Orthodontic Treatment Need of Children in Trinidad and Tobago

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ABSTRACT

Objective: *This prospective cross-sectional study was undertaken to determine the normative and perceived orthodontic treatment needs of children aged 11−12 years in a Caribbean country, Trinidad and Tobago.*

Methods: *One author, an experienced orthodontist, examined 367 children using the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN) to assess the normative need. The same orthodontist administered the questionnaire to assess the patient's perceived needs using the Aesthetic Component (AC) of the IOTN and the Oral Aesthetic Subjective Impact Scale (OASIS).*

Results: *The DHC and the AC of the IOTN and the OASIS showed respectively that 61.4%, 2.5% and 0.6% of the children had definite need for orthodontic treatment. The female proportion of the sample was more than the target population but the perceived need and normative need for orthodontic treatment did not depend significantly (*$p < 0.05$*) on the gender or ethnicity of the subjects of this study. The perception of need for orthodontic treatment differed inversely from the normative need and this is seen to be significant (*$p < 0.05$*) when OASIS was used.*

Conclusions: *Approximately three out of five children in Trinidad and Tobago have a great (or very great) need for orthodontic treatment for dental health reasons.*

Keywords: Index of Orthodontic Treatment Need (IOTN), normative need, Oral Aesthetic Subjective Impact Scale (OASIS), perceived need

Necesidad de Tratamiento Ortodóntico de los Niños en Trinidad y Tobago

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RESUMEN

Objetivo: *Este estudio prospectivo transversal fue emprendido con el objeto de determinar las necesidades del tratamiento ortodóntico normativo y percibido para niños de 11–12 años de edad en un país caribeño – Trinidad y Tobago.*

Métodos: *Un autor – ortodoncista experimentado – examinó a 367 niños usando el Componente de Salud Dental (DHC) del Índice de Necesidad del Tratamiento Ortodóntico (IOTN) para evaluar la necesidad normativa. El mismo ortodoncista aplicó la encuesta para evaluar las necesidades percibidas del paciente usando el Componente Estético (CA) del IOTN y Escala ortodóntica de impacto estético subjetivo (OASIS).*

Resultados: *El DHC y el CA del IOTN y el OASIS mostraron respectivamente que 61.4%, 2.5% y .6% de los niños tenían una necesidad definida de tratamiento ortodóntico. La proporción de hembras de la muestra fue mayor que la población objetivo, pero la necesidad percibida y la necesidad normativa de tratamiento ortodóntico no dependía significativamente (*$p < 0.05$*) del género o etnicidad de los sujetos de este estudio. La percepción de la necesidad de tratamiento ortodóntico difería inversamente de la necesidad normativa y puede verse que es significativa (*$p < 0.05$*) cuando el OASIS fue usado.*

Conclusiones: *Aproximadamente tres de cada cinco niños en Trinidad y Tobago tienen una necesidad grande (o muy grande) de tratamiento ortodóntico por razones de salud dental.*

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Palabras claves: Índice de necesidad de tratamiento ortodóntico (IOTN), necesidad normativa Escala ortodóntica de impacto estético subjetivo (OASIS), necesidad percibida

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INTRODUCTION

Various occlusal indices have been developed which assess the severity of malocclusion and aid in determination of the normative need for orthodontic treatment (1−6). However, several studies have shown that self-perceived dental appearance is an important determinant in the decision to seek orthodontic treatment (7−10). Referrals are usually based on professional opinions but it is the patient's perception of orthodontic treatment need with respect to both aesthetics and function that is the main factor which encourages them to seek treatment (11). For these reasons, perceived treatment need must also be determined and considered simultaneously with normative treatment need for manpower planning.

The Index of Orthodontic Treatment Need (IOTN) is useful for defining the severity or degree of occlusal traits and has been used as an epidemiological tool to assess treatment need among school children (12−14). It incorporates both a Dental Health Component (DHC) as first described by Brook and Shaw (2) and an Aesthetic Component (AC) described by Evans and Shaw (15). The validity and reliability of the IOTN have been established in several studies (16−18).

The Oral Aesthetic Subjective Impact Scale (OASIS) is a relatively new independent self-evaluation tool which has been used to measure perceptive treatment need (19−20). It is a consumer-based measure based on a child's perceived socio-psychological impact of their malocclusion (19). This scale measures the childhood impact of external influences by asking questions about their perceptions of others and themselves, as well as about their previous behaviour related to the appearance of their teeth. The validity of OASIS is supported by its correlation with the normative IOTN AC, which may be considered as the gold standard (21).

Studies have been published that determined the orthodontic treatment needs of children in many countries. However, there is no publication of a well-conducted study on children representative of a Caribbean country. In this study, both the normative and perceived orthodontic treatment needs of 11- to 12-year old children in Trinidad and Tobago were assessed and analysed using the IOTN and the OASIS. The main aim of this study was to determine these normative and perceived needs. The second aim was to test the validity of the OASIS self-evaluation tool in expressing the orthodontic treatment need of children in a Caribbean country, Trinidad and Tobago.

SUBJECTS AND METHODS

After obtaining approval from the Ethics Committee of the Faculty of Medical Sciences of The University of the West Indies, St Augustine, subjects were selected from the target population of 11- to 12-year-old school children of Trinidad and Tobago. Trinidad and Tobago is a twin island Caribbean country with an area of 5128 km^2. The population at the time of the study, January to April 2009, was estimated at 1 310 106. The mean population density was 257 per km^2. The ethnic composition of the population of the country is: African, 38%, East Indian, 40%, mixed, 20%, and Caucasian, Chinese or 'other', 2%. The secondary school enrolment for 2008/2009 was estimated to be 79 600 but only approximately two-thirds of the first year school children during the period of data collection was eleven or twelve years old, therefore the size of the target population was approximately 10 880. The ratio of girls to boys in secondary school was approximately 1.06:1 (22).

Subjects were selected by a stratified cluster sampling method (23). Trinidad and Tobago was divided into five geographical zones (North-West, North-East, Central, South and Tobago) for random selection of an all-boys school, an all-girls school and a co-educational school in each zone. Subjects were recruited from participating schools by obtaining informed consent from their parent/guardian; a small percentage was excluded if they had present or past experience of orthodontic appliance treatment.

A total of 367 subjects were examined but four subjects (3 Chinese and 1 Caucasian) were dropped; although they represent their minority proportionally accurately in the sample, they were too small as one or two subgroups to represent their ethnicities statistically. Hence, data from 363 subjects (159 boys and 204 girls) with a mean age of 11.93 + 0.27 years who represented approximately 3.3% of the target population were analysed.

Permission was obtained from the Ministry of Education of Trinidad and Tobago to perform the examinations during school hours. A well-lit room was provided in each school for the interview and clinical examination. All eligible subjects were asked to complete the OASIS questionnaire (Fig. 1). Their age, gender, race and geographic area of residence were also recorded. The subjects were then presented with 10 coloured photographs of anterior teeth displaying varying degrees of malocclusion, and were asked to evaluate which photograph on this aesthetic scale most closely resembled their own dentition to let them determine

(Please answer the following questions by circling the best possible option)

1. How do you feel about the appearance of your teeth?
   1 2 3 4 5
   Not concerned at all somewhat concerned Very concerned

2. Have you found that other people have commented on the appearance of your teeth?
   1 2 3 4 5
   Not at all sometimes All the time

3. Have you found that other people have teased you about the appearance of your teeth?
   1 2 3 4 5
   Not at all sometimes All the time

4. Do you try to avoid smiling because of the appearance of your teeth?
   1 2 3 4 5
   Not at all sometimes All the time

5. Do you ever cover your mouth because of the appearance of your teeth?
   1 2 3 4 5
   Not at all sometimes All the time

Fig. 1: Oral Aesthetic Subjective Impact Scale (OASIS) questionnaire.

their IOTN AC score in the range of 1 to 10 with 1 for the best occlusion and 10 for the worst malocclusion using aesthetic criteria (15). They were initially shown a face mirror which was then removed so that they refreshed their memory but were not allowed continuing self-examination while viewing the photographs. Finally, the subjects were carefully examined using gloves and mouth mirrors (by the first author) to determine their IOTN DHC score using morphologic criteria as shown in Table 1. To assess for the reliability of the IOTN rating, 30 children were re-examined by the first author one month later in two schools.

For each of the three assessment tools, IOTN DHC, IOTN AC, and OASIS, patients were categorized into three groups as having: (i) little/no need; (ii) borderline need; or (iii) definite need (Table 2). Frequencies and percentages were determined for each of these groups, gender, ethnicities, and the worst features of malocclusion used to determine the IOTN DHC.

Table 1: Hierarchical scale of occlusal anomalies for assessment of orthodontic treatment need according to the DHC of the IOTN

Grade 5 (definite treatment need)	*Grade 3* (moderate treatment need)
5.a Increased overjet greater than 9 mm	3.a Increased overjet greater than 3.5 mm but less than or equal to 6 mm with incompetent lips
5.h Extensive hypodontia with restorative implications (more) than 1 tooth missing in any quadrant) requiring pre-restorative orthodontics	3.b Reverse overjet greater than 1 mm but less than or equal to 3.5 mm
5.i Impeded eruption of teeth (except for third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth and any pathological cause	3.c Anterior or posterior crossbites with a discrepancy of more than 1 mm but less than or equal to 2 mm between retruded contact position and intercuspal position
5.m Reverse overjet greater than 3.5 mm with reported masticatory and speech difficulties	3.d Contact point displacements greater than 2 mm but less than or equal to 4 mm
5.p Deflects of cleft lip and palate and other craniofacial anomalies	3.f Deep overbite complete on gingival or palatal tissues but no trauma
5.s Submerged deciduous teeth	
Grade 4 (definite treatment need)	*Grade 2* (minimal treatment need)
4.a Increased overjet greater than 6 mm but less than or equal to 9 mm	2.a Increased overjet greater than 3.5 mm but less than or equal to 6 mm with competent lips
4.b Increased overjet greater than 3.5 mm with no masticatory or speech difficulties	2.b Reverse overjet greater than 3.5 mm but less than or equal to 1 mm
4.d Severe contact point displacements greater than 4 mm	2.c Anterior or posterior crossbite with a discrepancy of less than or equal to 1 mm between retruded contact position and intercuspal position
4.e Extreme lateral or anterior open bite greater than 4 mm	2.d Contact point displacements greater than 1 mm but less than or equal to 2 mm
4.f Increased and complete overbite with gingival or palatal trauma	2.e Anterior or posterior open bite greater than 1 mm but less than or equal to 2 mm
4.h Less extensive hypodontia requiring prerestorative orthodontics or orthodontic space closure to obviate the need for a prosthesis	2.f Increased overbite greater than or equal to 3.5 mm without gingival contact

4.m Reverse overjet greater than 1 mm but less than 3.5 mm with recorded masticatory and speech difficulties

4.l Posterior lingual crossbite with no functional occlusal contact in 1 or both buccal segments

4.t Partially erupted teeth, tipped and impacted against adjacent teeth

4.x Presence of supernumerary teeth

2.g Pre-normal or post-normal occlusions with no other anomalies (includes up to half a unit of discrepancy)

Grade 1 (no treatment need)

1 Extremely minor malocclusion including contact point displacements of less than 1 mm

The Chi-square test of independence was used to test for any dependency on gender or ethnicity for normative and perceptive treatment needs (IOTN DHC, IOTN AC and OASIS) in the sample. The significance of the treatment needs for the whole sample was assessed using the Chi-square test of equality. Association between normative need and perception assessment measures in the whole sample was also tested using the Chi-square test of independence.

One specific interest was to determine the validity of the use of the OASIS by assessing its correlation with the IOTN components for the whole sample. It should be noted that all three measures, OASIS, DHC and AC, are rankings with different ranges but they were homogenized into three categories of treatment need; hence the Chi-square test of independence is the appropriate statistical test of the null hypothesis of no correlation.

Intra-examiner reliability was tested using normative orthodontic treatment need data obtained from the repeated examinations to calculate the Pearson correlation coefficient. SPSS, the Statistical Package for the Social Sciences (version 16.0, SPSS, Inc., Chicago, Illinois, USA) was used to analyse the data. A five per cent significance level was set for all tests.

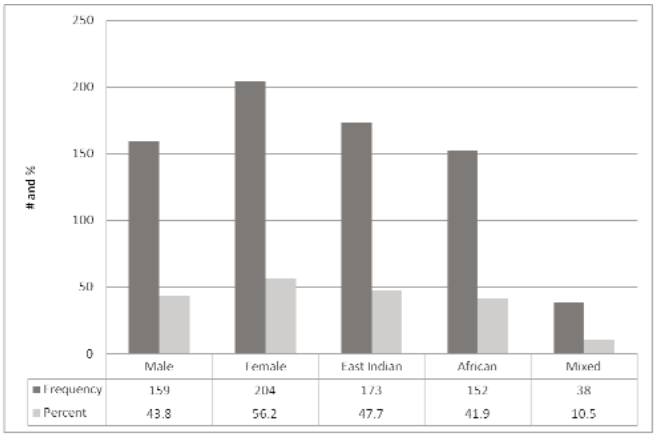

Fig. 2: Distribution of gender and ethnic groups of subjects.

Table 2: Levels of treatment need

	Little/no need	Moderate need	Definite need
IOTN DHC	1 to 2	3	4 to 5
IOTN AC	1 to 3	4 to 6	7 to 10
OASIS	5 to 10	11 to 15	16 to 25

IOTN DHC/AC = Index of Orthodontic Treatment Need Dental Health Component/Aesthetic Component; OASIS = Oral Aesthetic Subjective Impact Scale

RESULTS

Frequencies and percentages for gender and ethnicities of the sample of 363 school children are shown in graphical and tabulated form in Fig. 2. The age of this sample had a mean of 11.9 years with a standard deviation of 0.27 years.

The intra-examiner reliability for the DHC of the IOTN (number/grade; and letter *ie* worst feature of malocclusion) was almost perfect with mean correlation coefficients of 0.96 and 0.96.

Table 3 shows the frequency distribution of the worst features of malocclusion that were identified in the sample and thus used to determine the DHC of the IOTN. The vast majority of the worst features were contact point displacements (80.4%) which were a result of crowding and increased overjet (12.4%).

Numerical comparison of frequencies of the orthodontic treatment needs is helpful (Table 4) and visual assessment with graphs (Figs. 3−5) is even more so. Figure 3 shows that using the DHC of the IOTN, 61.4% of the sample had a definite need for orthodontic treatment, 20.4% had a moderate need while only 18.2% were assessed as having little/no need. The AC of the IOTN used by the children indicated that 2.5% perceived their level of orthodontic treatment need to be definite, 25.3% moderate and 72.2% thought their orthodontic treatment need was little/none (Fig. 4). Results with OASIS show that their need was perceived to be definite by 0.6%, moderate by 33.3% and little/none by 66.1% (Fig. 5).

Chi-square tests of independence showed that the need for orthodontic treatment using the IOTN DHC and AC, and OASIS, does not depend significantly on ethnicity as χ^2 was 8.355, 1.834 and 7.371, respectively (compared to the test

Table 3: Distribution of the worst features of malocclusion

DHC letter	Frequency	Per cent
a	45	12.4
b	1	0.3
c	1	0.3
d	292	80.4
e	0	0
f	0	0
g	0	0
h	6	1.7
i	1	0.3
l	0	0
m	4	1.1
p	0	0
s	0	0
x	1	0.3
No letter	12	3.3
TOTAL	**363**	**100.0**

Table 4: Distribution of orthodontic treatment needs: frequency (%)

	Little/No need	Moderate need	Definite need
DHC	66 (18.2)	74 (20.4)	223 (61.4)
AC	262 (72.2)	92 (25.3)	9 (2.5)
OASIS	240 (66.1)	121 (33.3)	2 (0.6)

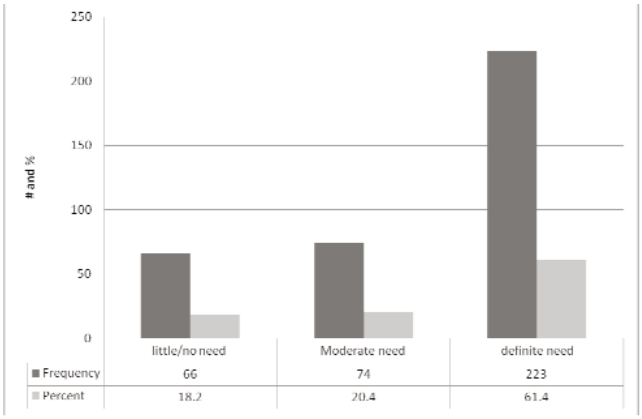

Fig. 3: Severity of treatment need found with the Index of Orthodontic Treatment Need Dental Health Component (IOTN DHC).

value of 9.488 with df = 4). Similarly, Chi-square tests of independence showed that the need for orthodontic treatment using the IOTN DHC and AC, and OASIS, does not depend significantly on gender either, as χ^2 was 5.068, 1.784 and 2.498, respectively (compared to the test value of 5.991 with df = 2). Chi-square tests of equality confirmed that the results for the IOTN DHC and AC, and OASIS are significant as χ^2 was 129.240, 274.926 and 234.066, respectively (compared to the test value of 5.991 with df = 2).

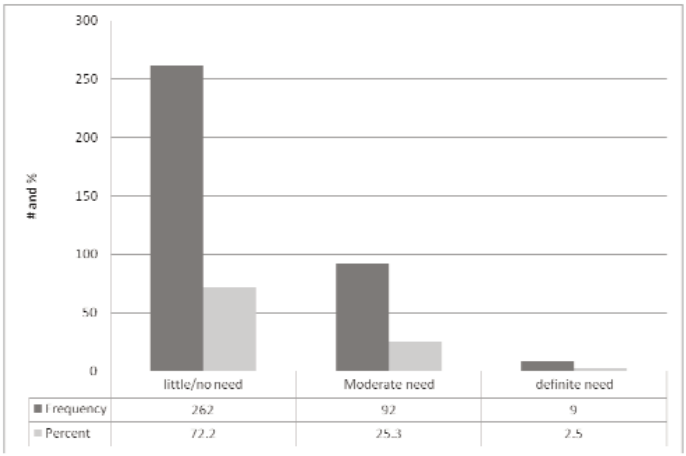

Fig. 4: Severity of treatment need found with the Index of Orthodontic Treatment Need Aesthetic Health Component (IOTN AC).

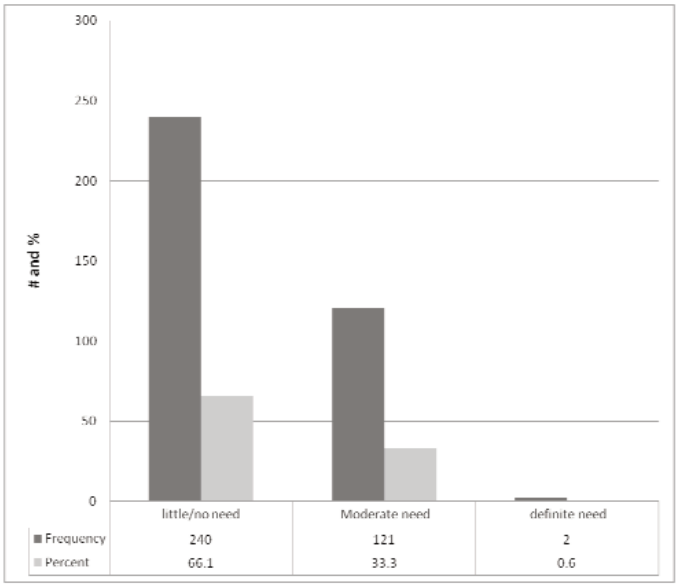

Fig. 5: Severity of treatment need found with the Oral Aesthetic Subjective Impact Scale (OASIS).

Results of Chi-square tests of independence calculated for cross-tabulation comparisons of normative and perceptive needs data for the whole sample are displayed in Table 5. These tests show that the inverse association between the DHC of the IOTN and OASIS is significant; for the DHC and AC of the IOTN, this is not significant. However, the association between the two perceptive needs, the AC of the IOTN and OASIS, is also statistically significant.

DISCUSSION

Ethnic and gender ratios in the sample were similar to those seen in the target population. Despite the aforementioned need for removal of minority ethnicities from the studied

Table 5: Statistical comparisons of normative and perceptive treatment needs

	χ^2	df	Level of significance
DHC *versus* AC cross tabulation	8.884	5	Not significant
DHC *versus* OASIS cross tabulation	18.482	4	Significant
AC *versus* OASIS cross tabulation	36.193	4	Significant

sample, these characteristics and sample size indicate that the sample should be highly representative of the target population, children of age 11−12 years in Trinidad and Tobago.

The chronological age range of 11−12 years is commonly associated with the early permanent dentition stage. This makes it the earliest age at which the IOTN can be used as intended. At this early age, the percentage of the target population that has started orthodontic fixed appliance treatment is at its lowest and the likelihood of loss of permanent tooth material affecting the IOTN disproportionally is greatly reduced; consequently, these two potential sources of error in epidemiological studies are reduced. As the IOTN is widely used for comparisons of orthodontic treatment needs of populations, the age range for this study also facilitated comparison with several other studies.

Contact point displacement was the most commonly found worst feature of malocclusion in the sample. This is observed in most populations but the incidence of this finding (80.4%) is much higher than what is reported for children in Senegal (49.4%), Kuwait (39.5%) and other populations (24−26). Similarly, our finding that 61.4% of 11- to 12-year old children in Trinidad and Tobago have a definite orthodontic treatment need according to the DHC of the IOTN is much higher than those reported for children in the following countries: Malaysia, 47.9% (27), Senegal, 42.6% (24), Turkey, 38.8% (28), the United Kingdom, 35% (29), Ireland, 30.4% (30), Kuwait, 28% (25) and northern Jordan, 34% (31). Although free primary dental care is available in Trinidad and Tobago and accessed by a significant percentage of the population (for patients with moderate or severe carious lesions), provision of this service is far too often limited to extraction of teeth; this is an important contrast to the range of primary dental services provided in most of the aforementioned countries. A relatively high prevalence of premature loss of deciduous molars (without space maintenance of the extraction space) and relatively short mandibles in Trinidad and Tobago are aetiological factors for crowding that are probably largely responsible for the large percentage of contact point displacements and, consequently, definite need for orthodontic treatment.

Using (OASIS and) the AC of the IOTN, only (0.6% and) 2.5% of the children in this study perceived their orthodontic treatment need to be definite and this is similar to the finding for children in Senegal, 3.2% (24). In Trinidad and Tobago, the children were observed to be more lenient than the orthodontist and this has been reported for other studies on significantly differing views of lay-persons and professionals; this is probably partly due to features of malocclusion involving posterior teeth not having an aesthetic impact (21, 32−35). Socio-economic factors (which, in Trinidad and Tobago, are mainly availability and perceived affordability of fixed appliance treatment and deprivation) have been found to influence the perceived need for orthodontic treatment in other studies and are probably even more influential in Trinidad and Tobago (29, 36). As most of these socio-economic factors usually co-exist in varying combinations that are difficult to isolate to pinpoint the extent of their influence on perceptive orthodontic treatment needs, few studies show convincing proof of hypothetical causes of a low level of agreement or actual disagreement of normative and perceptive orthodontic treatment needs.

The finding that perceptive orthodontic treatment needs did not differ significantly between ethnic groups in this study is supported by a similar result using the same perceptive orthodontic treatment need indices applied to 14- to 15-year old Asian and Caucasian children in Manchester, England (37). However, the finding that normative orthodontic treatment needs did not differ significantly between ethnic groups in Trinidad and Tobago is in disagreement with the findings of the study done in Manchester (37). As the two main ethnic groups (African and East Indian) are readily distinguishable physically and probably have different prevalence rates for particular features of malocclusion that are influenced by genetics more than the environment, this finding was expected for perceived treatment needs but not expected for normative treatment needs.

As seen in studies in Senegal, Kuwait and Manchester (England), that tested for effects of gender, we did not find any gender differences in perceptive treatment needs (24, 25, 37). Our finding of no gender dependency for normative treatment needs is in agreement with findings for Senegal and Kuwait but not for Manchester (24, 25, 37).

The perception of need for orthodontic treatment differed inversely from the normative need and this is seen to be significant ($p < 0.05$) when OASIS was used. The validity of OASIS has been supported by its correlation with the normative AC of the IOTN which may be considered as the gold standard (21). Although the AC of the IOTN can be used to indicate the likely level of demand for orthodontic treatment, OASIS appears to be the more appropriate tool to use to determine the patient's perceived need and is therefore a better indicator of the level of demand for orthodontic treatment.

CONCLUSIONS

This 2009 study has shown that 61.4% of school children in Trinidad and Tobago, regardless of their ethnicity or gender, were in definite need of orthodontic treatment for dental health reasons. The children's perceptive orthodontic treat-

ment need is best assessed using the OASIS but the children disagree with the professional in opinion on their orthodontic treatment need to the extent that the two sets of data have an inverse relationship. As perceptive orthodontic treatment needs are influenced by a multitude of varying socio-economic factors most of which cannot be clearly ascertained, the DHC of the IOTN should be considered as the most important factor in determining manpower requirements.

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