

## Assessment of Orthodontic Treatment Needs Using a Modified Aesthetic Scale (Penilaian Keperluan Rawatan Ortodontik Menggunakan Skala Estetik yang Diubahsuai)

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### ABSTRACT

*Early treatment of orthodontic problems is important to ensure the best outcome and to avoid social stigmatization. Treatment is often prioritized based on scales such as the Index of Orthodontic Treatment Need (IOTN). Unfortunately, the conventional aesthetic component of IOTN measurement is slanted towards Caucasian malocclusions. Thus, Asian children find it particularly difficult to rate their appearance on this scale and therefore treatment may be wrongly prioritized. This study aimed to assess the use of a newly modified aesthetic scale in assessing orthodontic treatment need in adolescent. A total of 522 16-year old children were recruited. The subjects as well as the examiner rated the subject's own dentition according to the conventional scale of aesthetic component of IOTN and the newly modified aesthetic scale. Questionnaire was given to assess the practicality of the two scales. When conventional scale was used, subjects and examiner tends to rate more to the no/slight treatment need category. However, when the newly modified scale was applied, the rating has skewed to the moderate/great need treatment category in both subjects and examiner. Moderate inter-agreement between examiner and subjects were detected when using the modified scale while poor agreement was found when using the conventional scale. Moreover, subjects found the modified scale to be easier and faster to use and more relevant to their own dentition. In conclusion, the newly modified aesthetic scale can be suggested as a better tool in assessing level of orthodontic treatment need in adolescent.*

*Keywords: Aesthetic; IOTN; orthodontic assessment; treatment need*

### ABSTRAK

*Rawatan awal untuk permasalahan ortodontik adalah penting dalam memastikan hasil yang terbaik dan dapat menghindari keaiban sosial. Keutamaan untuk mendapatkan rawatan selalunya menggunakan skala seperti Indeks Keperluan Rawatan Ortodontik (IOTN). Malangnya, skala konvensional ini cenderung ke arah maloklusi 'Caucasian'. Ini menyebabkan kanak-kanak Asia sukar untuk menilai penampilan mereka menggunakan skala ini dan keutamaan untuk rawatan mungkin disalahtafsirkan. Penyelidikan ini bertujuan untuk menguji kegunaan satu skala estetik baru yang diubah suai dalam menilai keperluan rawatan ortodontik dalam kalangan remaja. Sejumlah 522 remaja berusia 16 tahun telah direkrut. Subjek dan pemeriksa telah menilai gigi subjek itu sendiri berdasarkan skala estetik konvensional IOTN dan skala estetik baru yang diubah suai. Soalan kaji selidik juga telah diberikan untuk menilai keberkesanan kedua jenis skala tersebut. Apabila skala konvensional digunakan, subjek dan pemeriksa cenderung untuk menilai ke kategori tidak/sedikit perlu untuk rawatan. Namun, apabila skala baru digunakan, penilaian telah memencong ke kategori sederhana/sangat memerlukan rawatan dalam kalangan subjek dan pemeriksa. Keserasian pendapat antara pemeriksa dan subjek adalah sederhana apabila menggunakan skala yang diubah suai manakala ketidakserasian pendapat berlaku apabila skala konvensional digunakan. Tambahan pula, subjek merasakan skala yang diubah suai itu lebih senang dan cepat digunakan serta lebih berkait dengan kegiatan mereka. Skala estetik baru yang diubah suai ini boleh dicadangkan sebagai satu alat yang lebih baik dalam menilai tahap keperluan rawatan ortodontik dalam kalangan remaja.*

*Kata kunci: Estetik; IOTN; keperluan rawatan; penilaian ortodontik*

### INTRODUCTION

Having an orthodontic problem at an early age as the permanent dentition may interfere with a child's normal physical and psychological development. The orthodontic problems may lead to other dental health problems such as caries and traumatized tooth. Bullying, lower self-esteem and reduced in quality of life of a child have been associated with orthodontic problem (Seehra et al. 2011). Thus, there is a great need in early detection

for orthodontic treatment prioritization in children with malocclusion.

Index of Orthodontic Treatment Need was developed with the purpose of assessing the level of orthodontic treatment need (Brook & Shaw 1989). It consists of two components, i.e. the dental health component (DHC) and aesthetic component (AC). The DHC assessment can only be carried out by the professional as it has its own specific objective criteria. However, the AC has the advantage of

having the professional as well as the lay person to be able to judge the level of orthodontic treatment need based on selection of the 10 intraoral photographs. Determination of orthodontic treatment should not only be based on normative treatment need as judged by the professional but should also consider the patient's perception of their own dentition (Mandall et al. 2001).

Unfortunately, the conventional AC scale has few disadvantages. Differences in the scores rated by the dental professional and laymen have been noted by some researchers (Badran 2010; Grzywacz 2003). Furthermore, the conventional AC scale did not include few malocclusions which are more prevalent in Asian population such as the Class III malocclusion with reverse overjet (Lew & Foong 1993; Woon et al. 1989). During AC assessment, there are tendency for the assessor to match patient's dentition to the photographs shown in the illustrated scale. Consequently, difficulties in assessing arise when there is an absence of similarity in the photograph of the current scale (Grzywacz 2003, Hamdan et al. 2012). When inaccurate photograph was chosen, treatment prioritization may be wrongly done.

Therefore, a modified aesthetic scale was developed, consisted of 16 photographs which covers more malocclusions such as the reverse overjet and anterior openbite (Sharihan et al. 2011). Inclusion of such photographs has also been suggested as to increase the sensitivity of the scale (Hamdan et al. 2012). Thus, the purpose of this study was to assess the use of the newly modified aesthetic scale in assessing orthodontic treatment need in adolescent.

## MATERIALS AND METHODS

### SAMPLE RECRUITMENT

This study was designed as a cross sectional study based on clinical examination and self-appraisal by 16 years old schoolchildren. Five schools located within 20 km radius from Faculty Dentistry UKM were selected. Approvals were obtained from the Educational Planning and Research Division, Ministry of Education and Wilayah Persekutuan Education Department. Sample size calculation was based on a study which showed that 22.8% of children need orthodontic treatment according to aesthetic component of IOTN (Abdullah & Rock 2002). The minimum sample required at a 95% probability level was 270 schoolchildren.

A total of 522 students aged 16 years old who met the inclusion and exclusion criteria were selected. Students with all permanent teeth from the incisors to the first molars were recruited. Students who had previously received any forms of orthodontic treatment or currently wearing orthodontic appliances, had mental impairment or learning difficulties and with history of dental trauma or maxillofacial injuries were excluded from this study. Ethical approval and guardians' consent were obtained prior to the start of this study.

### ASSESSMENT OF ORTHODONTIC TREATMENT NEED

The conventional aesthetic scale (CA) which consisted of 10 intraoral photographs was labeled as photograph A. Meanwhile, the modified aesthetic scale (MA) which consisted of 16 intraoral photographs was labeled as photograph B (Figure 1). A designated number (score) was placed on every lower left corner of each photograph. These numbers represent the level of orthodontic treatment need. Grade 1 to 4 indicates no/slight need of treatment, grade 5 to 7 indicates moderate need of treatment and grade 8-10 indicates the great need of treatment.

The examination took place with the student seated on a chair facing toward natural light. Using a face mirror and while their upper and lower teeth are biting together, the students were asked to compare their teeth with photographs in A and B and select a photograph which matched most to their own dentition. The students were then wrote their score for each photograph chosen for the two aesthetic scales. Examiner then assessed the student's anterior dentition and gave the score for both scales. All assessments were done by a single examiner (SK). The students were then asked to answer 3-items questionnaire which looked into which scale is easier to use, faster to use and more similar to their own dentition.

### VALIDATION PROCESS

The validation process was done prior to the start of the fieldwork study. The single examiner for this study (SK) was trained and calibrated by two qualified orthodontists (RMAW & AA). Thirty intraoral photographs were assessed by the three examiners (SK, RMAW & AA). The kappa values for the inter-examiner reliability test were 0.76 for CA and 0.84 for MA. Reproducibility test was also conducted whereby 50 students were re-assessed within 3-6 weeks after the initial examination. The kappa values for the intra-examiner reliability test were 0.70 for CA and 0.88 for MA.

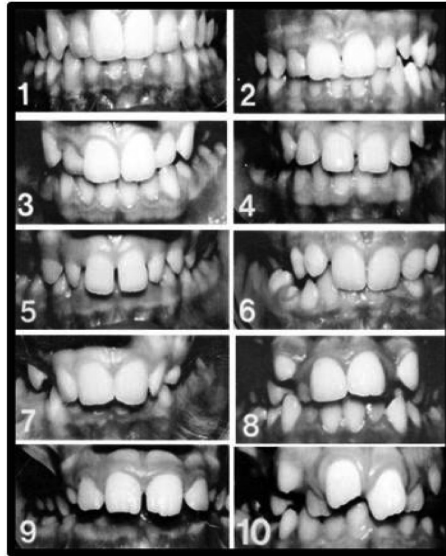
### DATA MANAGEMENT AND ANALYSIS

The data were compiled and analyzed using SPSS Version 19. Chi square test was used to test for significant differences between the grade selected by the student and the examiner in the conventional and the modified AC. Kappa statistics was used in this study to compare the agreement between students and examiner and between the conventional and the modified AC.

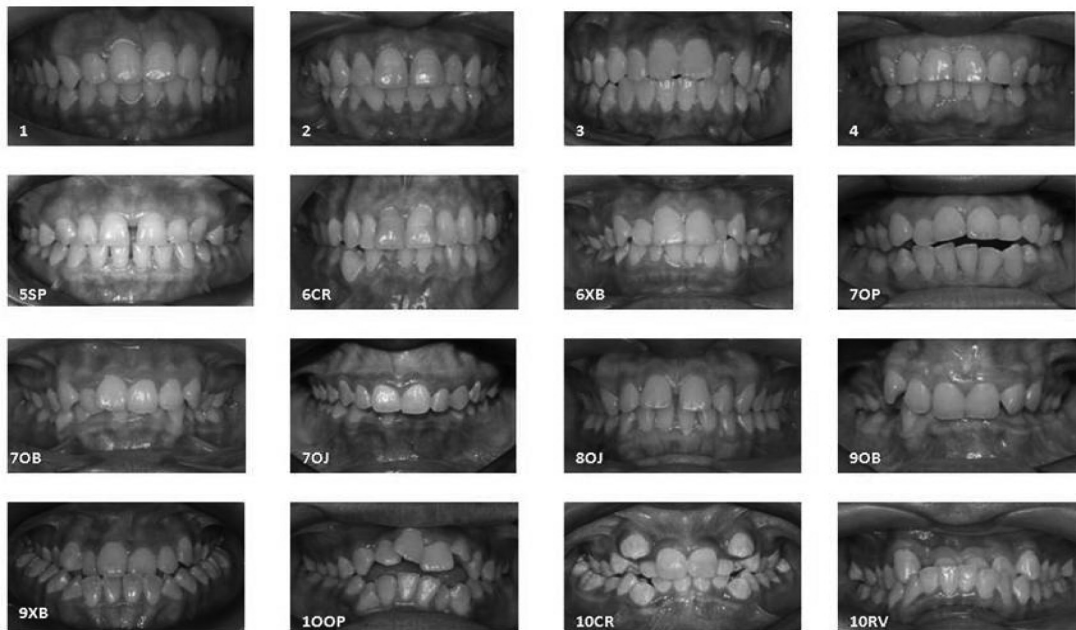
## RESULTS

### ASSESSMENT OF ORTHODONTIC TREATMENT NEED

The majority of students rated their treatment need as no/slight need category when using the two tested scales i.e. conventional AC (CA) and the modified aesthetic scale (MA). When using the CA, only 4% of the students rated themselves as in need of orthodontic treatment. However,



(a)



(b)

FIGURE 1. (a) 10 photographs of the conventional aesthetic component of IOTN & (b) 16 photographs of the modified aesthetic scale

when they were using the MA, more students had rated themselves as in need of orthodontic treatment as the percentages increased to 21% when compared with the CA with the difference of 17% (Figure 2). There was significant difference between the assessments of treatment need assessed by students under the two scales ( $p < 0.05$ ).

More than half of the students need no orthodontic intervention as rated by the examiner in both the scales. There was a 16% increment of subjects who were in need of orthodontic treatment as assessed by examiner from using the CA to the MA (Figure 2). The difference between the

CA and MA rated by examiner was significantly different ( $p < 0.05$ ).

Overall, during the CA assessment, both the assessors had chosen more of the no/slight need category compared with the need (moderate/great) treatment category. However, when they were using the MA, a reduction in the no/slight treatment category was seen with an increased in the numbers of the moderate/great need treatment categories rating. The rating pattern in the MA has skewed to the need treatment category when compared with the rating during the CA.

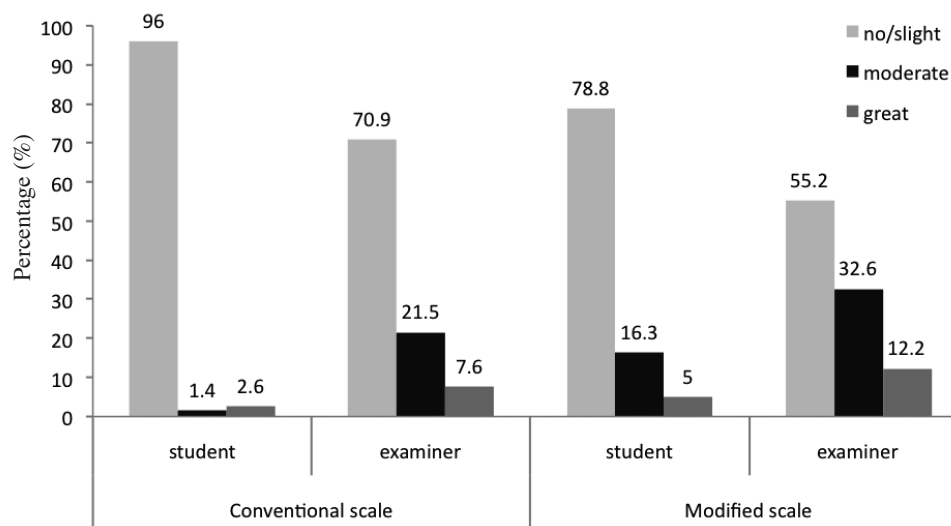


FIGURE 2. Percentages of treatment need rating using conventional scale of AC and the modified scale among students and examiner

The students tends to rate higher in both scale for no/slight treatment need when compared with score assessed by examiner. When students rated themselves as in the need of treatment using CA, they tend to rate more in the great need category (2.6%) compared with the moderate need category (1.4%). Meanwhile, the examiner has the opposite view when applying the CA. The examiner tends to rate subjects more in the moderate need category (21.5%) rather than the great need category (7.6%). When the MA was used, rating for the in need treatment category were similar for the students as well as the examiner. The moderate need treatment category was chosen more frequently when compared with the great need treatment category. Overall, the patterns of students' rating as well as the examiner's rating are similar in MA where majority scores were in the no/slight need category, followed by the moderate need and great need categories. However, the rating in CA did not follow the similar pattern between the students and the examiner.

#### ASSESSMENT OF AGREEMENT

The kappa score for agreement between student and examiner in CA was 0.16 which showed poor agreement (Table 1). The agreement between the examiner and students in MA was significantly higher ( $p < 0.05$ ) compared

with agreement when assessed using conventional AC with moderate correlation was detected.

The kappa score obtained for students when using CA and MA was 0.22 which showed fair agreement whilst for the examiner, the kappa value was 0.61, showing good agreement between the conventional and the modified aesthetic component (Table 1).

#### PERCEPTION OF SUBJECTS TOWARDS CONVENTIONAL AND THE MODIFIED AESTHETIC SCALES

Most of the respondents (63.4%) found the modified scale easier to use, whilst 27.2% found the conventional scale easier and 9.4% found no difference. Most students (58.2%) found it faster to select photographs from the modified scale than from the conventional scale (32.2%), whilst only 9.6% found both scales were equally fast. The modified scale's photographs were rated to have more similarity to students' own dentition (67.2%) (Figure 3).

#### DISCUSSION

Adolescent age group is represented by our samples of 16-year old schoolchildren. This age group was chosen as permanent dentition has been established and Malaysian students have no major academic exams at this age, thus

TABLE 1. Level of agreement between the raters (students versus examiner) and between the two scales i.e. conventional aesthetic component (CA) and the modified aesthetic scale (MA) using Kappa analysis

		Kappa score	Level of agreement
Students versus examiner	CA	0.16	Poor
	MA	0.41	Moderate
CA versus MA	Students	0.22	Fair
	Examiner	0.61	Good

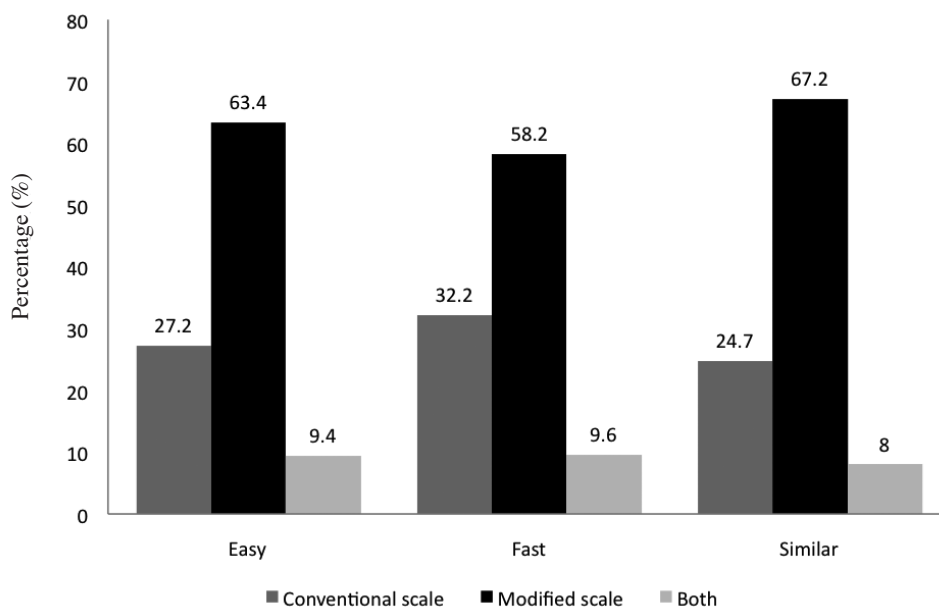


FIGURE 3. Questionnaire response in assessing the practicality of the conventional scale of AC and the modified scale in schoolchildren

making this study is less disruptive to their academic performance. Majority of the students were rated in the no treatment need category. This is strongly related to our exclusion criteria which exclude patient who had history of any orthodontic treatment.

The children were asked to rate their own dentition based on the two tested scale i.e. the conventional aesthetic component of IOTN (CA) and the modified aesthetic scale (MA). Initially, when using the CA, only minority rated themselves as in need of orthodontic treatment. However, when MA was applied, an increased number of children rated that they need orthodontic treatment. This may be explained by the incorporation of additional 6 photographs in the new MA which may be closely related to the subjects' dentition. It has been suggested that assessment of the treatment need using this scale would be easier when there are some similarity of the photographs in the illustrated scale to subject's dentition (Birkeland et al. 1996). Similar pattern of deviation to the moderate/great need category were seen in the examiner scores after using the MA. It may be suggested that the new MA is more sensitive in recognize more malocclusion which in need of orthodontic treatment and be able to prioritize treatment more accurately.

Using an illustrated scale such as the aesthetic component of IOTN, subjectivity was shown to be high and the rating may largely varies among professional and laymen (Badran 2010). This is because the dental professional has been shown to assess the malocclusion more critical than the layman (Hamdan 2004). When assessments were made using CA, differences in pattern of rating distribution were observed with poor correlation of agreement between the students and the examiner was noted. Similar result was found in a study done in London (Alkhatib et al. 2005). We also found a significant ( $p < 0.05$ )

difference between the grades rated by the students and those rated by the examiners. Many studies also showed that students were less critical in their aesthetic evaluation than the examiner (Badran 2010; Burden & Pine 1995; Evans & Shaw 1987; Kerosuo et al. 2004; Shaw et al. 1991).

There was similarity in the distribution of rating in the 3 main treatment need categories when MA was used. In addition, moderate strength of agreement between the two groups of raters was detected. Thus, our result showed that by using the MA, the subjectivity of assessment and the range of scores between the professional and laymen could be lowered. The examiner which represents the dental professional was well trained with both the aesthetic scale; a good agreement was seen in the two tested scales.

The majority of the subjects agreed that the MA was easier and faster to use. It was also shown to detect more similarity of the subjects' dentition. By suggesting the use of MA in the fieldwork such as epidemiological study, this scale can be an efficient tool in assessing orthodontic treatment need with less time and effort to cover a large population. It can also be used by the laymen themselves for self-orthodontic referral thus empowering the community on their dental health status with fewer burdens to the government dental service. The drive to embark on orthodontic treatment should also consider the demand from patients and not solely rely on the normative need as seen by dental professional (Mandall et al. 2001). Willingness to cooperate for orthodontic treatment and motivation for treatment should come from the patients themselves (Grzywacz 2003). By introducing a better treatment need assessment tool to the public, they can make their own orthodontic treatment need assessment and decision to undergo for orthodontic treatment.

## CONCLUSION

The majority of the subjects need no orthodontic intervention as rated by conventional aesthetic component of IOTN and the newly modified aesthetic scale. The pattern of score distribution skewed to the moderate/great need treatment category when the modified aesthetic scale was applied as compared with the conventional scale in the two groups of raters. A higher level of agreement was found between the students and examiner when they were using the modified aesthetic scale as compared with the conventional aesthetic scale. Majority of the students perceived that modified aesthetic scale as easier and faster to use and comparable to their own dentition as compared with the conventional aesthetic component of IOTN. Therefore, the newly modified aesthetic scale can be suggested as a better tool in assessing orthodontic treatment needs which can be used by the dental professional as well as the adolescent in the community.

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