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Orthodontic Treatment Complexity and Need in a Group of Nigerian Patients: The Relationship between the Dental Aesthetic Index (DAI) and the Index of Complexity

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Abstract

Aim: The aim of this retrospective analytical study was to assess the relationship between the Dental Aesthetic Index (DAI) and the Index of Complexity, Outcome, and Need (ICON) on the orthodontic treatment need and complexity in a group of Nigerian patients.

Methods and Materials: Fifty-six cases were randomly selected from the model storage of the orthodontic unit of the University College Hospital in Ibadan, Nigeria. The ICON was used to assess the pre-treatment study models for orthodontic treatment need and complexity of the cases while the DAI was also used to assess the same cases for treatment need. Descriptive statistics as well as the non-parametric (Spearman Rank-Order and Pearson's Product Moment) correlations were used to analyze the data.

Results: The mean ICON and DAI scores were 67.38±19.63 (SD) and 42.27±12 .66 (SD), respectively. Both the ICON and DAI agreed that one (1.8%) case did not need treatment while 46 (82.1%) needed treatment. All the difficult and very difficult cases according to the ICON were assessed as needing treatment by the DAI with 18 (13.1%) out of 22 (39.3%) in the very difficult category belonging to the handicapping group where treatment was mandatory. In all positive significant correlations were recorded for the ICON and DAI scores.

Conclusion: The ICON and DAI showed favorable agreement when used to assess treatment needs through the use of study casts. The ICON could be a good substitute for the DAI in assessing pre-treatment needs of Nigerian patients.

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Keywords: Orthodontics, treatment need and complexity, ICON, DAI, Nigeria

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Introduction

An orthodontic index is a numerical scale that is derived by scoring specific features of a malocclusion to objectively assess some parameters such as how far a malocclusion varies from an ideal occlusion.[1] Occlusal indices are useful for research, audit, practice management, and quality assurance in orthodontics.[2] Over the years different occlusal indices have been employed to assess different facets of orthodontic service.[3-12] However, not many of these indices have enjoyed international acceptance.



The Dental Aesthetic Index (DAI) was accepted by the World Health Organization (WHO) as an international cross-cultural index in the assessment of orthodontic treatment need.[13] The DAI has the ability to grade malocclusions of study models (dental records) or patients into four severity groups.[8,13-17] Despite the favorable qualities of the DAI (such as high intra-examiner reliability, usefulness in allocating limited resources to handicapping malocclusions, and international applicability), the index is limited by its inability to include some parameters such as missing molars, impacted teeth, posterior crossbites, and midline discrepancies in the computations of its case scores, thereby, limiting any comprehensive esthetic assessment.[17-18]

The Index of Complexity, Outcome, and Need (ICON) is a more recent index developed with the intent of providing a single index for assessing treatment inputs and outcomes (orthodontic quality control). The index was developed from the subjective judgments of an international panel of 97 orthodontists on the need for treatment, treatment complexity, treatment improvement, and acceptability on a diverse sample of pre-treatment and post-treatment study models. The validity and reliability of this index have been reported.[19-20] This index holds promise for use in the assessment of orthodontic cases in general dental practice as it is easy to use as well as making assessments of different facets of orthodontic service possible instead of employing separate indices in the assessment of the same patient(s). Therefore, the ICON promises to be more cost-effective while maintaining international standards in orthodontic services as well as encouraging international comparisons of data.

Nigeria is the most populous black nation in the World today having over 120 million people with the majority being young adults, adolescents, and children. The country was a former British colony and received its independence in 1960. The teaching and practice of orthodontics is relatively young in Nigeria with the awareness of such dental care also growing.

In the face of the increasing importance of clinical effectiveness and auditing, the use of the ICON would be very relevant for orthodontic centers of both the developing and developed countries of the world. Therefore, the aim of this study was to assess the relationship of the DAI and the ICON in the assessment of orthodontic treatment complexity and need. It is hoped this could assist in making informed decisions on the use of the ICON alone in the assessment of these facets of treatment.

Methods and Materials

This study was carried out in the Orthodontic Unit of the University College Hospital, Ibadan, Nigeria. A retrospective sample of 56 pre-

treatment study models was selected from the collection of study models stored in the clinic. There was no gender or age bias in the selection of the sample.

The pre-treatment study models were scored using the ICON and the DAI by the author. No patient identifier was available to the investigator during the use of the study models. The models were assigned serial numbers, and the assessed variables were entered on a prepared data sheet for the DAI and ICON indices. The examiner strictly followed the guidelines for the application of the ICON[2,21-22] and the DAI.[8,13]

Intra-examiner Reliability

Excellent intra-examiner reliabilities of the investigator on the uses of the DAI and ICON indices have been previously reported.[17,23-24]

Statistical Analysis

Descriptive statistics such as means and standard derivations were employed in the data analysis. Cross-tabulation analysis was used to determine the ability of the ICON and DAI to detect the same treatment needs as well as to determine the agreement between severity of malocclusion according to the DAI and complexity of the cases using the ICON. Non-parametric correlations (Spearman Rank Order and Pearson's Product Moment Correlation coefficients) were used to test the relationship between the two indices.

Results

The mean ICON and DAI scores for the samples were 67.38±19.63 (SD) and 42.27±12.66 (SD), respectively, as shown in Table 1.

Table 2 displays the treatment needs according to the ICON and DAI with the DAI scores dichotomized into those needing treatment (as from DAI scores of 26 and greater) and those not needing treatment (DAI scores of 25 and less). The table shows the two indices agreed only one case did not need treatment. The DAI considered 9 (16.1%) cases as needing treatment while the ICON considered the 9 (16.1%) cases as not needing treatment. However, there was complete agreement concerning 46 (82.1%) cases as requiring treatment.

The ICON score complexity grades versus the severity levels of the DAI score groups are shown in Table 3. The only case the ICON considered as easy to treat was considered by the DAI as belonging to the second severity group of the DAI scoring system (DAI scores in the range of 26-30). Eighteen (66.1%) out of the 22 (39.3%) cases belonging to the very difficult ICON complexity grade belonged to the very severe (handicapping) malocclusions with treatment considered mandatory by the DAI scoring system.

Table 4 shows the correlations between the ICON and DAI scores using the Spearman Rank Order and Pearson's Product Moment Correlation

Table 1. Mean ICON and DAI scores, standard deviation, and standard error means.

Index	N	Mean	Standard Deviation	Standard Error
ICON	56	67.38	19.631	2.623
DAI	56	42.27	12.660	1.692

Table 2. Treatment needs according to the ICON versus treatment needs according to DAI scores dichotomized.

	DAI Scores		
ICON Scores for Treatment Need	No treatment need or slight need (≤ 25)	Treatment need present (≥ 26)	Total
No need (< 43)	1(1.8%)	9(16.1%)	10(17.9%)
Treatment Need (>43)		46(82.1%)	46(82.1%)
Total	1(1.8)	55 (98.2)	56 (100)

Table 3. The ICON complexity grades versus the severity levels of malocclusion according to the DAI.

ICON Complexity Grades	DAI Severity Groups				
	Normal or minor Malocclusion No treatment need or slight need (≤ 25) n (%)	Definite Malocclusion Treatment need (26-30). n (%)	Severe Malocclusion Treatment highly desirable (31-35). n (%)	Very Severe (Handicapping Malocclusion) Mandatory treatment. (≥ 36) n (%)	Total n (%)
Easy <29	-	1(1.8)	-	-	1(1.8)
Mild 29-50	1(1.8)	3(5.4)	2(3.6)	7(12.5)	13(23.2)
Moderate 51-63	-	2(3.6)	2(3.6)	4(7.1)	8(14.3)
Difficult 64-77	-	2(3.6)	2(3.6)	8(14.3)	12(21.4)
Very Difficult >77	-	2(3.6)	2(3.6)	18(32.1)	22(39.3)
Total	**1(1.8)**	**10(17.9)**	**8(14.3)**	**37(66.1)**	**56(100)**

Table 4. Correlations between the ICON and DAI scores (symmetric measures).

	Value	Asymptomatic Standard Error	Approximate T Value	Approximate Significant Value
Interval by Interval (Pearson's Product Correlation Coefficient)	289	140	2.220	.031
Ordinal by Ordinal (Spearman Rank Order Correlation)	289	140	2.220	.031
Number of valid cases	56	-	-	-

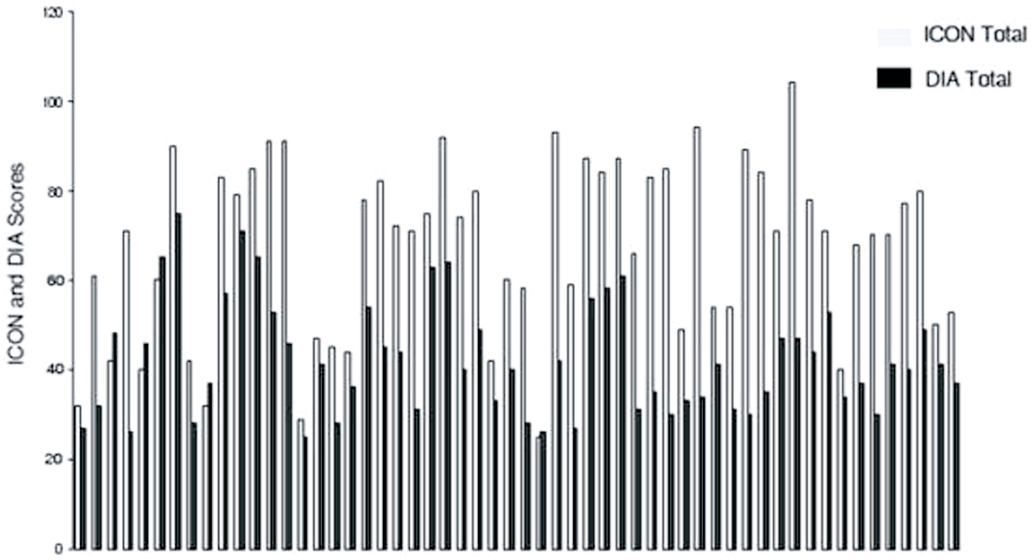


Figure 1. Graphic presentation of pre-treatment ICON and DAI scores of the 56 orthodontic cases.

coefficients. The correlations were found to be significant (p = 0.031). Figure 1 shows the graphic distribution of the ICON and DAI scores for the whole sample.

Discussion

The pre-treatment ICON score recorded in this Nigerian study is comparable to that (67.8±20.6 SD) reported in a recent North American study.[24] The mean DAI score reported in this present study (42.77±12.66 SD) is greater than reported in the same US study (36.3±13.4 SD). The North American study[24] recorded a significant correlation between the pre-treatment ICON scores and the pre-treatment DAI scores (.5523, $p < .001$). This Nigerian study has recorded a significant correlation between the pre-treatment ICON scores and the DAI scores (.289, $p < .05$).



In a study carried out in the UK Fox et al.[22] reported positive correlations between the ICON and DAI scores; they concluded the ICON could be a substitute for IOTN (AC) and IOTN (DHC). In a similar recent North American study[24] it was concluded the ICON could replace the DAI in the assessment of pre-treatment orthodontic need in the US. Considering the very close agreement between the ICON and DAI scores in these pre-treatment study casts of Nigerian patients, the ICON could equally be a good substitute for the DAI in assessing pre-treatment orthodontic needs among Nigerian patients. Also, the strength of association between subjective and professional assessments by both age and gender reported by Koochek et al.[25] in the UK were positively significant.

The present Nigerian sample is relatively small but is comparable to the 55 retrospective sample used in the analysis of the UK study.[22] The present sample size is also similar to the UK sample[22] in the sense that both gave fairly broad range of treatment starts.

Conclusions

Considering some of the previously stated advantages of the ICON and the significant positive agreement between the ICON and DAI scores in this present study, the following can be concluded:

1. The ICON would be a good substitute for the DAI in the assessment of orthodontic pre-treatment needs of patients.
2. Although severity and complexity of treatment do not have exactly the same clinical meaning, this study has shown a positive significant relationship between the two when the ICON and DAI are used.
3. Based on the samples from this study, the DAI was a reliable instrument for the assessment of pre-treatment needs of patients even though it was not developed with input from many countries of the world as was the ICON.

The use of the ICON should be encouraged in the assessment of treatment standards because of its ability to assess different aspects of orthodontic care as well as its applicability in general dental practice and the relatively short time it takes to apply it.

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