

Orthodontic Treatment Need and Demand among 12- and 16 Year-Old School Children in Malaysia

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Abstract

Background of the study: Assessment of orthodontic treatment need and demand helps in planning orthodontic services and estimating the required resources and man power. The aim of this study was to assess the orthodontic treatment need and demand and to assess the association between the orthodontic treatment demand and factors such as IOTN, gender, and age.

Materials and methods: Treatment need was assessed using the DHC and AC of IOTN among 12- and 16-year-old Malay school children. The treatment demand was also assessed through a modified health questionnaire and its association with IOTN, age, and gender. A total number of 837 Malay school children were randomly recruited (389 males and 448 females divided into two age groups; 12-year olds; and 16-year olds).

Results: Findings showed that 51.4% of 12-year-old school children had definite need for treatment (DHC>4) while 22% of them desired treatment. Among 16-year-old subjects, 56.4% showed definite need for treatment while 47.2% desired treatment. The 16-year-old group was more interested in orthodontic treatment than the 12-year-old group (P<0.001). Only age was associated with treatment demand while gender had no effect (P>0.05).

Conclusion: There is a high level of need for treatment among Malay school children which was not associated with orthodontic demand. Age was associated with orthodontic demand.

Key Words: Index of Orthodontic Treatment Need (IOTN), Malay, Treatment Demand

Introduction

The assessment of malocclusion and orthodontic treatment need is necessary to plan for public health purposes and training programs for specialists. Malocclusion, particularly when it is more evident in anterior teeth, has tremendous social impact in terms of perceived attractiveness, employability and school functioning. It is therefore necessary to determine the prevalence of orthodontic treatment need and demand which is currently unavailable for the Malay population.

A variety of occlusal indices have been described in orthodontic literature. Angle's and incisor classification of malocclusion were diagnostic indices used to describe incisor and buccal segments relationships separately serving their purposes reasonably well and allowing ease of communication between orthodontists. However, these clinical assessments do not really reflect the priority of treatment need as they do not describe the severity of malocclusion.

Dental epidemiologic indices were further introduced to allow estimation of the prevalence of malocclusion in a given population such as Summer's occlusal index, Darker's HLD index, and the FDI method. Other attempts developed indices of treatment need based on a patient's dental appearance. One such example is the Dental Aesthetic Index. Again, these assessments were not based on treatment priorities. The Index of Orthodontic Treatment Need (IOTN) is one of the most widely used occlusal indices worldwide [1,2]. It was developed with the intention to identify those individuals who would be most likely to benefit from orthodontic treatment. It is essentially a method of defining the severity or degree of occlusal traits that may constitute a threat to the longevity of the dentition. These traits are then allocated into grades which

define the priority of treatment need. The index incorporates both a Dental Health Component (DHC) [3] which is a five-level severity scale, and an Aesthetic Component (AC) [4] which records the aesthetic need for orthodontic treatment using a ten grade standardized ranking scale of colored photographs showing different levels of dental attractiveness. The two components are analyzed separately and although they cannot be united into a single score, they can be combined to classify the patient's orthodontic treatment need as Yes or No. The IOTN has been shown to be valid and reproducible [5]. The index was also modified to ensure greater reliability especially when used by non-specialists in oral health surveys [6].

Orthodontic treatment demand is the desire to receive orthodontic care for oneself (or one's child or significant other). Orthodontic treatment need and demand varies in children and adolescents in different populations [7-9]. The primary objective of this study was to determine the orthodontic treatment need and demand of Malay population through a broad representative sample of the school-aged child population. The secondary aim was to compare the findings with those from other populations and to assess the association between the treatment demand and factors such as the treatment need, gender, and age of the subjects.

Materials and Methods

This cross-sectional study evaluated orthodontic treatment need and demand among Malay school children aged 12- and 16-years old. The study was approved by the Research and Ethics Committee of the Health Campus in Universiti Sains Malaysia. In addition, parents' informed consent and children's approval form were obtained. The schoolchildren

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were divided into two age groups: 1) 12-year olds (210 males and 218 females); and 2) 16-year olds (179 males and 230 females). Schoolchildren wearing orthodontic appliances or with a history of previous orthodontic treatment were excluded from the study. Systematic random sampling was used to select the required number of subjects and to ensure a representative sample of the population, accounting for gender and social class variations. The final sample size was 837 school children (428 subjects for the 12-year old group and 409 subjects for the 16-year old group).

Assessment of orthodontic need by IOTN

Upper and lower alginate impressions were made and orthodontic study models were prepared of the same type of plaster and trimmed in the same manner. Numbers were then randomly assigned to each model and marked in pencil with no other means of identification. IOTN was tested by two calibrated orthodontists in order to estimate the treatment need. As it is known, The IOTN records the need for treatment based on two components: the Dental Health Component (DHC) and the Aesthetic Component (AC). The DHC-IOTN consists of a hierarchical scale with five levels: level 1 represents little or no need for treatment and level 5 represents a great need for treatment. It evaluates the malocclusion by means of five characteristics: tooth loss, overjet, crossbite, displacement of the contact point, and overbite. On the other hand, The AC-IOTN consists of a scale of ten coloured photographs showing different levels of dental attractiveness. The matching is allocated for overall dental attractiveness rather than specific morphological similarity to the photographs. Needs are categorized as follows: Pictures (1-4) little or no treatment required, (5-7) moderate or borderline treatment required while (8-10) represent definite treatment.

Examiner reliability

To test intra-examiner and inter-examiner agreement, 90 study models from both groups were re-examined two weeks later by the same assessors. The reliability and reproducibility of the ranking were determined using the linear weighted Kappa (k) statistical test. For ordered categorical data, it has been suggested that a kappa value of more than 0.60 represents good agreement and more than 0.80 indicates a very good

strength of agreement [10].

Assessment of orthodontic demand

To index the participants' demand for orthodontic treatment, a specially designed questionnaire was conducted by both examiners through structured face-to-face interviews with schoolchildren. The questionnaire was modified from the National Health and Nutrition Survey. It had 5 potential responses: "not very interested", "not interested", "not sure", "interested", and "very interested". The responses were dichotomized to desire for treatment (responses of "interested", and "very interested") and no desire for treatment ("not very interested", "not interested", and "not sure").

Statistical analysis

All the data were collected and entered into the Statistical Package for Social Sciences program for statistical analysis (version 17, SPSS, Chicago, Ill). Gender and age differences in orthodontic treatment need were compared by using the chi-square test. Kappa statistics were used to analyze the agreement between the DHC and the AC of the IOTN and any P values less than 0.05 were interpreted as statistically significant

Results

Tables 1 and 2 show both IOTN components distribution among the study sample. Using the DHC-IOTN component, researchers found a definite need for treatment in 53.9%, moderate need in 24.9%, and no need for 21.2%. Using the AC-IOTN assessment, researchers found 46.7% had definite need for treatment, 29% had moderate need, and 24.3% had no need. In subgroup analysis, 51.4% of the 12-year old group and 56.4% of the 16-year old group had a definite need for treatment when the researchers used the DHC-IOTN, while 43.7% of the 12-year old group and 49.9% of the 16-year old group had a definite need for treatment when using the AC-IOTN component. Assessment of agreement between the DHC and the AC components of the IOTN showed that the kappa statistic values for the diagnostic agreement was 0.86 (95% CI, 0.77–0.91), indicating very good agreement.

Table 3 shows the demand for orthodontic treatment

Table 1. Distributions of DHC- IOTN grades within the sample and within categorical variables.

	Total	IOTN Grades		
		No need Grade 1 and 2 n (%)	Borderline Grade 3 n (%)	Definite need Grade 4 and 5 n (%)
All	837	178(21.2)	208(24.9)	451(53.9)
Male	389	74(19.0)	101(26.0)	214(55.0)
Female	448	104(23.2)	107(23.9)	237(52.9)
12-year-old*				
All	428	87(20.4)	121(28.2)	220(51.4)
Male	210	38(18.1)	61(29.0)	111(52.9)
Female	218	49(22.5)	60(27.5)	109(50.0)
16-year-old*				
All	409	91(22.2)	87(21.3)	231(56.4)
Male	179	36(20.1)	40(22.3)	103(57.6)
Female	230	55(23.9)	47(20.4)	128(55.7)

Table 2. Distributions of AC-IOTN grades within the sample and within categorical variables.

	AC-IOTN Grades			
	Total	No/little need (1-4) n (%)	Borderline (5-7) n (%)	Definite need (8-10) n (%)
All	837	203(29.0)	243(29.0)	391(46.7)
Male	389	83(21.3)	115(29.6)	191(49.1)
Female	448	120(28.6)	128(28.6)	200(44.6)
12-year-old*				
All	428	99(23.1)	142(33.2)	187(43.7)
Male	210	42(20.0)	70(33.3)	98(46.7)
Female	218	57(26.1)	72(33.0)	89(40.8)
16-year-old*				
All	409	104(25.4)	101(24.7)	204(49.9)
Male	179	41(22.9)	45(25.1)	93(52.0)
Female	230	63(27.4)	56(24.3)	111(48.3)

Table 3. Association of (DHC) and (AC) with demand for orthodontic treatment.

Variable	Total (837)	Demand n (%)	No Demand n (%)	χ^2 statistic ^a (df)	P-value
D.H.C					
No need	178	61(29.2)	126(70.8)	15.8(12.0)	0.2000
Need	659	226(34.3)	433(65.7)		
A.C					
No need	203	69(34.0)	134(66.0)	11.6(2.0)	0.184
Need	634	218(34.4)	416(65.6)		

Chi-square test (Significant when $P < 0.05$).

and its association with both IOTN components. Using the DHC-IOTN component, researchers found that 29.2% of participants who had no need for treatment desired treatment. Also using the DHC-IOTN, the researchers found 34.3% of the participants who had a definite need for treatment also desired treatment. For the AC-IOTN component, 32.3% of the subjects who had no definite need for treatment did desire treatment. There were 36.1% of participants who had a definite need for treatment who did desire treatment.

Table 4 shows the association of orthodontic demand with the age and gender; the researchers found that the 16-year old group was more desirous for orthodontic treatment (41.5%) more than the 12-year-old group (27.6%) with $P < 0.001$. however, results showed no significant associations between orthodontic treatment desire and sex ($P = 0.273$).

Discussion

In a previous study, the Aesthetic Component of the IOTN was used to reflect the perception of malocclusion by Malay children and parents respectively [11]. The current study involves careful evaluation of orthodontic treatment need and demand in Malaysia.

It should provide the region with a level of information that is presently unavailable. The data will permit the first comparison with other studies where a similar index has been used as well.

Malocclusion is the only dental anomaly which varies considerably according to the population [12]. For many years, epidemiological studies of malocclusion suffered from disagreement among investigators about how much deviation from normal should be accepted. Considerable variations exist in the reported prevalence of orthodontic treatment need. As

mentioned earlier, there are number of orthodontic treatment need indices, however, they are not evidence based [13]. These indices, however, have been used for epidemiological studies to assist resource allocation.

The results of current study showed that 53.9 per cent of schoolchildren had a definite need for orthodontic treatment. This is considered high compared to previous studies which used a similar index where approximately one third of the population were considered to be in need of orthodontic treatment. Holmes [14] reported a prevalence of 32 per cent in a survey of 12-year-old British schoolchildren and Crowther et al. [15] had a similar finding of 31.3 per cent in 10-year-old New Zealand schoolchildren. In the United States, a public health survey for 12- to 17-year old students revealed that 29 per cent had a definite need [16]. Other cross-sectional study revealed that 36.1% of Iranian school children had definitive orthodontic treatment need [17]. However, our results were comparable with the 53 per cent for 18-year-old Swedish males [18] and with the 48.9% of 14–15-year-old schoolchildren in Lithuania [19].

The AC scale is based on visual stimuli, nevertheless. The IOTN- AC, being a clinician based measure proved that clinicians' ratings are in agreement with the objective assessment of IOTN-DHC measure as indicated in this study with 46.7% of the sample had a definite need according to the IOTN-AC. However, aesthetic orthodontic indices have some limitations such as their subjective nature which make them unsuitable for scientific data collection [20,21].

Dissatisfaction with one's dentofacial appearance, the influence of schoolmates who are in orthodontic treatment, gender, age, intellectual level, social class, severity of the

malocclusion are among the main factors directly involved in the demand for orthodontic treatment [22-25]. The influence of these factors depends on the cultural and social characteristics of each subgroup of the population [26].

The results of the present study revealed that 287 (34.3%) subjects demanded orthodontic treatment from the study sample. However, researchers estimated need as 78.7% using the DHC-IOTN component and 75.7% using the AC-IOTN component which means that need exceeds demand. In the same way, in Hong Kong, 25 students out of 105 desired orthodontic treatment while 87 had a need for orthodontic according to IOTN (30 borderline and 57 definite need) [27]. This may suggest that south east Asians are more tolerant to the aesthetic effects of malocclusion than other populations. In an epidemiological study, the orthodontic concern expressed by school children in Brazil was greater than the normative need for orthodontic treatment [27]. In another study, while the demand for orthodontic treatment among Jordanian students was 49 per cent, approximately half of them (54 per cent) had a need for orthodontic treatment [28]. Nevertheless, the lower recognition of treatment need for our study group suggests possible future oral health problems and a lower oral health quality of life. In this context, two factors to be highlighted; a large portion of subjects with malocclusion were unable to enjoy the benefits of treatment due to the financial costs involved. In addition, cultural and socioeconomic status

16-year-old age group showed higher demand for treatment than 12-year-old group ($P < 0.05$).

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variations among races and countries may play a role; a certain type of malocclusion which is considered aesthetically unacceptable by one population (teeth proclination for example) may be a sign of beauty for another population [22].

Concerns over appearance, dental attractiveness, and related treatment demands are thought to be affected by gender, social class and age [23,24]. In spite of the fact that girls are thought to be more critical regarding their appearance [12,28], the insignificant gender difference in terms of orthodontic treatment demand obtained from this study ($P=0.273$) was an interesting finding since such relationships still raise controversy in the literature.

The 16 year-old group showed more demand for orthodontic treatment when compared to the 12 year-old group ($P < 0.001$). The difference could be due to the effect of malocclusion on the oral health and on health in general and may indicate that the older age group had developed an ability to make a decision about their oral perception with the hope to be treated.

Conclusion

There is a high level of definitive orthodontic treatment need among Malay school children as assessed by both components of the IOTN. The orthodontic treatment need recognized by the researchers was not appropriately recognized as a demand by many participants. No significant difference in orthodontic treatment need in terms of gender was detected while the

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