Original Article

Angle's Classification versus Dental Esthetic Index in Evaluation of Malocclusion among 12–15-Year-Old School Children in Thiruchengode, Tamil Nadu

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ABSTRACT

Objective: To evaluate Angle's classification and Dental Aesthetic Index (DAI) among 12-15 year old school children and find the association between them. **Methods:** Sample consists of 400, 12-15 year old school children. Malocclusion prevalence, the severity of malocclusion and treatment requisite were evaluated to find the association between Angle's and DAI. Pearson Chi-square test was used for the comparison of categorical data. (P<0.05 was considered significant). **Results:** The percentage of children with DAI< 25 indicating little or no need for treatment was 65.5% and 12.8% had highly desirable or mandatory need fot treatment ie DAI>31. Among children with DAI< 25, a significantly high percentage of patients were in Class I (83.2%) whereas among children with DAI>31, higher percentage was noted in Class II/div 1 (29.2%) and Class III (28.6) than in Class 1(5.7) (*P*<0.001). Only 28.6% of children with Class III malocclusion were associated with appropriate DAI scores (>31) of severity and treatment need category. **Conclusion:** Only 12.75% of children had DAI score of > 31 suggesting highly desirable or mandatory orthodontic treatment requisite. DAI was not sensitive in terms of severity and treatment requisite criteria. Complimentary use of two methods seems to be feasible in all inclusive evaluation and care.

KEYWORDS: *Angle's classification, dental esthetic index, malocclusion*

INTRODUCTION

Malocclusion, defined as irregularity of the teeth, ranked third among worldwide dental public health priorities.[1,2] Gathering epidemiological data on the prevalence and distribution of malocclusions becomes a field of special interest for screening and resource planning for orthodontic treatments within a public health system. Angle's classification is the most widely used instrument for evaluation of malocclusion.

The dental esthetic index (DAI) is a universally accepted cross-cultural index for assessing malocclusion.[3,4] The present study is designed to find the correlation between them in assessment of malocclusion among 12– 15-year-old school children in Thiruchengode.

Objective

1. To evaluate Angle's classification and DAI among 12– 15-year-old school children in Thiruchengode

2. To find the correlation between Angle's classification and DAI among 12– 15-year-old school children in Thiruchengode.

METHODOLOGY

A descriptive cross-sectional study of 400, 12– 15-year-old school children from randomly selected schools from Thiruchengode constitutes the sample, of which males and females were selected proportionately. 12– 15-year-old students who require orthodontic treatment and those who are willing to participate in this study were included, and

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informed consent was obtained from the relevant school authority, and verbal consent from the participants was obtained. Oral examination was performed by two trained and calibrated examiners. The children who had or who are undergoing orthodontic treatment including interceptive orthodontics, children with mental and physical impairment, children diagnosed with syndromes were excluded from the study. Angle's classification is based upon the relationship and position of the erupted permanent first molars. The malocclusion is recorded according to Angle's classification which revolves around as

1. Class I (neutral occlusion)
2. Class II (distocclusion)
   a. Division 1 (increased overjet >4 mm)
   b. Division 2 (retroclined upper central incisors with increased overbite)
3. Class III (mesiocclusion).

The DAI evaluates 10 occlusal characteristics:

1. Missing anterior teeth
2. Incisal segment crowding
3. Incisal segment spacing
4. Midline diastema
5. Maxillary anterior irregularity
6. Mandibular anterior irregularity
7. Maxillary overjet
8. Mandibular overjet
9. Vertical anterior open bite and
10. Anteroposterior molar relationship.

The DAI are scored based on severity:

a. A score lower than or equal to 25, (normal or mild occlusion with little or no need for treatment)
b. A score between 26 and 30, (defined malocclusion with the elective need for treatment)
c. A score between 31 and 35 (severe malocclusion with highly desirable need for treatment) and
d. A score >36 (very severe or disabling malocclusion with mandatory treatment).

The instruments used were the community periodontal Index probe, plain mouth mirror, and light source.

Sufficient numbers of autoclaved instruments were used in the examination site, and proper autoclaving was done.

RESULTS

The percentage of patients with DAI <25 indicating that little or no need for treatment was 65.5%, whereas only 12.8% of patients had a DAI >31 indicating that highly desirable or mandatory need for treatment. Among patients with DAI <25, a significantly higher number of patients were Class 1 (88.5%) (*P* < 0.001) and among patients with DAI >35, higher percentage of patients were Class II/Div 1 (63%) and Class I (21%) than in Class III (0%) groups (*P* < 0.001). Only 28.6% of patients with Class III malocclusion were associated with appropriate DAI score (>31) of severe malocclusion, and mandatory treatment need category.

Malocclusion according to Angle's classification and dental aesthetic index scores

Angle's classification revealed Class I, Class II/1, Class II/2, and Class III malocclusion in 69.8%, 24%, 2.8%, and 3.5% of patients, respectively. According to DAI scores, 65.5% of patients (DAI ≤25), 21.8% (DAI 26–30), and 12.8% (DAI ≥31) [Table 1].

Distribution of dental esthetic Index components

Crowding (52.5%), mandibular irregularity (43.7%), and deviation from the normal molar relationship (34.5%) and maxillary irregularity (34%) were the four most commonly observed components of DAI [Table 2].

Association between Angle's classification and dental aesthetic index scores

Among patients with DAI scores of ≤25, significantly, higher percentage of patients were Class I (88.5%) than Class II (10.6%; 9% for Class II/1 and 1.5% for Class II/2) and Class III (0.7%) as Angle's classification (*P* < 0.001). Among patients determined to have DAI score of ≥35; significantly, higher percentage of patients was Class II/1 (63%) and Class I (21%) (*P* < 0.001 for each). Only 28.6% of patients with Class III malocclusion were

Table 1: Evaluation of malocclusion according to Angle's classification and Dental Esthetic Index

Angle's classification	Malocclusion Prevalence, *n* (%)		
Class I	279 (69.8)		
Class II/1	96 (24)		
Class II/2	11 (2.8)		
Class III	14 (3.5)		

DAI	Prevalence, *n* (%)	Severity	Treatment requisite
≤25	262 (65.5)	Normal or mild occlusion	Little or no need
26-30	87 (21.8)	Defined malocclusion	Elective
31-35	32 (8.0)	Severe malocclusion	Highly desirable
≥35	19 (4.8)	Very severe or disabling malocclusion	Mandatory

DAI=Dental Esthetic Index

associated with appropriate DAI scores (≥31) of severity and treatment need category [Table 3].

DISCUSSION

The study findings in cohort of school going children revealed the presence of malocclusion in all examined patients based on Angle's classification as Class I (69.8%), Class II (26.8%), and Class III (3.5%). These results have sustainability in the international literature.[5-7] When compared to published data, on the prevalence of malocclusion determined via Angle's classification in relation to the general population of children in from the other countries, our findings revealed a higher rates for Class I (69.8%) and Class III (3.5%) while a lower rate for Class II (26.8%) malocclusions,[8] but almost the same rates according to a study by Sidlauskas and Lopatiene, done on school going children of the same age group.[9]

Using the DAI, 262 children (65.5%) with no abnormality or with mild malocclusion which require no treatment were found. The defined malocclusion was found in 87 children (21.8%), which was a little lower when compared with other studies.[6,10] Severe malocclusion was observed in 8% of students, and very severe or disabling malocclusion was found in 4.8% of the children which was lower when compared with other studies by Borzabadi-Farahani, Rudan *et al.*, Mtaya *et al.* and Camilleri and Mulligan[1,11-14] Differences between our results and those of other studies are most likely due to differences in the selection of subjects and ethnicity. In addition, the variations in the prevalence of malocclusions from the other studies may be due to different sample sizes or to different ethnic origins, ages, and dentition stages of the patients.[4, 15-17]

Class I malocclusion was the most prevalent malocclusion in our patients which is not in agreement with data from a past study on an occlusal pattern among the general population of Central Anatolian adolescents, which revealed Class II malocclusion as the most prevalent (44.7%) malocclusion.[18]

More than half of children (65.5%) had no treatment need or little need which is by the previous study by Garbin *et al.*[8] Other surveys have highlighted the need to treat around 50%[6] and in the city of Recife (Brazil) also using the DAI, the need to treat was revealed as 77%, at the age of 13–15 years.[19] Data on the DAI-based evaluation of malocclusion in the general population of children revealed consistent data with an indication of almost two-thirds of the general population of children to have no abnormality or mild malocclusion with no need of treatment in studies by Esa *et al.*, and Al-Zubair.[4,16]

Crowding (52.5%), mandibular irregularity (43.7%) and deviation from the normal molar relationship (34.5%) and maxillary irregularity (34%) were the prominent DAI component, whereas open bite (1.5%) was the least prevalent DAI component in our study population. These findings are in line with the available data on the general population of children aged 10–15 years.[8,16,19,21-23] Similarly, in the past study[17] on the patterns of malocclusion in a sample of orthodontic patients aged

Table 2: Distribution of Dental Esthetic Index components

DAI components	Present, *n* (%)	Absent, *n* (%)
Dentition		
Missing		389 (97.3)
One tooth	5	
Two tooth	5	
Three teeth	1	
Crowding		190 (47.5)
Single jaw	103 (25.8)	
Both jaws	107 (26.8)	
Spacing		309 (77.3)
Single jaw	66 (16.5)	
Both jaws	25 (6.3)	
Diastema		349 (87.3)
Maxillary irregularity	140 (35)	260 (65)
Mandibular irregularity	175 (43.7)	225 (56.3)
Maxillary overjet	26	
Mandibular overjet	17	383 (95.8)
Openbite	6	394 (98.5)
Molar relationship		
Deviation from the normal molar relationship		263 (65.8)
Half cusp	97 (24.3)	
Full cusp	40 (10)	

DAI=Dental Esthetic Index

Table 3: Association between Angle's classification and Dental Esthetic Index scores

DAI	Angle's classification				
	Class I (*n*=279)	Class II/1 (*n*=96)	Class II/2 (*n*=11)	Class III (*n*=14)	Total (*n*=400)
≤25	232 (88.5)	24 (9.1)	4 (1.5)	2 (0.7)	262 (65.5)
26-30	31 (35.6)	44 (50.5)	4 (4.5)	8 (9.1)	87 (21.8)
31-35	12 (37)	16 (50)	0	4 (12.5)	32 (8)
≥35	4 (21)	12 (63)	3 (15)	0	19 (4.8)

DAI=Dental Esthetic Index

12–25 years, crowding in the upper and lower dental arches were reported to be the most frequent of all anomalies which are by our data.

Identification of deviation from the normal anteroposterior molar relationship was found to be about 34.2% which comprises less than one-third of the population which is in accordance with the results of Garbin *et al.*, Thilander *et al.*, and Shivakumar *et al.*.[8,22-24] which was mostly affecting the half cusp. Notably, the ancestral background of the various populations as well as premature loss or massive caries of deciduous teeth have been suggested to be associated with identification of greater frequencies of children with the deviated anteroposterior molar relation.[3,4,22]

The need for orthodontic treatment found in our study is 12.8% (DAI ≥31), i.e., less than one-third of population which is in accordance to studies by Garbin *et al.*, Thilander *et al.* and Shivakumar *et al.*.[8,23-24]

Notably, a higher percentage of Class II patients composed within the category of DAI score of ≥31 in the present study seems quite consistent with the published data in the general population[8] and indicates a good correlation between the indexes regarding detection of severe cases.

However, it should be noted that only less than one-fourth of the children (*n* = 14) in the Class III group were associated with orthodontic treatment need category about DAI (DAI score ≥31). A similar disagreement in ranking was also reported in a past study on the comparison of two methods in the diagnosis of malocclusion which revealed that the majority of cases in Angle's Class III malocclusion were not associated with the real severity of the malocclusion in DAI scores.[8]

Accordingly, by our finding that substantial portion of Angle's Class III malocclusion cases were not associated with DAI index of >35 indicating a very severe or disabling malocclusion. DAI may not be sensitive to specific occlusion problems, i.e. like Angle's Class III which definitely needs treatment and therefore may lead to neglect or delay of treatment in such cases. DAI scores neglect the tet-a-tet incisor relationship in Class III patients, and hence, the majority of cases found in Angle's Class III malocclusion do not fit in the DAI distribution in the very severe or the disabling malocclusion group.[7-8,11]

In fact, DAI has also been reported to unable to identify malocclusion cases in its early stages due to the inadequacy of the method for the deciduous and mixed dentition which hampers the prevention and early treatment. In addition, DAI fails to record certain traits that could strongly influence the treatment need such as dental midline discrepancy, impacted teeth, traumatic deep overbite, buccal cross-bite and posterior open bite.[22,24-27] Further modifications should be implemented to overcome limitations associated with severity and treatment requisite criteria of this index to be able to propose it as an ideal instrument in the assessment of malocclusion.[7,8,11]

Nonetheless, given that Angle's classification has also been associated with certain limitations based on evaluation of the positioning of teeth rather than elucidating bone and muscular aspects, and the sagittal changes disregarding the vertical or transversal alterations along with rather questionable feasibility and reliability to be used in epidemiological studies being a qualitative method and not a malocclusion quantitative index.[8] Our findings support the distinct characteristics of the two indexes offering an alternative method of using them in a mutually complementary manner.[8]

About the dentition anomalies, the lowest recorded was anterior open bite with only 6 cases. Regarding the condition of space and occlusion, the highest recorded was mandibular misalignment (175 children = 43.7%), followed by maxillary irregularity (140 children = 35%). The DAI component which had the lowest frequency regarding space and occlusion anomalies was missing tooth (*n* = 11,) which was not in accordance as found in others surveys.[12,14,20,28] According to previous evidence[20] in this study, most children (69.8%) presented normal anteroposterior molar relationship and a smaller portion (30.2%) characterized deviation from the normal molar relationship. In descriptive terms, from 262 children with mild malocclusion or without abnormality in the DAI, 88.5% were classified as Angle's Class I, 10.68% as Angle's Class II and 0.76% as Angle's Class III, which suggested a diagnostic sensitivity difference between the methods. Of the 87 children with defined malocclusion by the DAI, 35.6% were classified as Class I Angle's malocclusion, 55.17% as Class II Angle's malocclusion and 9.19% as Class III angle's malocclusion. Considering the 32 children with severe malocclusion, by the DAI, 37.5% were classified as Class I Angle's malocclusion, 50% as Class II Angle's malocclusion and 12.5% as Class III Angle's malocclusion. Considering the 19 children with very severe or disabling malocclusion, by the DAI, 21% were classified as Class I Angle's malocclusion and 78.94% as Class II Angle's malocclusion, showing a good correlation between the indexes considered in the data analysis. Of the 14 children with Angle's Class III malocclusion, two were, according to the

DAI, without abnormality or with mild malocclusion, eight with slight malocclusion and four children with severe malocclusion. There is more disagreement in the ranking, while the majority of cases found in Angle's Class III malocclusion did not fit, in the DAI distribution score >35 which requires mandatory treatment.

With the DAI, the WHO attempted to create an easy index, universally accepted and that could be used in epidemiologic research to establish the orthodontic treatment need and the priority of orthodontic care in public programs. This index has the characteristic of being measurable, objective, simple and easy to use, but regarding the results obtained in this study, it was not sensitive to some occlusion problems. Another factor that limits this index is the fact that it was developed for the permanent dentition, therefore inadequate for the deciduous and mixed dentition, being unable to identify malocclusion cases in its early stages, which hampers the prevention and early treatment.[18,29] Angle's classification has limitations too, because the first upper permanent molar is not stable in the craniofacial skeleton. It is based only on the positioning of teeth, not elucidating bone and muscular aspects; in addition, it only considers the sagittal changes disregarding the vertical or transversal alterations. Angle's classification feasibility and reliability for epidemiological studies has been questioned because it is a qualitative method and not a malocclusion quantitative index.[30]

Despite these factors, over time and to overcome the technique limitations, problems such as anterior and posterior crossbite, anterior and posterior open bite and upper and lower crowding, diastemas, individual tooth malposition, overjet, and overbite were subjected to additional studies with their own classification criteria.[8] As an example, the DAI could also receive modifications in order to overcome limitations. A critical analysis of several methods of malocclusion registration showed that it was not yet proposed an ideal classification that could be used as standard in the malocclusion studies.[30]

Conclusion

In the DAI the item "no abnormality or mild malocclusion" (no need or slight need of treatment) was found in most children (65.5%) and 12.8% of patients suggesting "severe, very severe or disabling malocclusion with highly desirable or mandatory" orthodontic treatment requisite.
- Crowding was observed with greater frequency
- Most of the children had normal molar relationship (69.8%)
- The majority of cases with Angle's Class III malocclusion were not grouped under DAI score >35

indicating very severe or disabling malocclusion, which definitely needs mandatory treatment
- The DAI was not sensitive to some occlusion problems, when it was compared with Angle's classification
- The differences found in both indexes exposes the alternative of using them in a mutually complementary form.

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Conflicts of interest

There are no conflicts of interest.

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