

# Relationship between Index of Complexity, Outcome and Need and Dental Aesthetic Index and Perception of Malocclusion in School Children of Bangalore City

## Abstract

**INTRODUCTION:** Malocclusion compromises the health of oral tissues and also can lead to psychological and social problems. Till date, there are not many studies available on the comparisons of the most commonly used tools for measuring malocclusion in epidemiological studies. Hence, the present study has been undertaken to assess the relationship between the Index of Complexity, Outcome and Need and Dental Aesthetic Index and perception of malocclusion in school children of Bangalore city. **MATERIALS AND METHODS:** The present study was a cross sectional comparative study conducted among 705 high school children of Bangalore city in the age group of 13-15 years. Perceived oral aesthetic impact of malocclusion and need for orthodontic treatment was assessed using Orthodontic Aesthetic Subjective Impact Scale (OASIS). Malocclusion was measured using the Index of Complexity, Outcome and Need (ICON) and Dental Aesthetic Index (DAI). The results were statistically analyzed using Chi square test, Pearson correlation coefficient and Spearman's rank correlation coefficient test. **RESULTS:** The cross tabulation between ICON and DAI treatment needs was highly significant ( $p < 0.001$ ). Hence the treatment needs of the children categorized as having severe and handicapping malocclusion, requiring highly desirable and mandatory treatment according to DAI were correctly categorized as needing treatment by ICON as well. Spearman correlation between DAI and ICON was 0.936, between DAI and OASIS was 0.938 and between ICON and OASIS was 0.973. These results were very highly significant ( $p < 0.001$ ).

## Key Words

ICON; DAI; OASIS; malocclusion

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## INTRODUCTION

Well aligned teeth not only contribute to the health of the oral cavity and stomatognathic system, but also influence the personality of the individual. Malocclusion compromises the health of oral tissues and also can lead to psychological and social problems. A systematic and well-organized dental care program for any target population suffering from malocclusion in a community requires some

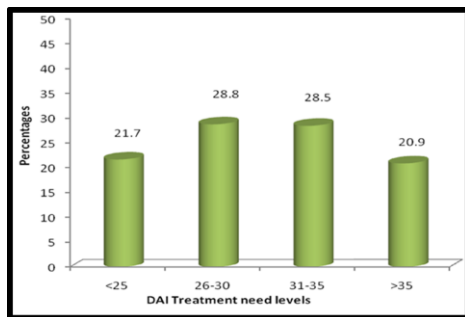
basic information. In more developed parts of the world, where the specialties of Orthodontics and Pedodontics have been established, adequate basic information is available on the prevalence of this condition. In developing nations, such information still lack. With increasing interest in the early detection and treatment of malocclusion and a corresponding emphasis on preventive procedures, it would be beneficial to collect more information

**Table 1: Distribution of school children according to association between DAI and ICON treatment need level**

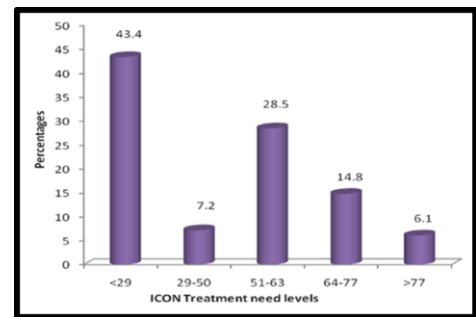
ICON Treatment need levels	DAI Treatment need levels				Number of children	P value
	<25 (n=153)	26-30 (n=204)	31-35 (n=201)	>35 (n=147)		
<29	153(50%)	153(50%)	0(0%)	0(0%)	306(100%)	$\chi^2=1498.00$ P<0.001**
29-50	0(0%)	51(100%)	0(0%)	0(0%)	51(100%)	
51-63	0(0%)	0(0%)	201(100%)	0(0%)	201(100%)	
64-77	0(0%)	0(0%)	0(0%)	104(100%)	104(100%)	
>77	0(0%)	0(0%)	0(0%)	43(100%)	43(100%)	
Total	153(21.7%)	204(28.8%)	201(28.5%)	147(20.9%)	705(100%)	

**Table 2 : Spearman correlation between DAI, ICON and OASIS in Children studied**

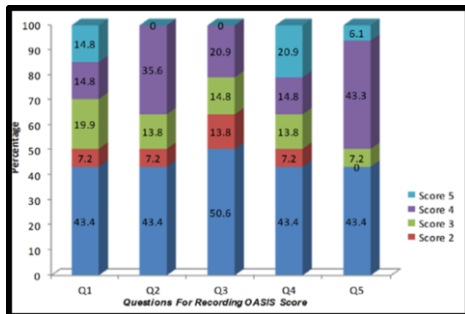
Pair	Spearman correlation	P value
DAI vs ICON	0.936	<0.001**
DAI vs OASIS	0.938	<0.001**
ICON vs OASIS	0.973	<0.001**



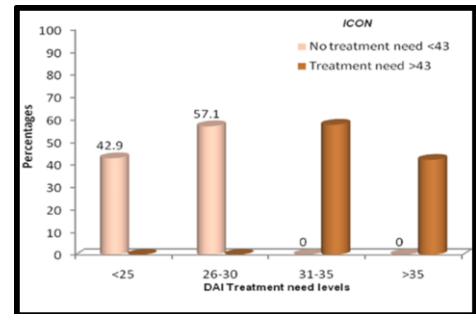
Graph 1: Distribution of school children according to DAI score



Graph 2: Distribution of school children according to ICON treatment need level score



Graph 3: Distribution of school children according to OASIS



Graph 4: Correlation of DAI Index with ICON Index (at 2 points)

on patients at younger age levels.<sup>[1]</sup> In such cases occlusal indices are useful. The Dental Aesthetic Index (DAI) was developed originally based on North American Caucasian sample. However, subsequently the DAI was adopted as a cross-cultural index by the World Health Organization for assessment of orthodontic treatment need, and its excellent reliability and validity has also been documented. DAI has proven to be reliable and valid as well as a simple and easily applied index.<sup>[2]</sup>  
<sup>3]</sup> Later, in response to the need for an international composite index for assessment of different facets of orthodontic provision, the Index of Complexity, Outcome and Need (ICON) was developed based on

the expert opinion of 97 practising orthodontists from 9 countries - Germany, Greece, Hungary, Italy, Netherlands, Norway, Spain, UK and the United States of America. Importantly, the ICON has helped to solve the problem of modifying indices for assessment of orthodontic treatment outcome as well as being a universal index for clinical application and international comparison of data. This makes it an index of great potential for both developing and developed economies of the world. In addition to being relatively easy to use and its cost effectiveness, recent reports have shown that the ICON could replace other orthodontic indices in assessing different facets of orthodontic

care.<sup>[4,5]</sup> Teenage children generally develops their oral perceptual awareness, hence, there is a strong need to assess the discrepancy between an individual's own views of the acceptability of his or her dental appearance and the views of dental assessor's. So the aesthetic perception and treatment need of children could be assessed using Orthodontic Aesthetic Subjective Impact Scale (OASIS), and the observations could be compared with the treatment need registered by a dentist.<sup>6,7</sup>

On the basis of these concepts, dental public health administrators and dental epidemiologists need an epidemiological tool to rank dental aesthetics and orthodontic treatment needs on a scale of social norms for a socially acceptable dental appearance.<sup>[8,9]</sup> Till date, there are not many studies available on these tools. Hence, the present study has been undertaken to assess the relationship between the Index of Complexity, Outcome and Need and Dental Aesthetic Index and perception of malocclusion in school children of Bangalore city.

#### **MATERIALS AND METHODS**

The present study was a cross sectional comparative study conducted among 705 high school children of Bangalore city in the age group of 13-15 years. A list of all the schools in Bangalore was obtained from the DDPI (Deputy Director of Public Instructions) office prior to the commencement of the study. A multistage random sampling technique was employed in this study. In the first stage the Bangalore city was divided into two zones, north and south. In the second stage, using simple random sampling, 3 schools each were selected from the south and north zones. A total of 6 schools were included for the study. In the third stage using cluster random sampling, all the children studying in these schools who met the inclusion criteria comprised the study population.

#### **INCLUSION CRITERIA**

Children in the age group of 13-15 years, who were ready to give consent for the examination.

#### **EXCLUSION CRITERIA**

- Children with orthodontic appliance.
- Children reporting a history of orthodontic treatment.
- Children with mixed dentition.

#### **SAMPLING TOOLS**

The proforma used for the study contained questions regarding the demographic details (age, gender, date of birth etc.) required for the study. Perceived oral aesthetic impact of malocclusion and need for orthodontic treatment was assessed using

Orthodontic Aesthetic Subjective Impact Scale (OASIS). Malocclusion was measured using the Index of Complexity, Outcome and Need (ICON) and Dental Aesthetic Index (DAI). Ethical clearance to conduct the study was obtained from Institutional Review Board, The Oxford Dental College and Research Centre, Bangalore. Prior to start of the study, permission to examine the subjects was obtained from the concerned school authorities. All the parents were informed about the study and a written informed consent was obtained from all the parents of the children participating in the study. To ensure the standardization of instruments, the CPI probes, dividers and rulers were calibrated from the Department of Physics, The Oxford Engineering College, Bangalore.

#### **STATISTICAL ANALYSIS**

The data analysis and graphic preparations was performed using the SPSS and Microsoft Excel 2007 software. The results were statistically analyzed using Chi square test, Pearson correlation coefficient and Spearmans rank correlation coefficient test.

#### **RESULTS**

Among the 705 school children studied, 314 (44.5%) were 13 years of age, 166 (23.5%) were of 14 years of age and 225(31.9) were 15 years old. Male children were 359 (50.9%) and female children were 346 (49.1%) in this study. Children in the age group of 13 years consisted of 191 (53.2%) males and 123 (35.5%) females. In 14 years age group 101 (28.1%) were males and 65 (18.8%) were females students and 15 years of age group had 67 (18.7%) males and 158 (45.7%) female students.

The result of the DAI score and the ICON score for the school children is shown in Graph 1 and 2 respectively. With reference to the Oral Aesthetic Subjective Impact Scale (OASIS), the results obtained are shown in Graph 3. Of the 705 school children examined, 306 (100%) children belonged to the score range of (<29 - Easy) according to ICON and in relation to DAI score. 153 (50%) children belonged equally to the score range of (≤25- No treatment required ) and (26-30- treatment elective) . 51 (100%) children belonged to the score range of (29-50- Mild) in ICON and 51 (100%) belonged to the score range of (26-30- treatment elective) in DAI. 201 (100%) children belonged to the score range of (51-63- Moderate) in ICON and 201 (100%) children belonged to the score range of (31-35-Treatment highly desirable) in DAI. 104 (100%) children belonged equally to both the score

range of (64-77-Difficult) in ICON and ( $\geq 35$ -Treatment mandatory) in DAI. 43 (100%) children belonged to the score range of ( $>77$ -Very difficult) in ICON and ( $\geq 35$ -Treatment mandatory) in DAI score equally. Both the indices revealed a high degree of similarity in accurately indicating the treatment need and complexity grade in children, and these results were statistically very highly significant ( $p < 0.001$ ) (Table 1). The treatment need levels were correlated between ICON and DAI. Among the 705 children, 153(42.9%) children fell in the No treatment need ( $<43$ ) of ICON and  $<25$  score range (Normal or Minor malocclusion) of DAI. 204(57.1%) children fell under the No treatment need ( $<43$ ) of ICON and 26-30 score range of DAI (Definite malocclusion). 201(57.8%) children fell in the Treatment need ( $>43$ ) of ICON and in the score range of 31-35 in DAI (Severe malocclusion). 147(42.2%) fell in the Treatment need ( $>43$ ) of ICON and  $>35$  score of DAI (Handicapping malocclusion). Here the cross tabulation between ICON and DAI treatment needs is highly significant ( $p < 0.001$ ). Hence the treatment needs of the children categorized as having severe and handicapping malocclusion, requiring highly desirable and mandatory treatment according to DAI were correctly categorized as needing treatment by ICON as well (Graph 4). Spearman correlation between DAI and ICON was 0.936, between DAI and OASIS was 0.938 and between ICON and OASIS was 0.973. These results were very highly significant ( $p < 0.001$ ) (Table 2).

## DISCUSSION

The prevalence of malocclusion varies from country to country and among different races. Fundamentally, the difficulties seen are due to the fact that malocclusion is not a disease but a morphological variation which may or may not be associated with pathological conditions. As malocclusion is a morphological variation, its diagnosis is heavily dependent on a manmade, more or less arbitrary classification system. This may explain why it has been so difficult to obtain the desired international standardization of the registration of malocclusion. The World Health Organization (1987), had included malocclusion under the heading of Handicapping Dento Facial Anomaly, defined as an anomaly which causes disfigurement or which impedes function, and requiring treatment "if the disfigurement or functional defect was likely to be an obstacle to the patient's physical or emotional well-being".

## Relationship between the Index of Complexity, outcome and need (ICON) and Dental Aesthetic Index (DAI)

Both the indices revealed a high degree of similarity in accurately measuring the malocclusion present in the children, and these results were statistically very highly significant ( $p < 0.001$ ). The highly significant relationship between orthodontic treatment needs as assessed by ICON as well by DAI in the present study is in agreement with the similar Nigerian clinic-based study by Onyeaso and a North American report on malocclusion<sup>11</sup>. It is also comparable to the finding of Fox et al in UK involving ICON and IOTN (Index of Orthodontic Treatment Need). The present finding of highly significant relationship between orthodontic treatment complexity according to ICON and severity of malocclusion according to DAI is consistent with another Nigerian study conducted by Chukwudi Ochi.<sup>[10]</sup> However, the present study was a cross sectional study and due to time constraints follow up of the orthodontic cases and assessment of the end treatment acceptability was not possible. In the present study, the high correlations of 0.936 found between ICON scores and the DAI scores using Spearman correlation is an indication that the power of prediction of the scores by either index for the other in these school children was not a matter of chance. The present value is indicative of a strong and a very reliable prediction. This finding is very similar to the study conducted by Chukwudi Ochi Onyeaso.<sup>[10]</sup>

## Evaluation of the agreement between the ICON and DAI to OASIS in the assessment of orthodontic treatment needs

The Spearman correlation between DAI and OASIS was 0.938 and between ICON and OASIS was 0.973. Again, this is an indication that the power of prediction of malocclusion by the perception of the school children and the indices was not a matter of chance. The present value is indicative of a strong and a very reliable prediction. The results of the present study are in agreement with the study conducted by K A Kolawole *et al.*, on 100 orthodontic patients. It also agrees with the findings of the study conducted by Shaw et al and Holmes et al. However, the present study disagrees with a study conducted by C Flores *et al.*,<sup>[14]</sup> in their study visual analogue scale (VAS) was considered as a better indication of the perception of malocclusion. Analysis of the professional scores in relation to subjective assessments revealed that the ICON and

DAI had a significant correlation with patients' perceptions of aesthetics, function, speech and treatment need. As the ICON is a new index, no studies till date have been undertaken to investigate the correlation of patients' subjective perceptions of malocclusion with professional opinions. However, a study conducted by Shue-Te Yeh *et al.*, comparing the relationship of two professional indices with patients' perceptions of aesthetics, function, speech and treatment need has shown that the AC (Aesthetic component) of IOTN (Index of Orthodontic Treatment and Need), also used as component 1 of ICON (Index of Complexity, Outcome and Need), to have a statistically significant correlation with the patients' subjective opinions. Furthermore, studies in Finland, Norway and the UK have demonstrated that the AC of IOTN (Index of Orthodontic Treatment and Need), also used as component 1 of the ICON, is a strong indicator for patient satisfaction. However, the present study disagrees with a study conducted by A R Koochek *et al.*,<sup>[18]</sup> which indicated that the ICON is not necessarily a suitable predictor for aesthetics, function, speech and treatment need for those individuals of the normal population attending routine dental care. To the best of our knowledge, till date, this is the first study carried out to assess the relationship between ICON and DAI and to correlate both the indices with patient's perception using OASIS. However, there are a few limitations for the present study, this study was exclusively carried out on school children in a school setting, hence there was no provision to make impressions and study casts for the further assessments or comparison of the indices. There are only a very few studies that has been carried on the relationship between ICON and DAI, hence extensive comparison of the findings of the present study with other similar studies was not possible. The present epidemiological study has not only supported earlier similar but clinic-based studies but has also provided the reports on such facets of pretreatment orthodontic assessment involving two important international orthodontic indices and its correlation with patients perception of the condition.

#### CONCLUSION

In terms of provision of orthodontic care, the importance of a scale like OASIS cannot be underestimated as it is ultimately the patients who are receiving treatment, and need to gain satisfaction from improved aesthetics and function, also, it's the responsibility of the clinicians to assess the

treatment need accurately and set standards for the need and acceptability of the outcome of orthodontic treatment. In this study, the ICON (Index of Complexity Outcome and Need) was found to correlate more with patients' opinions of aesthetics, function, speech and treatment need. The ICON promises to be a cost-effective and valid index for the assessment of pretreatment needs of orthodontic patients. It can be concluded that the ICON alone is a suitable predictor for appearance, function, speech or treatment need for those individuals attending general dental practice for routine dental care or as a predictor of malocclusion in surveys. In combination with a simple scale like OASIS (Oral Aesthetic Subjective Impact Scale) to assess the patients' desire for treatment, the shared decision for any particular individual to enter the treatment process can be determined. The use of this international composite index, Index of Complexity, Outcome and Need (ICON) provides a single assessment method to record treatment complexity, outcome and need. Hence, dental public health administrators and dental epidemiologists can use this Index as an epidemiological tool to rank dental aesthetics and orthodontic treatment needs on a scale of social norms for a socially acceptable dental appearance. More studies involving larger sample size using ICON is encouraged, especially from other parts of the country, at least for the purpose of comparison of data.

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