

Assessment of Severity of Malocclusion and Orthodontic Treatment Need Using the Dental Esthetic Index and Angle's Classification: A Retrospective Study

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ABSTRACT

Introduction: Angle's classification is the most widely used instrument for evaluation of malocclusion. The dental esthetic index (DAI) is a reliable, valid, and universally accepted cross-cultural index adopted by the World Health Organization (WHO) that links objective, clinical, and subjective esthetic factors to produce a single score that reflects the severity and the treatment needs of the malocclusion. The present study aims to evaluate Angle's classification and DAI to assess the severity of malocclusion and treatment needs.

Materials and methods: This retrospective cross-sectional study was done on pretreatment orthodontics records of 145 male patients and 153 female patients in the age-group 9–42 years with malocclusion who had received or were undergoing orthodontic treatment in the orthodontic department clinics of the College of Dentistry, Jazan University. Preorthodontic study casts, orthopantomography, and lateral cephalometric X-rays were analyzed. DAI scores were calculated, and treatment needs were assessed. Angle's classification of malocclusion was also noted.

Results: Among patients with normal or minor malocclusion (DAI score ≤ 25), a significantly higher percentage of patients were class I (58%) than any other class of malocclusion. Among patients determined to have handicapping malocclusion (DAI score ≥ 36), significantly higher percentage of patients were class II/1 (44%) than any other class of malocclusion. Class II/1 showed the highest percentage of definite (24%) (DAI score 26–30), severe (19%) (DAI score 31–35), and handicapping malocclusions (44%) (DAI score ≥ 36). A total of 26% of patients had skeletal class I. A total of 38% of patients had skeletal class II. A total of 36% of patients had skeletal class III. Approximately 13% of patients had maxillary canine impactions and 3% of patients had mandibular canine impactions.

Conclusion: The study reported 35% of patients were having handicapping malocclusion (DAI ≥ 36) and 14% having severe malocclusion (DAI score 31–35). The malocclusion was characterized by a high frequency of anterior crowding. Thus, the complementary use of DAI and Angle's classification, with improvements, helps establish an all-inclusive criterion for screening and prioritizing of patients eligible for receiving subsidized, publicly funded orthodontic care and thus allows better use of limited available resources.

Keywords: Angle's classification, Dental esthetic index, Malocclusion, Orthodontics.

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INTRODUCTION

Malocclusion is the third most commonly reported dental problem worldwide, as stated by the World Health Organization (WHO). Malocclusion is a deviation from the normal occlusion as a result of poorly aligned teeth, skeletal structures, or both. Malocclusion is multifactorial disorder with hereditary, environmental, and paraoral habits playing a significant role in causing malocclusion.¹ The psychosocial impact of the malocclusion helps in establishing the need for treatment of malocclusion. The primary function of orthodontic treatment is to improve the dental esthetics, functioning, and interarch discrepancies. The orthodontically treated cases have reported better quality of life as compared to the individuals without treatment.^{2,3}

Angle's classification proposed in the year 1899 is still the most widely used instrument for evaluation of malocclusion. The global epidemiology of the malocclusion indicates the maximum number of individuals in the population with Angle's class I malocclusion followed by class II and class III. The Angle's classification of malocclusion has limitations in accounting for skeletal deformities, individual or local area malalignments of teeth, and mainly depends on molar relation for its assessment and expressing treatment needs.^{4–6}

Dental esthetic index (DAI) is a reliable, valid, and universally accepted cross-cultural index adopted by the WHO that links

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objective, clinical, and subjective esthetic factors to produce a single score that reflects the severity and the treatment needs of the malocclusion. The interpretation and classification based on DAI scores are as follows:^{7–10}

- Scoreless than 26: Little or no treatment need.
- Score between 26 and 30: Treatment elective.
- Score between 31 and 35: Treatment highly desirable.
- Score more than 35: Treatment mandatory.

The present study aims to evaluate Angle's classification and DAI to assess the severity of malocclusion and treatment need among orthodontic patients who were referred to the orthodontic clinic at the College of Dentistry, Jazan University after the initial diagnosis was made in the oral diagnostic clinics. Hence the main objectives of the study were

- To assess the severity level of malocclusion and orthodontic treatment needs using the DAI.
- To compare the Angle's classification and DAI.
- To assess the distribution of the different malocclusion variables.

MATERIALS AND METHODS

This retrospective cross-sectional study was done on pretreatment orthodontics records of 298 patients with malocclusion. A total sample size of 298 with complete records was selected based on the sample size calculation on the prevalence of malocclusion in Saudi Arabia population. The data were collected from pretreatment orthodontics records of 145 male patients and 153 female patients in the age-group 9–42 years with malocclusion who had received or were undergoing orthodontic treatment in the orthodontic department clinics of the College of Dentistry, Jazan University. The patient records fulfilling the requirements of the study were included in the study. Preorthodontic study casts, orthopantomographs, and lateral cephalometric X-rays were analyzed. Data on multiple traits of malocclusion, Angle's classification, and DAI scores were recorded for each patient. DAI score was calculated using the regression equation of 10 occlusal traits: "(visible missing teeth × 6) + (crowding) + (space) + (diastema × 3) + (anterior maxillary misalignment) + (anterior mandibular misalignment) + (anterior maxillary overjet × 4) + (anterior mandibular overjet × 4) + (anterior vertical open bite × 4) + (anteroposterior molar relationship × 3) + 13."⁷ Malocclusion prevalence with gender variation was identified according to both methods, while the severity and treatment requisite were assessed according to DAI. Institutional ethical clearance was obtained before the start of the study. The data were entered in Microsoft Office Excel 2016, and IBM SPSS Ver.20 was used to calculate the study results. Descriptive analysis was carried out, and the association between DAI and Angle's classification was also evaluated using Pearson's Chi-squared test.

RESULTS

A total of 298 records were collected, which included preorthodontic study casts, orthopantomograph, and lateral cephalometric X-rays, out of which 145 were male and 153 were female. The patients were of the age-group 9–42 years. The DAI scores of study subjects were analyzed (Fig. 1), 24% showed little or no treatment need (DAI score ≤25), 27% showed need for elective treatment (DAI score between 26 and 30), 14% showed highly desirable treatment need (DAI score between 31 and 35), and 35% showed mandatory treatment need (DAI score ≥36). The DAI scores for males and females were calculated separately (Fig. 2). The malocclusion when measured with Angle's classification showed 24% of subjects with class I, 68% of subjects with class II division 1, 4% with class II division 2, and 4% with class III malocclusion (Figs 3 and 4). Among patients with normal or minor malocclusion (DAI score ≤25), significantly higher percentage of patients were class I (58%) than any other class of malocclusion (Fig. 5). Among patients determined to have handicapping malocclusion (DAI score ≥36), significantly higher percentage of patients were class II/1 (44%) than any other class of malocclusion.

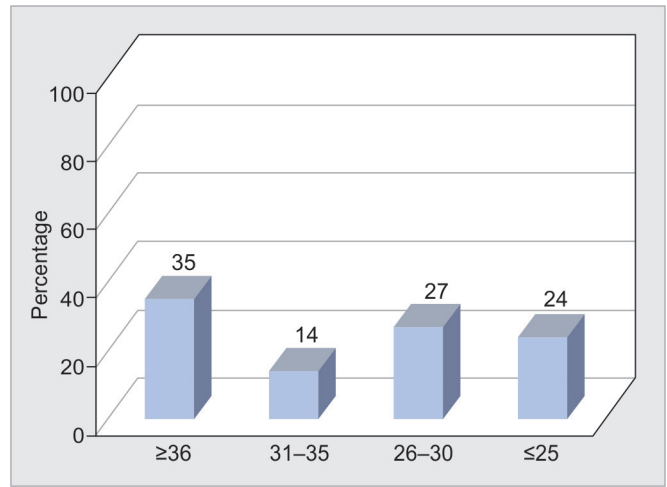


Fig. 1: Dental esthetic index scores showing the interpretation for treatment need in percentage

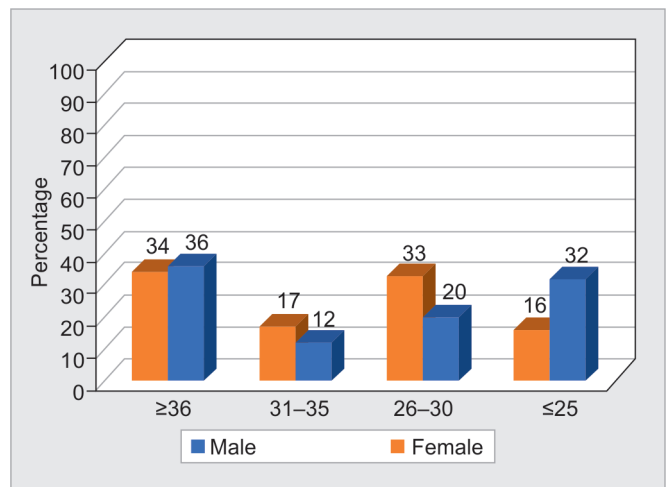


Fig. 2: Dental esthetic index scores showing the interpretation for treatment need among males and females in percentage

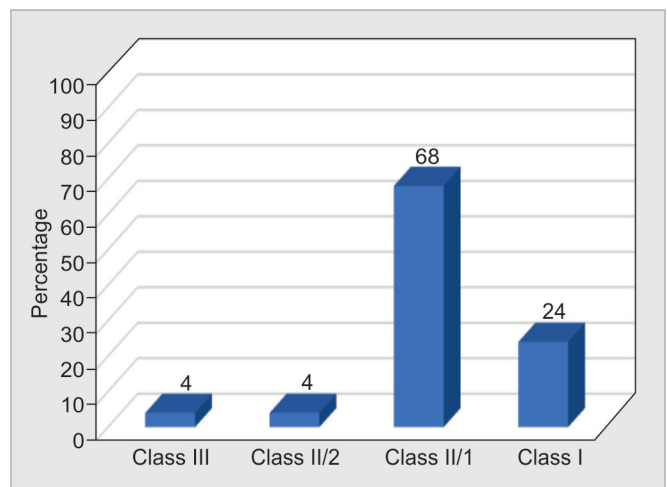


Fig. 3: Angle's classification showing the distribution of malocclusion

Class II/1 showed the highest percentage of definite (24%) (DAI score 26–30), severe (19%) (DAI score 31–35), and handicapping malocclusions (44%) (DAI score ≥36) (Table 1). The proportion of class II/1 was the highest (68%) among all the classes of malocclusions. Anterior crowding in both arches was the most commonly seen malocclusion trait. A total of 26% of patients had skeletal class I. A total of 38% of patients had skeletal class II. A total of 36% of patients had skeletal class III (Table 2). Approximately 13% of patients had maxillary canine impactions and 3% of patients had mandibular

canine impactions (Table 3). There was a weak positive correlation ($r = +0.291$) between the Angle's classification and the DAI score (Table 4).

DISCUSSION

The results from this study showed that 68% of subjects in the study population had Angle's class II division 1 followed by class I (24%), class II division 2 (4%), and class III (4%). Since the reported cases of malocclusion to the Department of Orthodontics were considered, they differed from the prevalence of malocclusion in Saudi Arabia population, which reports class I followed by class II and class III. Consistent with the results of our study, which includes patients from dental hospitals, the study from Turkey and other countries in general population showed similar results. The contrast results were obtained from studies from different countries are due to sampling variation from orthodontic clinics to the public hospital, age difference in population, and other ethnic group variations.^{1,11–15} However, Angle's classification of malocclusion has its own limitations in terms of reporting the treatment needs and inclusion of some local malocclusion types.⁶

The DAI is a more acceptable index globally as proposed in WHO oral health basic survey methods 1997. The DAI includes esthetics and occlusal aspects, which accounts for dentition, space, and occlusion while calculating a single final score that is used to interpret treatment need in the patient.⁷ The DAI scores from our study showed 35% of subjects having disability malocclusion and needing mandatory treatment, 27% needing elective treatment, 24% needing minor or no treatment, and 14% with severe

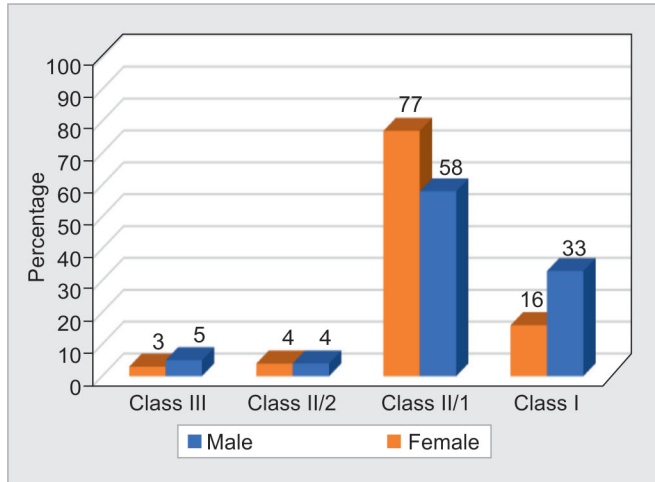


Fig. 4: Angle's classification showing the distribution of malocclusion among males and females

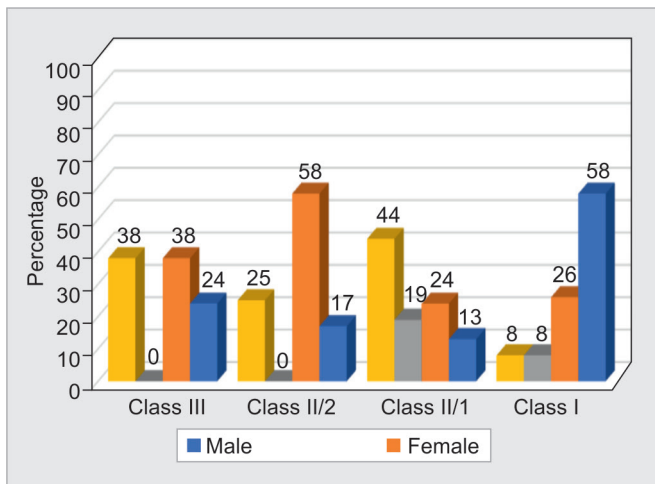


Fig. 5: Dental esthetic index scores showing the interpretation for treatment need with Angle's classification expressed in percentage

Table 2: Distribution of sample according to skeletal classification

| Skeletal class | Class I | Class II | Class III | Total |
|----------------|----------|-----------|-----------|------------|
| Prevalence | (79) 26% | (113) 38% | (106) 36% | (298) 100% |

Table 3: Distribution of sample according to canine impactions

| Canine impaction | Maxillary | Mandibular |
|------------------|-----------|------------|
| Prevalence % | 38 (13%) | 9 (3%) |

Table 4: Correlation between Angle's classification and dental esthetic index score

| Angle's classification | N | Mean DAI | Std. deviation | Pearson's correlation coefficient | p value |
|------------------------|-----|----------|----------------|-----------------------------------|---------|
| Class I | 71 | 25.65 | 6.299 | 0.291 | 0.000 |
| Class II Div. 1 | 202 | 35.47 | 9.945 | | |
| Class II Div. 2 | 12 | 33.08 | 13.182 | | |
| Class III | 13 | 35.89 | 14.680 | | |

Table 1: Association between Angle's classification and dental esthetic index (DAI) scores

| DAI | Severity | Treatment requisite | Class I | Class II/1 | Class II/2 | Class III | Total prevalence |
|-------|---------------------------|-----------------------------|----------|------------|------------|-----------|------------------|
| <25 | Normal/minor malocclusion | No treatment or slight need | 41 (58%) | 26 (13%) | 2 (17%) | 3 (24%) | 72 (24%) |
| 26–30 | Definite malocclusion | Treatment elective | 18 (26%) | 49 (24%) | 7 (58%) | 5 (38%) | 79 (27%) |
| 31–35 | Severe malocclusion | Treatment highly desirable | 6 (8%) | 38 (19%) | 0 (0%) | 0 (0%) | 44 (14%) |
| >36 | Handicapping malocclusion | Treatment mandatory | 6 (8%) | 89 (44%) | 3 (25%) | 5 (38%) | 103 (35%) |
| Total | | | 71 | 202 | 12 | 13 | 298 (100%) |

malocclusion needing highly desirable treatment. The studies conducted in general population from other countries showed inconsistent results with our research as majority of the people need no or slight treatment followed.^{15,16}

DAI score-based treatment needs are not sensitive to the specific occlusal problem as in Angle's class III malocclusion, therefore, may lead to neglect or delay in the treatment. It appears that DAI is also unable to identify malocclusion cases due to inadequacy of the method for the deciduous and mixed dentition in its early stages, which hampers the prevention and early treatment.^{12,16} The DAI can help as a screening tool to assess the level of severity of malocclusion and orthodontic treatment needs. However, the treatment indications by DAI should serve only as a guide since other traits, such as skeletal mal-relationships, impacted teeth, traumatic deep overbite, buccal cross-bite, posterior open bite, and dental midline shift also strongly influence the decision of orthodontic treatment.¹ In this study, the assessment of skeletal classification and canine impactions have also been taken into consideration in addition to the Angle's classification. The present study has the limitation of being conducted in limited sample size; more such studies should be carried out to assess the severity of malocclusion and treatment needs. The present study recommends the use of Angle's classification with DAI to determine the state of malocclusion.

CONCLUSION

Most of the patients had significant treatment need, as per the DAI scores, with almost 35% having handicap malocclusion (DAI \geq 36) and 14% having severe malocclusion (DAI score 31–35). The malocclusion was characterized by a high frequency of anterior crowding. Thus, the complementary use of DAI and Angle's classification, with improvements, helps establish an all-inclusive criterion for screening and prioritizing of patients eligible for receiving subsidized, publicly funded orthodontic care and thus allows better use of limited available resources.

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