Dental Journal
Majalah Kedokteran Gigi

Original article

Comparison of the Occlusal Feature Index (OFI) and Dental Aesthetic Index (DAI) in 10–14-year-old children at the Universitas Sumatera Utara Dental Hospital

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ABSTRACT

Background: *Malocclusion often occurs in children due to discrepancies between primary teeth and permanent teeth. An assessment of the severity of the malocclusion is necessary for establishing the diagnosis and determining the need for treatment. The Occlusal Feature Index (OFI) and Dental Aesthetic Index (DAI) are indices that assess the need for orthodontic treatment, but they use different weights.* **Purpose:** *This study aimed to compare the need for orthodontic treatment based on the OFI and DAI in 10–14-year-old children.* **Methods:** *The sample in this study is secondary data in the form of 66 study models pre-treatment in children aged 10–14 years at the Universitas Sumatra Utara (USU) Dental Hospital. All samples were collected based on inclusion and exclusion criteria. The measurement results were analysed statistically by the Chi-square test to see the comparison between the OFI and DAI. The results obtained are presented in the form of frequency and percentage.* **Results:** *For the OFI, 42.4% of the samples had no orthodontic treatment needed, 31.8% were indicated to treat, and 25.8% require mandatory treatment. For the DAI, 47% of samples had no/little treatment need, 25.8% had elective treatment need, 16.7% had treatment considered mandatory, and 10.6% treatment highly desirable. Based on the assessment to compare the OFI and DAI using the Chi-square test, p=0.001 was obtained.* **Conclusion:** *There was a significant difference in the need for orthodontic treatment between OFI and DAI in children aged 10–14 years at the USU Dental Hospital.*

Keywords: *children; DAI; malocclusion; OFI; orthodontic indices*

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INTRODUCTION

Malocclusion means dental peculiarities and occlusal properties that represent deviations from ideal occlusion.[1] Malocclusion will cause concerns related to dental health and quality of life due to oral health resulting from the appearance and function of teeth.[1,2] In adolescence, physical appearance is considered a very important factor for physical attraction when socialising.[3] Therefore, children with malocclusion will experience ridicule and ostracism as well as lower self-esteem and an affected social life.[4] Generally, the rate of malocclusion in adolescence is high. Research by Adha et al.,[5] found 97.9% of 8–12-year-old students with malocclusion in Banjarmasin's primary schools. Research in Cimahi by Dayataka et al.,[6] also described a high prevalence of

malocclusion, amounting to 96.7% of 12–15-year-old children.

Orthodontic treatment is needed as an action to treat malocclusion, to correct the abnormal arrangement of teeth and jaws, as obtaining good dental function and dental aesthetics as well as a pleasant face will improve one's psychosocial health.[7] For ensuring appropriate orthodontic treatment, a uniform standard is needed to assess the severity of malocclusion to minimise subjectivity, which is known as the malocclusion index.[8] Malocclusion recording methods can be classified into qualitative and quantitative methods. The qualitative method describes the occlusal features and provides a descriptive classification of the teeth, but does not provide any data about the need and result of treatment. Meanwhile, quantitative methods measure the complexity and severity of the problem assessed on a scale

or as a proportion. This method focuses on requirement for care. Its utilisation minimises the subjectivity related to the diagnosis, result, and assessment of the complexity of orthodontic treatment.[9]

The Dental Aesthetic Index (DAI) assesses the aesthetic component as well as the clinical component in a single score that combines the physical and aesthetic aspects of occlusion, in contrast to other indices that require separate assessments. Compared to different indices, the DAI is more popular, easier to use, and efficient.[10] The Occlusal Feature Index (OFI) is also an index that is easy to use, does not require complicated diagnostic equipment, and is objective. This method has proven that the severity of malocclusion indicated by an orthodontist subjectively and an assessment by a public health expert were very close or almost the same.[11] Both the OFI and DAI can determine the severity of malocclusion and allocate orthodontic treatment needs, but the OFI is a very simple index that uses only 4 components to assess orthodontic treatment needs compared to the DAI with 10 components.[9] Therefore, this study aimed to compare the need for orthodontic treatment based on the OFI and DAI in 10–14-year-old children at the Universitas Sumatra Utara (USU) Dental Hospital.

MATERIALS AND METHODS

This descriptive cross-sectional study was carried out at USU Dental Hospital, Medan. The sample size for this study was determined by the formula for the sample size of the hypothesis test for the proportion of a single population. Based on the calculation results, the minimum sample for research was 60 samples, plus 10% to consider the exclusion problem, so the total sample required was 66 samples. The samples were pre-treatment study models of children, collected using a purposive sampling method based on the inclusion and exclusion criteria. The inclusion criteria were study models of children aged 10–14 years, could be measured using the OFI and DAI indices, were in good condition (not broken, cracked, or porous), had good occlusion/bite, and had complete permanent teeth up to the first molar on the upper and lower jaws. The exclusion criteria were study models of patients already/ currently undergoing orthodontic treatment, and those with craniofacial anomalies of cleft lip and palate. This study had permission from the Research Ethics Committee of Universitas Sumatra Utara (Number 532/KEP/USU/2021).

After collecting the study models, measurements and scores were carried out on the study models using the OFI and DAI as shown in Tables 1 and 2. The scores obtained from the OFI and DAI measurements on each component were included in the orthodontic treatment need category group. The treatment needs based on the OFI were classified into no needed treatment (0–3), indicated treatment (4–5), and mandatory treatment (6–9). For the DAI, the total scores were categorised with no/little treatment need ($\leq$25), treatment considered elective (26–30), treatment highly

Table 1. OFI components and assessment weights[11]

OFI components	OFI Score			
	0	1	2	3
Crowding anterior	Neat teeth	The crowding is equal to half the width of the lower right first incisor	The crowding is equal to the width of the lower right first incisor	The crowding is bigger than the lower right first incisor
Interdigitation abnormalities	The relationship between cusp and groove	The relationship occurs between cusp and groove	The relationship between cusp and cusp	-
Overbite	1/3 of the incisal part of the lower incisor is covered by the upper incisor during occlusion	2/3 of the incisal part of the lower incisor is covered by the upper incisor during occlusion	1/3 of the gingival part of the lower incisor is covered by the upper incisor during occlusion	-
Overjet	0–1.5 mm	1.5–3 mm	3 mm or more	-
Total OFI score				

Table 2. DAI components and assessment weights[12]

DAI Components	DAI Score
The number of tooth loss (incisors, canines, and premolar in maxillary and mandibular arches)	6
Crowding in the incisors region (0 = no crowding; 1 = only one region with crowding; 2 = both regions with crowding)	1
Spacing in the incisors region (0 = no spacing; 1 = one region with space; 2 = two region with space)	1
Midline diastema (mm)	3
Anterior maxillary misalignment (mm)	1
Anterior mandibular misalignment (mm)	1
Anterior maxillary overjet (mm)	2
Anterior mandibular overjet (mm)	4
Vertical anterior open bite (mm)	4
Anteroposterior molar relationship (0 = normal; 1 = half cusp; 2 = one cusp; evaluated the right and left sides and only the largest deviation from normal molar relationship was recorded)	3
Constant	13
Total DAI score	

desirable (31–35), and treatment considered mandatory (>36).[11,12] The results of the OFI and DAI measurements for the need for orthodontic treatment were compared statistically using software version 21.0 of the IBM Statistical Package for Social Science (SPSS) (Chicago, US) with the Chi-square test (p value<0.05) and presented in terms of frequency and percentage.

The significance test of OFI and DAI measurements was carried out to obtain valid data by performing 2 measurements on each index, where measurement 1 and measurement 2 were carried out at different times by the same researcher. The average of each group was calculated and then statistically analysed by the Kappa test. The Kappa test results showed no significant difference from the p value <0.05. That is, the results of the first and second examinations by the same researcher are valid and similar.

RESULTS

The categories for orthodontic treatment needs based on OFI and DAI are shown in Tables 3 and 4. According to

Table 3. The need for orthodontic treatment based on OFI in children aged 10–14 years at the USU Dental Hospital

OFI Score	Treatment Need	n	%
0–3	No need	28	42.4
4–5	Indicated	21	31.8
6–9	Mandatory	17	25.8
	Total	66	100.0

Table 4. The need for orthodontic treatment based on DAI in children aged 10–14 years at the USU Dental Hospital

DAI Score	Treatment Need	n	%
≤25	No/Little need	31	47.0
26–30	Elective	17	25.8
31–35	Highly desirable	7	10.6
≥36	Mandatory	11	16.7
	Total	66	100.0

the OFI, out of 66 examined subjects, 42.4% showed no need for treatment (OFI: 0–3), 31.8% were indicated to treat (OFI: 4–5), and 25.8% showed mandatory treatment requirement (OFI: 6–9). According to the DAI, 47% of subjects showed no/little need for treatment (DAI <25), 25.8% had elective treatment needs (DAI: 26–30), 16.7% with treatment considered mandatory (DAI: 31–35), and 10.6% with treatment highly desirable (DAI >36).

The comparison of orthodontic treatment needs based on the OFI and DAI is shown in Table 5. The Chi-square test was used to assess the comparison of orthodontic treatment needs based on the OFI and DAI, the result showed that p=0.001; p<0.05. There was a statistically significant difference in the need for orthodontic treatment between the two indices. Regarding orthodontic treatment needs, the OFI classified 28 samples as no needed treatment, while the DAI classified 25 samples as having no/little need for treatment and three samples with orthodontic treatment considered elective. According to the OFI, 21 of the samples had treatment indicated, while according to the DAI, 6 of those samples had no/little treatment need, 7 samples elective treatment, 3 samples highly desirable treatment, and 5 samples with treatment considered mandatory. The results of the OFI also found that 17 samples needed mandatory treatment, but 7 of them were elective treatment needs according to the DAI, 4 samples with highly desirable treatment, and 6 samples where treatment was considered mandatory.

DISCUSSION

Malocclusion indices are a method to determine the level of treatment need or the number of deviations from normal occlusion and can be used for individual and population evaluation.[13] The OFI and DAI are indices to allocate patients into categories of treatment needs but with different assessment weights.[9] This study conformed with research by Nahusona and Aprilia[14] regarding the malocclusion status of dental students of Hasanuddin University measured according to the OFI using 144 samples. The results of the study with the highest percentage was no treatment need at 75%, followed by treatment indicated at 21.5%, and need to treat at 3.5%.[14] The results of this study also conformed with the research of Simangunsong et al.,[15] regarding the description of

Table 5. Comparison of orthodontic treatment needs based on OFI and DAI in children aged 10–14 years at the USU Dental Hospital

Treatment need	DAI										p value
	No/Little need		Elective		Highly desirable		Mandatory		Total		
OFI	n	%	n	%	n	%	n	%	n	%	
No need	25	89.3	3	10.7	0	0.0	0	0.0	28	100.0	
Indicated	6	28.6	7	33.3	3	14.3	5	23.8	21	100.0	0.001
Mandatory	0	0.0	7	41.2	4	23.5	6	35.3	17	100.0	
Total	31	47.0	17	25.8	7	10.6	11	16.7	66	100.0	

malocclusion in students at SMA Santo Thomas 2 Medan based on the DAI with 50 samples. It showed the highest percentage of no/little treatment needed at 62.8%, followed by needing elective treatment at 27.4%, mandatory treatment at 7.8%, and treatment highly desirable at 2.0%.[15]

The number of variations in the need for orthodontic treatment is in line with the variation in the severity of the malocclusion that occurs. The occurrence of malocclusion is greatly influenced by inheritance from parents and environmental factors such as bad habits. These two factors usually manifest themselves as an imbalance in the growth and development of the dental-facial structure. The effects of these factors can directly or indirectly cause malocclusion. Genetic factors have a significant impact on malocclusion, such as size, shape, and the number of teeth that are out of alignment with the mandibular arch and cause congestion.[16] Environmental factors such as bad habits that can cause malocclusion include thumb-sucking, sticking out the tongue, sucking or biting lips and nails, breathing from the mouth, and bruxism. Habits that produce intermittent stresses or forces exceeding 4–6 hours/day on the teeth can result in permanent deformities.[10,17]

In this study, there was a significant difference in the comparison of the orthodontic treatment needs between the OFI and DAI. Comparison of several orthodontic indices has been done, but none has compared the OFI with the DAI. With the exception of one of the studies on the comparison of two indices that is in line with this research, regarding the comparison of the DAI and Index of Orthodontic Treatment Needs (IOTN-DHC) in determining the orthodontic treatment needs of Qazvin students by Padisar et al.,[10] indicating that there is a statistically significant difference between the DAI and the Dental Health Component (DHC).

In this study, the OFI identified a greater proportion of samples in need of treatment compared with the DAI. The score assessment between OFI and DAI is not equal, it can be seen from the assessment of the molar relationship which shows that the OFI assesses the relationship of the upper and lower permanent first molars to be half bulge both in the mesial and distal directions higher with a score of 2 compared to the DAI with a score of 1. As for the assessment for crowding anteriorly, the DAI assesses the presence or absence of crowding in one jaw with a score of 1 or both jaws with a score of 2, while the OFI assessment looks at crowding only in the lower anterior by measuring the width of the position of the teeth that are crowded against the right lower first incisor. The assessment on overjet also shows that the DAI can only score if the overjet is more than normal (>2 mm), while the OFI can assess overjet >1.5 mm so measurements using OFI can be higher than DAI.[11,12]

The large number and submissions of malocclusion indices by expert researchers show the difficulty of designing a weighted, practical, valid, and reliable method to assess malocclusion with a uniform method.[18] A malocclusion index must be able to identify people who do not need treatment (specificity) and those who need treatment (sensitivity).[19] Malocclusion indices such as the OFI and DAI can be used to determine the need or priority of orthodontic treatment in epidemiological surveys.[13] Each malocclusion index has its own advantages and disadvantages. The OFI is a simple and objective method and does not require complicated diagnostic equipment. Assessment with this method can also be done in a short time if the researcher has been trained. However, the disadvantage of the OFI is that this method only assesses the interdigitation of the cusp which examines the relationship of the right upper and lower posterior teeth. This method also requires prior training in the assessment of front lower crowding because it takes time to measure the mesiodistal width of the lower anterior teeth and measure the length of the lower front dental arch.[11] The DAI is internationally established by the WHO, which identifies occlusal properties and includes the physical and aesthetic aspects of occlusion, including patient perception. The advantage of the DAI is that patients can get satisfaction from aesthetic and functional improvements because the DAI considers the patient's perception and is an effective method for prospective use in identifying the need for orthodontic treatment quantitatively and can be carried out directly in the patient's mouth. As for the possible limitations of using the DAI, this method does not identify cases with deep bite, buccal crossbite, open bite, and midline. Measurements made with a millimetre gauge can cause small errors due to inaccuracy, and this method does not take into account molar loss.[20,21] The availability of the number of research study models at the USU Dental Hospital that meets the inclusion criteria in this study is very minimal, so the number of samples obtained is small and can reduce the strength of this study.

In conclusion of this study, there was a difference between these two indices. The OFI classifies the need for orthodontic treatment to be greater than the DAI. The difference in the number of components and the weight of the assessment on each index greatly affects the results of this study. Further study is still needed with a larger sample size and more varied analysis methods.

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