The Correlation of Occlusal Indices with Patients Perceptions of Aesthetics, Function, Speech and Orthodontic Treatment Need

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Abstract:

Purpose: The aim of the study is to assess the relationship between two orthodontic indices, that is, Dental Aesthetic Index (DAI), and Index of Orthodontic Treatment Need (IOTN) and patient’s opinion regarding malocclusion and treatment needs.

Material and method: The study was done on 100 patients over a period of 8 months where patients were assessed by evaluating the patient before the orthodontic treatment on the basis of DAI and IOTN guidelines by two examiners who were trained and calibrated in the use of the. Subjects were also asked to complete a questionnaire consisting of three questions concerning appearance, function, and speech, using a 5-point Likert scale.

Results: There was a statistically significant correlation between the IOTN and DAI.

Conclusion: Both the Index of Orthodontic Treatment Need and Dental Aesthetic Index reliably record deviant occlusal traits. In addition of co-relation of the Aesthetic component of IOTN and Dental Aesthetic Index and speech suggest that this association is more than coincidental. There was a significant co-relation between:

1. Aesthetic Component and Dental Health Component of Index of Orthodontic Treatment Need.
2. Dental Health Component of Index of Orthodontic Treatment Need and Dental Aesthetic Index.
3. Dental Aesthetic Index and Question number 3 which is question on difficulty of speech.
5. Aesthetic Component of Index of Orthodontic Treatment Need and Question 3, which is the question on difficulty of speech.
6. Question 2, which is on biting and chewing and question 3, which is on speech.
Introduction

A variety of occlusal indices have been described in the orthodontic literature. The recent use of indices of treatment standards is gaining acceptance. The basic property of an index or system of measurement is that it should be reproducible.

While indices have been used with some success for recording dental disorders like caries, periodontal disease and TMJ dysfunction, malocclusion is unique as it presents as a group of often unrelated traits for which there may be considerable variability of adjustments in social psychological terms. Despite these considerable problems, several indices of malocclusion have been developed and have been used for diagnostic classification, epidemiological data collection, the recording of treatment need (treatment priority) and assessment of treatment success. Diagnostic classification is mainly the classification for the type of malocclusion where the best known example is the Angle’s classification although more recently, incisor classification which is reinforced with a series of statements concerning other inter and intra arch relationship. Then there is the epidemiological data collection where the indices record every trait in a malocclusion or its traits to be made in the population and include the epidemiological registration of malocclusion.

Among the newly developed indices such as PAR index, SCAN index and IOTN, the latter rank malocclusion in terms of the significance of various occlusal traits for the person's dental...
health and perceived esthetics impairment, with the intention of identifying those persons who would be most likely to benefit from orthodontic treatment.\textsuperscript{15}

**Materials and Methods**

This study was done on 100 patients referred to the Department of Orthodontics and Dentofacial Orthopaedics, A. B. Shetty Memorial Institute of Dental Science over a period of 8 month. The patients for this study had to be between the age group of 13 years to 18 years. All the patients were professionally assessed by evaluating the patient before the orthodontic treatment on the basis of DAI\textsuperscript{5} and IOTN\textsuperscript{6, 13, 14} guidelines by two examiners who were trained and calibrated in the use of the indices and subjective assessment were obtained from the patients by means of a questionnaire consisting of four simple questions.

The pretreatment and post treatment scores were evaluated for DAI and IOTN using the guidelines suggested by Jenny et al\textsuperscript{11} and Abdullah M. S. et al.\textsuperscript{1}

The second part of the overall assessment of treatment priority, was to record the aesthetic impairment contributed by the malocclusion \textsuperscript{8} where photographs were chosen giving a 10 point scale from 0.5 (attractive dental appearance) to 5.0 (unattractive dental appearance). (Fig. 1)

**Data analysis:** The Kappa statistic (K) was used to analyze intra examiner and inter examiners reliability for IOTN. Root mean square was used for the
Dental Aesthetic Index (DAI). Spearman rank correlation co-efficient, was used to explore the relationships between the various factors. The SCAN Index (Standardized Continuum of Aesthetic Need) was utilized for rating the photographs on a visual analogue scale. The index of treatment priority was used as the basis for grading the functional and dental health indications for treatment. There are five grades, grade 1 representing little or no need for treatment and grade 5 representing great need of treatment (Table 1).

**Results:**

By using the Spearman's Rank correlation, we found relationship of AC, DHC, DAI\(^{13}\), \(^{14}\) and subjective questionnaire, the results showed that, there was a statistically significant correlation between the AC and DHC where \(R = 0.61; P < 0.000\).

There was a statistically significant correlation between the DHC of IOTN and DAI where \(R = 0.49; P < 0.000\).

There was no statistically significant correlation between the DHC of IOTN and Question 2 which is the question on difficulty in chewing and biting \(R = -0.159; P = 0.115\), where R is less than 0.3 and P is greater than 0.000.

There was no statistically significant correlation between the DHC of IOTN and Question 3 which is the question on difficult in speech where \(R = -0.057; P = 0.574\).\(^{14}\)

There was a no statistically significant correlation between the DAI and Question 2 which is the question on
chewing and biting where $R = -0.094$ and $P = 0.353$.

There was a statistically significant correlation between the DAI and Question 3 which is the question on speech where $R = -0.353$ and $P = 0.000$.

There was a statistically significant correlation between the AC and DAI where $R = 0.560; P = 0.000$.

There was statistically significant correlation between the AC and Question 3 which is the question on speech where $R = -0.494; P = 0.000$.

There was statistically significant correlation between the Question 2 and Question 3 where $R = 0.319; P = 0.000$.

**Discussion:** In this study, with a sample size of 100 patients, results showed that:

After calculating the Root Mean Square (RMS) of Dental Aesthetic Index (DAI) we have found –

RMS < 2.78 which is almost equal to the RMS < 2.4 conducted by YEH et al, Am J Orhtod and Dent Orthop; Oct.2000

For Index of Orthodontic Treatment Needs (IOTN), Kappa (K) was used and the results showed for Dental Health Component (DHC) – $R = 0.019$

$P = 0.85$

Aesthetic Component (AC) – $R = 0.03$

$P = 0.702$

Were $P$ is the probability and $R$ is the Correlation coefficient.
To find the correlation between Aesthetic Component, and Dental Health Component of Index of Orthodontic Treatment Need, with Dental Aesthetic Index and subjective questionnaire we have used the Spearman Rank correlation coefficient.

We have found that there was statistically significant correlation between Aesthetic Component and Dental Health Component of Index of Orthodontic Treatment Need were $R = 0.61; P<0.000$ which is similar to the values got by Matthew Shue-Te Yeh et al (2000) ($R=0.46; P<0.01$).

We have found statistical correlation between Dental Aesthetic Index and Question 3 which is the question on difficulty of speech were $R=-0.353$ and $P<0.000$ which is similar to the values got by Ansai et al (1993)$^2$ & Matthew Shue-Te Yeh et al (2000)$^{16}$ ($R=-0.34; P<0.05$).

We have found statistical correlation between Aesthetic Component of Index of Orthodontic Treatment Need and Dental Aesthetic Index were $R = 0.560; P<0.000$ which is similar to the values got by Matthew Shue-Te Yeh et al (2000)$^{16}$ ($R=0.54; P<0.01$).
We have found statistical correlation between Aesthetic Component of Index of Orthodontic Treatment Need and Question 3 which is the question on difficulty of speech were R=-0.494; P<0.000 which is similar to the values got by Matthew Shue-Te Yeh et al (2000) (R=-0.39; P<0.01).

We have found statistical correlation between Question 2 which is on biting and chewing and Question 3 which is on speech were R=0.319; P<0.000.

There was no statistical correlations between Dental Aesthetic Index and Question 1 which is on the appearance of teeth (R=0.068; P<0.495), between Dental Health Component of Index Orthodontic Treatment Need and Question 2 which is on difficulty on chewing and biting (R=-0.159; P<0.115), between Dental Health Component of Index Orthodontic Treatment Need and Question 3 which is on difficulty of speech (R=-0.057; P<0.574), between Dental Aesthetic Index and Question 2 which is on difficulty on chewing and biting (R=0.094; P<0.353), between Aesthetic Component and Question 1 which is the Question on appearance of teeth.(R=-0.254; P<0.0249), between Aesthetic Component and Question 2 which is the question on biting and chewing (R=-0.011; P<0.936), between Question 1 which is on the appearance and Question 2 which is on chewing and biting. (R=-0.043; P<0.640) and between in Question 1 and Question 3 R=0.030; P<0.785.
As it is the patient who receives treatment, we should not disregard patients' perceptions regarding Orthodontic Treatment and the patients' need to gain satisfaction from improved Aesthetic and functions. We have found that the Dental Aesthetic Index and Index of Orthodontic Treatment Need attempt to incorporate these patient perceptions in their respective indexes.\textsuperscript{12} The findings of this study indicate that both the indexes can identify deviant occlusal traits. There are statistically significant correlations between both components of the Index of Orthodontic Treatment Need and Dental Aesthetic Index.

But the association between speech, biting and chewing and appearance of teeth showed very low correlation because the patient was not positive with the answer to the questions asked because the patient may have adapted to the speech and masticatory function, in other words this modified his behavior to the malocclusion in his mouth, hence the patient is not able to give a positive answer to the questions. The patients' taken for the study were between the age group of 13 to 18 years, so the patients are more of teenagers who are more bothered about their aesthetics and their functional maturity is not fully developed for them to understand the role of mastication over a prolonged period of time. So the patient has to be first educated about the function of his masticatory apparatus or the questionnaire has to be modified to obtain specific answer to the questionnaire. Hence further modifications of the patients
questionnaire have to be done to make the patient evaluation of his perception more focused and specific. The two indexes investigated in this study may initially seem very similar but on application differences become apparent. The Dental Aesthetic Index (DAI) appears to be easier to use but the lack of assessment of traits such as buccal crossbite, open bite, central line discrepancy, and deep overbite weakens the index. The Index Orthodontic Treatment Need proved to be more accurate in assessing patient's perception of both Aesthetics and Treatment needs.  

**Summary and Conclusion**

This study was done to assess the co-relation of Occlusal Indexes, that is, the Dental Aesthetic Index and the Index of Orthodontic Treatment Need with patients perception of aesthetic, function, speech and orthodontic treatment needs in patients referred for orthodontic treatment and two professional indexes co-related with each other.

All the patients in this study had come for orthodontic treatment and there was statistically significant co-relation between:-

- Aesthetic Component and Dental Health Component of Index of Orthodontic Treatment Need.
- Dental Health Component of Index of Orthodontic Treatment Need and Dental Aesthetic Index.
- Dental Aesthetic Index and Question number 3 which is question on difficulty of speech.
• Aesthetic Component of Index of Orthodontic Treatment Need and Dental Aesthetic Component.

• Aesthetic Component of Index of Orthodontic Treatment Need and Question 3, which is the question on difficulty of speech.

• Question 2, which is on biting and chewing and question 3, which is on speech.

Both the Index of Orthodontic Treatment Need and Dental Aesthetic Index reliably record deviant occlusal traits. There are statistically significant co-relations between both components of the Index of Orthodontic Treatment Need and Dental Aesthetic Index. The association between patient’s perception of appearance and speech appears to be weak. In addition of co-relation of the Aesthetic component and dental aesthetic index and speech suggest that this association is more than co-incidental and warrants for the further investigation. There was an association between Aesthetic Component Index and the Dental Aesthetic Index. The Aesthetic Component also showed the association with subjective question relating to the appearance and speech. But, surprisingly not biting and chewing.

Further studies will be required with larger samples in different population groups in the general population to confirm the usefulness of the professional Indexes and the professional objective assessment is more reliable than patient’s subjective questionnaire. Hence further modifications of the patient’s questionnaire have to be done to make
the patients perceptions more focused and specific.

**References**


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## DENTOFACIAL ANOMALIES

### DENTITION

| (166) | (167) | Missing incisor, canine and premolar teeth – maxillary and mandibular – enter number of teeth |

### SPACE

<table>
<thead>
<tr>
<th>(168) CROWDING IN THE INCISAL SEGMENTS</th>
<th>(169) SPACING IN THE INCISAL SEGMENTS</th>
<th>(170) DIASTEMA IN MM</th>
<th>(171) LARGEST ANTERIOR MAXILLARY IRREGULARITY IN MM</th>
<th>(172) LARGEST ANTERIOR MANDIBULAR IN MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = NO CROWDING</td>
<td>0 = NO SPACING</td>
<td>1 = ONE SEGMENT CROWDED</td>
<td>1 = ONE SEGMENT SPACING</td>
<td>2 = TWO SEGMENTS CROWDED</td>
</tr>
</tbody>
</table>

### OCCLUSION

<table>
<thead>
<tr>
<th>(173) ANTERIOR MAXILLARY OVERJET IN MM</th>
<th>(174) ANTERIOR MANDIBULAR OVERJET IN MM</th>
<th>(175) VERTICAL ANTERIOR OPEN BITE IN MM</th>
<th>(176) ANTERO-POSTERIOR MOLAR RELATION 0 = NORMAL 1 = HALF CUSP 2 = FULL CUSP</th>
</tr>
</thead>
</table>

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**ANNEXURE I**
### Index of Orthodontic treatment need; dental health component (DHC)

| GRADE 1 (none) | 1. Extremely minor malocclusion including displacements less than 1mm |
| GRADE 2 (little) | 1. Increased overjet greater than 3.5 mm but less than or equal to 6mm with competent lips.  
2. Reverse overjet greater than 0mm but less than or equal to 1mm.  
3. Anterior or posterior cross bite with less than or equal to 1mm discrepancy between retruded contact position and intercuspal position.  
4. Displacement of teeth greater than 1mm but less than or equal to 2mm  
5. Anterior or posterior open bite greater than 1mm but less than or equal to 2mm.  
6. Increased overbite greater than or equal to 3.5 mm without gingival contact.  
7. Premolar or postnormal occlusion with no other anomalies. Included up to half a unit discrepancy |
| GRADE 3 (moderate) | 1. Increased overjet greater than 3.5 mm but less than or equal to 6mm with incompetent lips.  
2. Reverse overjet greater than 0mm but less than or equal to 3.5 mm  
3. Anterior or posterior cross bite with greater than 1mm but less than or equal to 2mm of discrepancy between retruded contact position and intercuspal position.  
4. Displacement of teeth greater than 1mm but less than or equal to 4mm.  
5. Lateral and anterior open bite greater than 2mm but less than or equal to 4mm  
6. Increased or complete overbite without gingival or palatal trauma. |
| GRADE 4 (GREAT) | 1. Increased overjet greater than 6mm but less than or equal to 9mm  
2. Reverse overjet greater than 3.5mm with no masticatory or speech difficulties  
3. Anterior or posterior cross bite with greater than 2mm discrepancy between retruded contact position and intercuspal position.  
4. Severe displacement of teeth greater than 4mm  
5. Extreme lateral or anterior open bite greater than 4mm  
6. Increased and complete overbite with gingival or palatal trauma  
7. Less extensive hypodontia requiring pre-restorative Orthodontics or Orthodontic space closure to obviate the need for a prosthesis  
8. Posterior lingual cross bite with no functional occlusal contact in one or both buccal segments  
9. Reverse overjet greater than 1mm but less than 3.5mm with recorded masticatory and speech difficulties  
10. Partially erupted teeth, tipped and impacted against adjacent teeth.  
11. Supplemental teeth |
| GRADE 5 (very great) | 1. Increased overjet greater than 9mm  
2. Extensive hypodontia with restorative implications (more than 1 tooth missing in any quadrant requiring pre-restorative orthodontics)  
3. Impeded eruption of teeth with the exception of third molars due to crowding, displacements, the presence of supernumerary teeth, retained deciduous teeth, and any pathologic cause.  
4. Defects of cleft lip and palate  
5. Submerged deciduous teeth |
ANNEXURE 3

Subjective Assessment Questionnaire

1. How satisfied are you with the appearance of your teeth?
   
<table>
<thead>
<tr>
<th>Not satisfied</th>
<th>Satisfied</th>
<th>very satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

2. Do you have any difficulty biting and chewing food?
   
<table>
<thead>
<tr>
<th>Great difficulty</th>
<th>Some difficulty</th>
<th>No problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

   Do you have any difficulty in speaking?
   
<table>
<thead>
<tr>
<th>Great difficulty</th>
<th>Some difficulty</th>
<th>No problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

   Do you think you need orthodontic treatment?  Yes/No
Fig. 1: Stimulus photographs of IOTN (Esthetic Component)
The Correlation of Occlusal Indices with Patients' Perceptions of Aesthetics, Function, Speech, and Orthodontic Treatment Need

DENTAL HEALTH COMPONENT

AESTHETIC COMPONENTS

HOW SATISFIED ARE YOU NOW WITH THE APPEARANCE OF YOUR TEETH?
DO YOU HAVE ANY DIFFICULTY IN BITING AND CHEWING FOOD?

DO YOU HAVE ANY DIFFICULTY IN SPEAKING?

DO YOU THINK YOU NEED ORTHODONTIC TREATMENT?