 62.8% and Treatment required is 10.3%. In female is Little or No treatment is 48.7%, Moderate and Border line treatment is 89.7% and Treatment required is 17.9%. Table 4; represents that Spearman's rho Correlations with OI, DHC and AC, among all the categories are highly associate at 5% level of significance. Table 5: Requirements based on OI with Requirements based on DHC Index. Cohen's Kappa statistic for Inter rater agreement reliability and highly statistically significance at 5 % level. However, in the total Little or No treatment is 22.0%, Moderate and Borderline treatment is 45.0% and Treatment required is 33.0%.

Table 1: Requirements based on Occlusal Index (OI) * GENDER

Requirements based on OI	% (n) Male	% (n) Female	% (n) Total
Good occlusions	2.7% (3)	9.8% (12)	7.5% (15)
No treatments	14.1 % (20)	12.3% (15)	17.5% (35)
Minor treatment	49.9% (35)	45.1% (55)	45.0% (90)
Definite treatment	29.5% (17)	30.3 % (37)	27.0 % (54)
Worst occlusions	3.8% (3)	2.5% (3)	3.0% (6)
Total	78 (100%)	122 (100%)	200 (100%)

Table2:Requirements based on(IOTN)DHC Index*GENDER

Requirements based on DHC	% (n) Male	% (n) Female	% (n) Total
None	5.1% (4)	4.9% (6)	8.2% (10)
Little treatment	17.9% (14)	11.4% (14)	22.9% (28)
Moderate	25.6% (20)	31.1 % (38)	47.5 % (58)
Great treatment	30.7 % (24)	36.9 % (45)	56.55%(69)
Very great	17.9 % (14)	15.6% (19)	27.0% (33)
Total	78 (100%)	122 (100%)	200 (100%)

Table 3: Requirements based on Aesthetic Component (AC)*GENDER

Requirements based on AC score	% (n) Male	% (n) Female	% (n) Total
Little or No treatment	38.4% (30)	48.7% (30)	30.0% (60)
Moderate and Border line treatment	62.8% (49)	89.7% (78)	63.5% (127)
Treatment required	10.3% (8)	17.9% (14)	11.0 % (22)
Total	78 (100%)	122 (100%)	200 (100%)

Table 4: Spearman's rho Correlations with OI, DHC and AC

		OI	DHC	AC
OI	Correlation Coefficient	1.000	.657(**)	.424(**)
	Sig.(2-tailed)	.	.000	.000
	N	200	200	200
DHC	Correlation Coefficient	.657(**)	1.000	.554(**)
	Sig.(2-tailed)	.000	.	.000
	N	200	200	200
AC	Correlation Coefficient	.424(**)	.554(**)	1.000
	Sig.(2-tailed)	.000	.000	.
	N	200	200	200

Table5:Requirements based on OI*Requirements based on DHC Index

	RequirementsbasedonDHC Index			Total
Requirements basedonOI	LittleorNotreatment	ModerateandBorder line treatment	Treatmentrequired	
Little or No treatment	12.0 % (24)	8.0 % (16)	2.0 % (4)	22.0 (44)
Moderate and Borderlinetreatment	5.0% (10)	18.5% (37)	21.5% (43)	45.0% (90)
Treatment required	.0 % (0)	3.5% (7)	29.5% (59)	33.0 % (66)
Total	34	60	106	200

Note: Cohen's Kappa statistic for Interrater agreement reliability statistically significance at 5 % level

Discussion

Occlusal indices are used to curtail the prejudiceassociated with the evaluation, diagnosis,and treatment of malocclusions.[10]It is imperative todistinguish between various types of malocclusions based on the diagnostic, epidemiological, treatment need, outcome, and complexity indices. Both the dental health component (DHC) and the aesthetic component(AC) of IOTN have been assessed in several studies.[11,12,13]

This study representsa desired assessment and comparison of the cogency of commonlyused OIcomprising of various purpose categories.The effect of facial components on treatment need have beenevaluated bycephalometric measurements and anadditional facial index which produced unexpected results with respect to the indices and theirpossible use in orthodontics.[13]

In the present study, the evaluation of severity and treatment need was successfullydone for all the 200 samples. Initially, numerous studies have been conducted on the prevalence of malocclusion in the Caucasian populations.[14,15]In recent studies, the prevalence of malocclusion for Asians have been described which hasstated that the Asian population had a higher proportion of malocclusion.[16]

The distribution of the males and females for severity and treatment need has been researched previously in many studies. In 1994 Burden et al.[17] and Hedayati et al.[8], found that significantly males required more orthodontic treatment than females, whereas femlaes needed less treatment need according to a study done by Mandall et al.[19] In the present study, the difference between the IOTN, OI values of boys and girls were not statistically significant. It is interesting to note that this result is congruent with the results by Mourad et al.[20],Ucuncu et al.[21], Hosseinzadeh et al.[22], and Ugur et al.[23], thus signifying that malocclusion cases were equally distributed for severity and treatment need.

This study showed that the demand of orthodontic treatment for the young adults were principallyaffected by the yearningforenhancement in looksinstead of chewingfunction or speech.These findings were found to be similar to other studies on various ethnic populations.[24,25,26]Even though, it has been documented that females require and request for an orthodontic Treatment in maximum number of cases,[27,28], the present study found no significant difference between males and females with respect to this factor.There was no significant difference between them in the number of respondents who have already undergone orthodontic treatment. The validity and distribution of DHC grades has been researched previously. Brook and Shaw[29] observed that, the DHC proportions in 333 school children within 11-12 years old were 32.7% who needed great treatment,35.1% required no or little treatment need. Hosseinzadeh et al.[22]found 45.7%of 17-year-old students in Abade were found indefinite need of orthodontic treatment using DHC. So and Tang[16] examined 100 dental students in university of Hong Kong and observed that 52% patients required orthodontic treatment definitely.

Gurey et al.[30], showed that 72.26% patients needed treatment,27.74% required no or little treatment. Ugur et al.[23]showed that 59.62% required orthodontic treatment surely.Similarly, in the present study according to DHC, 83% of the sample population in the category of treatment needed. The results what we had from our study better correlates with the previous studies.

In our study IOTN-AC recommended a reduced the prevalence of orthodontic treatment need compared to IOTN-DHC and OI. This result is consistent with findings from some previous studies that has portrayed a low prevalence of orthodontic treatment need in individuals where IOTN-AC has been active to recommend orthodontic need.[31,32,33]The low level of great treatment needed in this study associates with the specializedevaluation of treatment need in 68 school children with the AC of the IOTN, caused only 8.7%of the sample as being positive need of orthodontic treatment. These results are analogousto some studiesdone by Otuyemi et al.[34] and Mugonzibwa et al.[35]who observed 7% and 11% of the children in definite need of orthodontic treatment with the help of AC grading.

One of the most plausible reasonsfor IOTN-AC index to recommend a lower prevalence of orthodontic treatment need as compared to other occlusal indices correlates with the subjective

aesthetic judgment that remainsdifferent from the anatomical trait evaluation.[4]A lower prevalence of orthodontic treatment need is also suggested when IOTN-AC is implemented to govern orthodontic treatment need as there is substantialargument about the appositeness of the cut-off points for the index in recommendingthe treatment need.[36,37] On the contrary, a larger rate of AC grade has been shown for certain racial groups. Few studies that were in contrast to the results of the present study were done by Brook and Shaw[6], Richmond et al.[38], Burden and Holmes[31],Neslihan Ucuncu[21].

In the present study it was found that 22% of the sample requiredno orthodontic treatmentand the remaining sample required treatment based on the OI,which moderately correlated with the study done by Tangs et al.[24]Moderate level of correlation between OI and IOTN-DHC were found in the present study that were in accordance to the study done by So and Tang.[24]Some studies done by So and Tang[24],Tarvit et al.[39], Jen Soh et al.[40], Mhd et al.[41], showed that there was a poor association between DHC and AC, and the present study results were close to their findings.However, some studies done by Neslihan Ucuncu[32], Abu Alhaija et al.[3], showed perfect agreement between DHC and AC in their studies.

Tang et al.[24]performed a study to show that a positive correlation of orthodontic treatment with treatment need was present with the help of IOTN and OI.They concluded that OI assessment correlates better than IOTN with individuals' perceptions of their own appearancebased on AC, and the treatment requirementrefereed by the OI has positive association with treatment demand. These results were congruent to the present findings.Even though the results of the present study could not be straight-away applied to a large population, it did deliveradequatedata to validate the requirement for future studies with large sample size to be conducted. The great level of positiveunbiased treatment need based on dental health problemsdespite the readily available orthodontic care within the population from which the sample was derived permits further evaluation of the application of orthodontic care in a larger population.

Conclusion

The present study done on Haldia population specified a high incidence of malocclusion with respect to severity and treatment requirement. The study also recognized a dependable baseline information in terms offrequency, distribution and severity of malocclusion to answer the treatment requirementswithin thelocal population. However, in an area with anenormous ethnic and cultural heritage and an extensive range of frequency of malocclusion, additional studies with larger sample size is required to analyse the demand for orthodontic treatment.

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