A Comparative Study of Dental Indices among Dental Students

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Abstract

Malocclusion is an appreciable deviation from ideal occlusion that may be considered as aesthetically or functionally unsatisfactory. Treatment need indices are used to determine the need prior to orthodontic treatment. Index of Treatment Need (IOTN) and Dental Aesthetic Index (DAI) are the most common indices used to determine the severity of malocclusion and treatment need.

The aims of this study are to evaluate students' diagnostic ability in determining orthodontic treatment need using IOTN and DAI, and to determine students' perception to both indices.

This study was carried out on 49 clinical dental students of the Islamic Science University of Malaysia (USIM). They attended a seminar and practical sessions on the IOTN and DAI indices given by orthodontist. All students were asked to score 20 study models using both indices. At the end of assessment, students were asked to answer questionnaires regarding their perceptions towards both indices. The data was analysed using paired t-test, kappa statistic and descriptive analysis.

USIM clinical dental students were able to determine the severity of malocclusion using IOTN significantly better (p< 0.05) than DAI. The inter-rater reliability assessment resulted in interclass correlation coefficient of 0.62 for the IOTN and 0.61 for DAI. Questionnaires revealed that students prefer to use IOTN more than DAI in determining severity of malocclusion.

Clinical dental students showed better understanding in diagnostic assessment using IOTN than DAI in determining severity of malocclusion.

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Introduction

Malocclusion is an appreciable deviation from ideal occlusion that may be considered aesthetically or functionally unsatisfactory[1]. In contrast to disease and pathological lesions it may be the result of a combination of minor variations from the normal, which summates to produce clinical problem[2].

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The provision of orthodontic treatment with the basis is to improve dental aesthetic, dental health, occlusal functioning and psychosocial adjustment.

Treatment need indices are used to plan for orthodontic treatment in countries where dental health services are subsidised. Therefore, use of indices has been limited in countries where publicly funded dental services are not provided. However, they are considered essential tools in recording prevalence and severity of malocclusion in epidemiological studies.

The dental aesthetic index (DAI) was introduced by Cons in 1987 and was accepted by World Health Organization (WHO) as an international cross-cultural index in assessment of orthodontic treatment need[3]. It links clinical

and aesthetic components mathematically, producing a single score that combines physical and aesthetic aspects of occlusion, including patient perceptions[4]. The score falls between 0 (the most socially acceptable) and 100 (the least socially acceptable). The DAI score of 36 serves as the cut-off point to differentiate handicapping from non-handicapping malocclusion[4]. The DAI outlines criteria for the assessment of dentofacial anomalies including missing teeth, crowding, spacing, diastema, overjet, reverse overjet, open bite and molar relationship[3].

The Index of Orthodontic Treatment Need (IOTN) was developed as a result of a government initiative[5]. IOTN is assessed using two separate components which are dental health component (DHC) and aesthetic components. DHC is used for grading the functional and dental health indications for treatment[4]. It has five categories ranging from 1(no need for treatment) to 5 (very great need for treatment)[5]. It uses acronym MOCDO which represents Missing teeth; Overjet; Crossbite; Displacement of contact points; Overbite[6]. It gives guidance to the clinicians or practitioners to classify the severity of malocclusion.

Orthodontic indices help dental profession to classify patients with malocclusion according to the level of treatment need. These indices are considered as an important tool for clinical assessment, epidemiology study and research purpose. As they have been widely used by dental auxiliaries in primary and secondary care. However, one reported study has found that dental foundation trainee and general dental practitioner achieved the least specificity score when using the Dental Health Component (DHC) in IOTN[7]. These groups were more likely to consider a case for needing treatment that was in fact did not require treatment[7]. Another study supports this finding, which reported a significant number of referrals for orthodontic treatment to be considered as inappropriate. Incorrect use of indices can have impact on patient treatment and cost[8].

Currently, our faculty uses IOTN as a tool to determine the severity of patients' malocclusion. Most of clinical dental students in USIM still doing their training in determining the orthodontic treatment need of patients in clinic. However, a study done by Cubas et al found that dental students did not improve their ability to determine orthodontic treatment need after

learning and applying the IOTN approach[9]. Therefore, we introduce the students with DAI in determining orthodontic treatment need as another option. As the DAI is the one of the commonly used indices apart from IOTN[4].

Spencer et al found in the research that DAI can reduce number of initial consultations by dentist or orthodontists and it provides an importance advantage in public health programmes[10]. The DAI scores have also been found to be significantly associated with the perception of treatment need by students and parents (Cons et al., 1987[11]; Spencer et al., 1992[10]), and these are good predictors of the acceptance of future fixed orthodontic therapy (Jenny and Cons, 1996)[12]

In this study, the aim are to evaluate students' diagnostic ability in determining orthodontic treatment need using DAI and IOTN indices by comparing the usage of the indices among dental students in determining orthodontic treatment need and their perception towards both indices so that they can refer patient for orthodontic treatment accordingly and accurately.

Materials and methods

This study was conducted in Faculty of Dentistry of the Islamic Science University of Malaysia (USIM). It was a convenient type of study that recruited 49 clinical dental students. The inclusion criteria in selecting the samples were they must be in the clinical stage of USIM dental students with an experience in doing an orthodontic screening for at least once, have received knowledge in form of a lecture regarding IOTN and DAI indices and they should be year 4 and year 5 clinical dental students. In addition, the study model casts been used study should be free from any defects. On the other hand, the exclusion criteria were the preclinical students and students who have never done any orthodontic screening were not selected as the subject. Defective orthodontic casts were also excluded from this study.

The ethical approval for conducting research was obtained from the Faculty of Dentistry USIM ethical committee. The inter examiner calibration was done between two orthodontists to obtain gold standard score for all study models prior to scoring by clinical dental students. Moderate agreement was found between the two orthodontists scores using

Kappa statistic. The USIM clinical dental students (n=49) was given an hour-long seminar on the indices IOTN and DAI by orthodontist at the beginning of the research study.

The students were then randomly divided into two groups to facilitate academic teaching and attended two hours of practical exercise provided by the orthodontist. During the practical exercise, the students were asked to score 10 study models showing range of malocclusion as a training exercise. The gold standard score answers were conveyed to the students in order to reinforce the teaching and learning in relation to application of both indices. Inter-rater agreement was measured between the students' answers and gold standard using Kappa statistic. Moderate agreement was found between student and orthodontist score for the practical session.

Perception of USIM dental students regarding usage of orthodontic indices in polyclinic USIM.			
Year of Study:			
Sex:			
(TICK THE RESPONSE OF YOUR CHOICE)			
Table 1: Attitude towards orthodontic indices			
	YES	NO	I'M NOT SURE
Do you think orthodontic indices are important in determining severity of malocclusion?			
Do you think, without orthodontic indices ,referral to orthodontic treatment is going to be difficult?			
IOTN is quick, simple and easy to use.			
Dental Aesthetic Index (DAI) is versatile, time-saving and simple to use			
Table 2: Practice of orthodontic indices in clinic			
	YES	NO	I'M NOT SURE
Have you ever practice using IOTN in clinic?			
I would like to use IOTN in clinic in the future?			
Have you ever practice using DAI in clinic?			
I would like to use DAI in clinic in the future?			

Figure 1. Questionnaire used in the study.

On the assessment day, another 10 pre-treatment study models cast of permanent dentition were chosen based on the IOTN (dental health component) and DAI components. The study models used during the assessment day were different from the practical session. The models were arranged on the table in a sequence that had no relation to treatment need. Students were asked to score the models for both indices. The students' scores of both indices were compared to the scores of gold standard, which previously established by consensus of two orthodontists. Then, all clinical students were given questionnaire (Figure 1) for their perception regarding the application of both indices. The

questionnaire was adapted from previous study and it consisted of two parts. Part 1 was regarding the student perception towards both indices and part 2 regarding the application of both indices in the clinic.
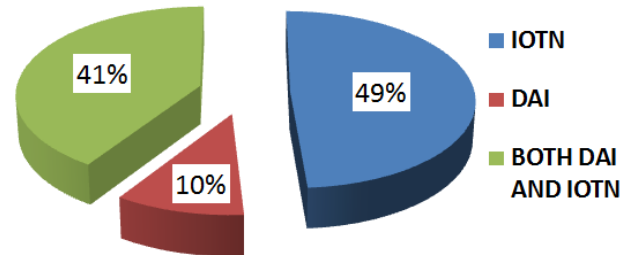

Figure 2. Preferences of USIM dental students towards IOTN and DAI

Kappa (k) statistic and paired t-test were used to assess the agreement between the student scores and gold standard and compared the scores collected while descriptive analysis was used for questionnaire analysis. All data were extracted manually and entered into SPSS software (version 21) for statistical analysis.

Results

Indices	Mean	N	Standard deviation (SD)	Standard error mean (SEM)	P value
IOTN	8.55	49	2.28	0.326	0.001* (p<0.05)
DAI	1.59	49	1.27	0.182	

Table 1. Comparison of scoring between DAI and IOTN.

INDICES	VALUE	LEVEL OF AGREEMENT
IOTN	0.62	MODERATE
DAI	0.61	MODERATE

Table 2. Inter-rater agreement between students and gold standard.

The mean IOTN is 8.55 (+ 2.28) and DAI is 1.59 (+ 1.27) when the comparison of scoring between DAI and IOTN was done (Table 1). There was higher agreement between students' and gold standards scores using IOTN compared

to DAI. There is statistically significant difference (p=0.001) between IOTN and DAI scores using paired t-test.

The inter-rater agreement between students' and gold standard scores where both indices possess showed moderate agreement (Table 2). The agreement with gold standard considered acceptable as the agreement recorded above 0.60.

Figure 2 showed the preferences of USIM clinical dental students towards IOTN and DAI indices usage. From the pie chart, most of the students (49%) preferred to use IOTN and only 10% students preferred to use DAI in determining the severity of malocclusion. The rest of students preferred to use both indices (41%).

Discussions

In this study, students were taught in form of seminar and practical in assessing the severity of malocclusion using two different types of indices which were IOTN and DAI. The students later were assessed on their scores of malocclusion (IOTN and DAI) using the study model and preferences of index. The USIM clinical dental students were found able to determine the severity of malocclusion using IOTN better than DAI. This was demonstrated by a higher mean of 8.55 when using IOTN compared to 1.59 when using DAI. The mean difference between these scores was statistically significant and was similar to the finding by Cubas et al (2012) when comparing two indices among the training dental students[9]. They found that the students exhibited better result when using IOTN and this indicates the use of IOTN improved assessment in pre-doctoral dental students to determine orthodontic need[9].

Previous study also has shown that IOTN found to be an effective educational resource for improving the orthodontic diagnostic abilities of dental students[7]. Furthermore, dentists who received IOTN training have referred patients more appropriately with a greater proportion of patients having definite treatment need[13].

Eventhough the students gave better score when using IOTN compared to DAI, the students display moderate agreement for both indices when comparing with the gold standard scores. This was agreed by David Manzanera et al (2010) where they found moderate agreement between DAI and IOTN in assessing treatment need[14]. However, it is in contrast with Mauro Henrique et al (2011) where they found less agreement with gold standard when comparing for both indices[15].

Analysis from questionnaire found that most of the students preferred to use IOTN more than DAI in determining severity of malocclusion and this finding was supported by Loke (2007). The IOTN was the index of choice by the majority of local orthodontists that use this index[16]. In a study by Holmes and Willmot who explored the use of IOTN in UK, found that British orthodontists' most common description of the IOTN were quick, simple and easy to use[17]. While in another study, found that Dental Aesthetic Index (DAI) was more versatile, time-saving and simple to use when being compared with other indices. This index can be used for different communities and populations without requiring any modification[18]. The DAI appears to be easy to use, but lack of assessment of traits such as buccal crossbite, open bite, centerline discrepancy and deep overbite is a limitation of this index. (Otuyemi and Noar, 1996a[19], b[20]).

It is found that both Index of Orthodontic Treatment Need (IOTN) and Dental Aesthetic Index (DAI) have their own criteria and advantages. These indices both are easy to be used and applied by the dental auxiliaries in the clinic. Studies have demonstrated that dentists of varying training and practical involvement can be easily trained to record the DHC and AC of the IOTN to a satisfactory level[21].Nowadays, both of the indices are widely been used by the students and clinicians. Jawad found the use of IOTN continue to rise in secondary care services with studies reporting that 33% of hospitals were using IOTN in 1991 which increased usage to 75% by 1994[21].

There were few limitations encountered during the study such as the usage of conventional ruler as this may affect the measurement obtained. Limited training time especially for DAI as the application of this index consider to be new among the students and they require longer period for training in order to improve the understanding towards new index. Lastly, the sample size that is used in this study is small when comparing with previous study done.

Conclusions

USIM clinical dental students able to determine the orthodontic treatment need using IOTN better than DAI and they also preferred to use IOTN more than DAI in determining severity of malocclusion.

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Declaration of Interest

The authors report no conflict of interest.

References

1. Borzabadi-Farahani. An insight into four orthodontic treatment need indices. Prog Orthod 2011; 12(2): 132-42.
2. Drummond RJ. 2003. Orthodontic Status and treatment need of 12-year-old children in South Africa: an epidemiological study using Dental Aesthetic Index. Master Thesis, University of Pretoria. Republic of South Africa. Retrieved from http://hdl.handle.net/2263/28580.
3. Koruyucu M, Ince EBT, Munevveroglu AP et al. Orthodontic Treatment Needs of Children: Comparison of Three Index. J Istanbul Univ Fac Dent. 2014;48(2):1–12.
4. Agarwal A, Mathur R. An overview of Orthodontic Indices. World J Dent. 2012; 3(1): 77-86.
5. Mitchell L. An introduction to orthodontics. 4th edition. Oxford: Oxford University Press; 2013:46.
6. Index of Treatment Need (IOTN). Available at: "https://www.chapelroad.co.uk/PDF's/IOTN.pdf". Accessed April 21, 2018
7. Bentele MJ, Vig KW, Shanker S. et al. Efficacy of training dental students in the Index of Orthodontic Treatment Need. Am J Orthod Dentofacial Orthop. 2002; 122(5): 456–62.
8. Chew MT, Aw AK. Appropriateness of orthodontic referrals: self-perceived and normative treatment needs of patients referred for orthodontic consultation. Community Dent Oral Epidemiology 2002; 30: 449–454.
9. Cubas YP, Hardy D, Dhillon DK. et al. Effectiveness of training dental students in two occlusal indices. J Dent Educ 2012; 76(6):739–45.
10. Spencer AJ, Allister JH, Brennan DS. Utility of the Dental Aesthetic Index as an orthodontic screening tool in Australia. Social and Preventive Dentistry, University of Adelaide. Southern Australia. 1992.
11. Cons NC, Jenny J, Kohout FJ. Associations of Dental Aesthetics Index (DAI) with dental appearance, smile and desire for orthodontic treatment. Journal of Dental Research 1987; 66: 1081.
12. Jenny J, Cons NC. Comparing and contrasting two orthodontic indices, the Index of Orthodontic Treatment Need and the Dental Aesthetic Index. American Journal of Orthodontics and Dentofacial Orthopedics 1996a; 110: 410 – 416.
13. Burden DJ, Garvin WC, Patterson C. A field trial of an orthodontic treatment needs learning package for general dental practitioners. Br Dent J 1997; 183: 123–129.
14. Manzanera D, Montiel-Company JM, Almerich-Silla JM, et al. Diagnostic agreement in the assessment of orthodontic treatment needs using the Dental Aesthetic Index and the Index of Orthodontic Treatment Need. Eur J Orthod. 2010;32(2):193–8.
15. Validity of two occlusal indices for determining orthodontic treatment needs of patients treated in a public university in Belo Horizonte, Minas Gerais State, Brazil. Available at: "http://www.scielo.br/pdf/csp/v27n3/18.pdf". Accessed April 21, 2018.
16. Loke ST. Efficacy of Training Dental Officers in the Index of Orthodontic Treatment Need (IOTN). Malaysian Dental Journal 2007; 28(1):16-23.
17. Holmes A, Willmot DR. The Consultant Orthodontists Group 1994 survey of the use of the Index of Orthodontic Treatment Need (IOTN). Br J Orthod. 1996; 23: 57–59.
18. Corneaga A, Dănilă, I, Balcos C. Assessment of orthodontic treatment needs of schoolchildren from Iasi according to Index of Orthodontic Treatment Needs (IOTN) and Dental Aesthetic Index (DAI). Romanian Journal of Oral Rehabilitation 2011; 3(4):27-32.
19. Otuyemi OD, Noar JH. A comparison between DAI and SCAN in estimating orthodontic treatment need. International Dental Journal 1996a; 46: 35 – 40.
20. Otuyemi OD, Noar JH. Variability in recording and grading the need for orthodontic treatment using the HMAR, OI and DAI. Community Dentistry and Oral Epidemiology 1996b; 24: 222 – 224.
21. Jawad Z, Bates C, Hodge T. Can dental registrants use the Index of Orthodontic Treatment Need accurately? Part 1: Knowledge of IOTN among dental registrants. British Dental Journal 2016; 220(10):527-532.