European Journal of Orthodontics 34 (2012) 646–651
doi:10.1093/ejo/cjr080
Advance Access Publication 1 August 2011

The perception of dental aesthetics and orthodontic treatment need by 10- to 11-year-old children

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SUMMARY The aim of the study was to assess the perception of dental aesthetics and treatment need in 10- to 11-year-old children using the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need. Subjects were asked to rank the 10 AC photographs in order from the one which looked the best set of teeth to the worst. They were also asked to say whether or not the teeth in each picture required orthodontic treatment. Three hundred and seventy-nine children completed the first task but only 369 were able to decide on treatment need for every picture. Girls ranked the pictures in the order 1, 3, 2, 4, 5, 6, 7, 9, 8, and 10; the boys' sequence was 1, 2, 3, 4, 5, 6, 9, 7, 8, and 10. Significant differences were found between girls and boys for the median rankings of photographs 2 ($P < 0.02$), 3 ($P < 0.004$), 5 ($P < 0.03$), 6 ($P < 0.05$), and 8 ($P < 0.01$). The sequence selected by the total sample was similar to that chosen by boys. The cut-off point for which photograph indicated a need for treatment was grade 4 (54.5 per cent), which was 34.7 per cent above the grade 3 score of 19.8 per cent. Three pairs of photographs were allocated similar median ranks, two and three received a rank of 3; five and six a rank of 6; and seven and nine a rank of 7. It is therefore possible that the number of AC grades could be reduced to the five photographs: 1, 4, 6, 8, and 10 in order to simplify the index without reducing its reliability. This premise could be tested by presenting firstly the five photographs and then the 10 on a separate occasion to see how the same participants rated the two sets of pictures.

Introduction

In the present climate of orthodontic provision in the United Kingdom National Health Service, the presence of a malocclusion that may appear obvious to a child and parents is not the only factor which determines whether or not treatment will be provided. In the past, the perception of treatment need depended upon subjective assessments by the patient and clinician. More recently, increasing demands for orthodontic treatment have created a need to allocate resources in a measurable way and a number of indices have been developed in order to standardize the assessment of treatment need and therefore provide greater uniformity of treatment provision.

The process was given impetus by the Shanschieff Report (HMSO, 1986), which identified a degree of over-treatment with regard to orthodontics within the general dental service in the UK. Indices of particular interest include the Index of Orthodontic Treatment Need (IOTN; Brook and Shaw, 1989), the Peer Assessment Rating (PAR; Richmond *et al.*, 1992), and the Index of Complexity, Outcome and Need (ICON; Daniels and Richmond, 2000).

Demand for orthodontic treatment has risen considerably over the past 20 years due improvements in treatment standards and changes in the perceptions by patients as to what is an aesthetically acceptable occlusion. The IOTN in particular has been used to prioritize the provision of treatment to individuals with the greatest need and therefore to allocate resources equitably.

Orthodontic indices use numerical scales to assess the severity of malocclusion and treatment need (Richmond *et al.*, 1997). The IOTN provides a way of defining those occlusal traits which affect an individual's dental health and it also identifies subjects who would be likely to benefit most from treatment (Brook and Shaw, 1989). The index is also used as an instrument for planning orthodontic provision (De Oliveira, 2003). It was developed from a combination of the Standardized Continuum of Aesthetic Need; (Evans and Shaw, 1987) and an index used by the Swedish Health Board (Linder-Aronson, 1974). There are two components to the IOTN, the Dental Health Component (DHC) and the Aesthetic Component (AC), which is based upon a series of 10 photographs (Figure 1).

Since the main motivation for many patients who seek orthodontic treatment is an improvement in appearance rather than function, the perception of dental appearance is of fundamental importance. It is also apparent that dental professionals are more likely than lay people to recommend that a particular malocclusion should be treated (Shaw *et al.*, 1975; Downer, 1987). Often, orthodontic treatment need is determined by a combination of socio-economic,

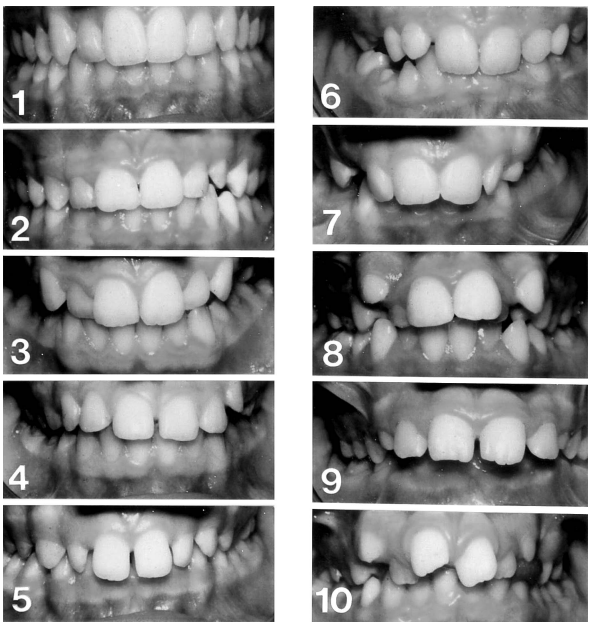

Figure 1 The 10 Index of Orthodontic Treatment Need (IOTN) Aesthetic Component (AC) photographs. Reproduced by kind permission of The Editor, *European Journal of Orthodontics* and under Licence from Oxford University Press.

ethnic, and cultural factors and is based on a mutual decision by the dentist in association with the patient and parents (Ahmed *et al.*, 2001).

The fact that the decision to seek orthodontic treatment is often influenced by the desire to look attractive (Burden, 1995) does not lessen the importance of that decision since self-esteem and body image are important factors to everyone (Birkeland *et al.*, 2000). For example, the prominence of the upper teeth has been shown to be an important factor in determining the social attractiveness of young adults (Shaw *et al.*, 1985). Consciousness about body image reaches a peak around the mid teens (Espeland and Stenvik, 1991) and girls tend to be more dissatisfied than boys with the appearance of their teeth (Shaw, 1981; Sheats *et al.*, 1998). Validation of the AC using professional opinion as the 'gold standard' has identified cut-off points for three categories of treatment need. Photographs 1–4 indicate 'no treatment need'; 5–7 indicate 'borderline need', and 8–10 'definite treatment need' (Richmond *et al.*, 1995).

The present study considers a re-evaluation of the method by which AC grades are identified. The basis of the method was that subjects were asked to place in order an unlabelled series of the 10 AC photographs.

The aims of the study were

1. To compare rankings made by a group of 10- to 11-year-old schoolchildren of dental aesthetics in the original sequence of 10 AC photographs.
2. To assess perceptions of orthodontic treatment need for each of the 10 photographs.
3. To determine whether perceptions of orthodontic treatment need by schoolchildren compared well with cut-off points introduced by professionals during the original validation of the AC of IOTN.

Materials and methods

Ethical approval

Ethical approval was obtained from the East Birmingham Local Research Ethics Committee prior to data collection (REC reference number: 06/Q2703/119).

Sample selection

The local education authority was contacted to obtain basic epidemiological data needed for sample selection. There were 82 primary schools in South Birmingham and Year 6 was chosen to represent the 10- to 11-year-old age group required for the present study. The total number of school children attending Year 6 classes in South Birmingham was 3691. Every 10th eligible child on each class register was included in the study since a sample size of around 10 per cent was considered to be representative of this target population. No statistical validation of sample size was attempted since neither inter-group comparison nor paired observations were part of the study (Altman, 1991).

The local education authority also provided a booklet entitled 'Starting your child at school' which included contact details of all the schools in Birmingham, UK. The list was used to select schools randomly for inclusion in the study; every third school in South Birmingham was selected, giving a total of 29 schools.

Selected schools were contacted by telephone and an appointment was made with the head teacher in order to obtain permission for the study. Of the 29 schools contacted, 5 were not interested and refused to arrange an appointment and 16 schools asked for additional information about the study to be sent in the post and indicated that they would be in contact if they were interested. Eight schools showed immediate interest and appointments were arranged with the head teachers of each of these schools.

A detailed explanation of the study was outlined at the initial appointment and if the head teacher agreed for the school to participate a date was arranged.

All eight schools visited agreed to participate in the study; however, it was not possible for data to be collected from one of the schools since a mutually agreeable date could not be arranged within the time constraints of the present study (i.e. before the summer holidays). Children from seven schools therefore formed the study sample. According to the ACORN system of classifying addresses into five socio-economic strata (CACI, 2011), three of the schools were in areas classified as 'Middle of the Road Britain' and four were from low income hard pressed areas, typical of the inner suburbs of a big city.

Subjects with previous experience of orthodontic treatment or who had learning difficulties were identified by the classroom teacher prior to data collection and excluded from the study.

Consent

During the process of obtaining ethical approval from the East Birmingham Local Research Ethics Committee, participation/consent forms for both parents and children were assessed and approved. Forms were given to the head teacher of each participating school for distribution to participating children 2 weeks prior to data collection. Children were asked to return a signed consent/participation form if they and their parent/guardian agreed to take part in the study. One of the authors (VS) was available on the day of the study to collect consent forms.

Methods

A simple data collection sheet was designed for subjects to record date of birth, gender, previous experience of orthodontic treatment, rankings of dental aesthetics, and assessments of orthodontic treatment need (Appendix 1).

The AC of the IOTN represents varying degrees of dental aesthetic impairment (Figure 1). The 10 numbered photographs were cut into equal-sized rectangles and the corresponding number of each was covered by a letter randomly picked from a hat. Photographs were then placed into a plastic envelope, in no particular order, and subjects were asked to arrange them from the 'one that looks best' to the 'worst set of teeth' and record their answers on the data collection sheet. Keeping the photos in order, subjects were then asked to determine whether each photo 'needed treatment with a brace to straighten the teeth' and record their answer on the data collection sheet.

In order to prepare an adequate number of data collection packs, the maximum number of pupils attending Year 6 was determined from two of the schools participating in the study. This number was found to be 30 pupils and a corresponding number of data packs were prepared.

Data collection

Data collection was carried out in the classroom by one of the authors (VS) with a teacher present. Examination conditions were maintained so that individual opinions were recorded without bias from peers or teachers. Each subject was given an individual pack containing a data collection sheet and 10 photographs.

Instructions were read out in the class room and children were told to make sure that they only looked at the teeth and not the gums when making their assessments. The lips are not shown on the IOTN pictures. Children had 15 minutes to complete the questionnaire and anyone who had a question was asked to raise their hand. Once the questionnaire was completed, the children were asked to replace the photographs in the envelopes and put their hand up so that their questionnaire could be collected.

Statistical analyses

Statistical analysis was carried out using the SPSS statistical package (SPSS Release 12.0.1 for Windows 2003. SPSS Inc., Chicago, Illinois, USA). Differences between male and female school children were examined using a chi-square test with significance levels set at $P < 0.05$.

Results

A total of 389 subjects from seven primary schools in South Birmingham participated in the study. The mean age was 11.3 years (SD = 0.3 years) and participants were almost equally divided according to gender (190 girls and 199 boys). Only fully completed questionnaires were included in the study. Fifteen participants failed to complete ranking for the 10 photographs, reducing the sample size to 374 (183 girls and 191 boys) and 5 failed to complete the assessment treatment need section (sample size = 369; 181 girls and 188 boys). Since the two tasks were separate exercises, all the completed forms for both sections were analysed.

Rankings of the 10 AC photos

Table 1 illustrates the sequences for the most frequently selected photographs at each AC grade. Girls reversed photos 2 and 3 and 8 and 9, whereas the sequence for boys was one, two, three, four, five, six, nine, eight, and seven. The sequence selected by the total sample was similar to that selected by boys.

Table 2 illustrates descriptive statistics of the rankings of the 10 AC photographs. For both genders, the median rankings of photographs 1, 4, 6, 7, 8, and 10 were identical to the original sequence of the AC of IOTN. The photograph

Table 1 Most frequent sequence selections for the 10 Aesthetic Component (AC) photographs of Index of Orthodontic Treatment Need (IOTN).

AC photo	1	2	3	4	5	6	7	8	9	10
Girls	1	3	2	4	5	6	7	9	8	10
Boys	1	2	3	4	5	6	9	7	8	10
Total sample	1	2	3	4	5	6	9	7	8	10

Table 2 Comparison of rankings of dental aesthetic grades by boys and girls.

AC grade	Girls (n = 183)			Boys (n = 191)			Total sample (n = 374)		
	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median
1	1.2	0.68	1	1.3	1.09	1	1.3	0.91	1
2	2.8	0.98	3	2.7	1.35	2	2.8	1.18	3
3	2.7	1.44	2	3.0	1.40	3	2.9	1.42	3
4	4.4	1.16	4	4.4	1.36	4	4.4	1.27	4
5	6.4	1.59	6	6.0	1.65	6	6.2	1.63	6
6	6.1	1.66	6	6.4	1.71	6	6.3	1.69	6
7	6.7	1.93	7	6.7	1.91	7	6.7	1.92	7
8	7.6	1.62	8	7.7	1.81	8	7.6	1.72	8
9	7.3	1.44	8	6.9	1.61	7	7.1	1.54	7
10	9.8	0.72	10	9.8	0.90	10	9.8	0.81	10

Table 3 Percentage distributions of perceptions of treatment need.

AC photo	Girls (n = 181)		Boys (n = 188)		Total sample (n = 369)	
	Need	No need	Need	No need	Need	No need
1	1.1	98.9	2.7	97.3	1.9	98.1
2	16.6	83.4	17.6	82.4	17.1	82.9
3	18.2	81.8	21.3	78.7	19.8	80.2
4	56.4	43.6	52.7	47.3	54.5	45.5
5	77.9	22.1	75.0	25.0	76.4	23.6
6	77.9*	22.1	86.7*	13.3	82.4	17.6
7	80.7	19.3	84.6	15.4	82.7	17.3
8	95.6	4.4	94.1	5.9	94.9	5.1
9	82.6	13.8	89.4	10.6	87.8	12.2
10	100	0	100	0	100	0

*Difference between genders significant, Chi Squared test ($P < 0.05$)

representing AC 5 was allocated the same median rank of 6 by both genders, while AC 9 was allocated a median rank of 8 by girls and 7 by boys. The median ranks allocated by girls for AC photos 2 and 3 were reversed from the numeric order. Combined data for both genders showed that AC photos 1, 3, 4, 7, 8, and 10 were allocated median ranks that were identical to the original sequence of the AC of IOTN. The photograph representing AC 2 was allocated a rank of 3, AC 5 a rank of 6 and AC 9 was allocated a rank of 7.

A chi-square test was used to compare rankings of girls and boys. Significant differences were demonstrated in the ranking of photographs 2, 3, 5, 6, and 8 ($P < 0.05$).

Perceptions of orthodontic treatment need

Table 3 illustrates percentage distributions of the perception of treatment need for each of the 10 AC photographs. Statistical analysis using chi-square tests showed that the only significant difference between genders was for AC 6, where a higher percentage of boys (86.7 per cent) than girls (77.9 per cent) perceived a need for treatment ($P < 0.05$). Data were therefore pooled for further analysis.

The majority of subjects did not perceive a need for treatment for AC grades 1–3, whereas around half (54.5 per cent) perceived a need for treatment of AC 4. Perceptions of treatment need for AC 6 and 7 were similar (82.4 and 82.7 per cent, respectively). A higher proportion of subjects perceived treatment need for AC 8 than for AC 9 (94.9 and 87.8 per cent, respectively) while all subjects perceived need for treatment of AC 10.

Figure 2 illustrates perceptions of need versus no need for treatment by the whole sample for the 10 AC photographs. Perceptions of Need versus No need intersected at AC 4.

Discussion

The present study examined rankings of dental aesthetics and perceptions of treatment need by a random and representative sample of 10–11 schoolchildren in South Birmingham, UK. This age range was selected because previous research into decision making has suggested that children below the age of 10 years have difficulty in making decisions concerning aesthetic improvement (Shaw, 1981).

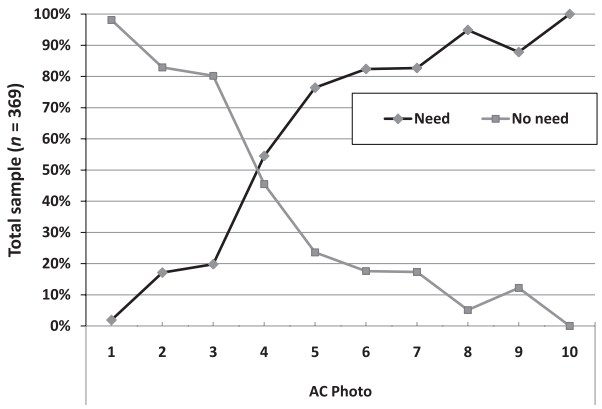

Figure 2 Perceptions of need versus no need for orthodontic treatment of the 10 Aesthetic Component (AC) photos.

The participants were at an age that they were unlikely to have experienced orthodontic treatment.

The provision of orthodontic treatment is not life saving but it can often be life changing since malocclusion is an important factor in determining the perception of a person's intelligence and attractiveness by peers and the wider public (Shaw, 1981). This is illustrated by the fact that when a new celebrity bursts upon the public scene, one of their first actions tends to be to have their teeth 'fixed'. The decision to provide/undergo orthodontic treatment should be made jointly between dentist and patient. Although the percentage input to this decision will vary, the decision of the patient should always be paramount. The present study is based upon the opinions of a randomly selected group of children in the late mixed dentition, the time at which orthodontic treatment begins to be considered.

Rankings of the 10 AC photographs

The photograph for AC 9 was allocated a median rank of 8 by girls and 7 by boys. This created a gap of two ranks between photographs 9 and 10. Possible explanations may be that it is difficult to assess increased overjet on a photograph and that the upper incisors are well aligned on AC 9 but severely misaligned on AC 10. Previous investigations in relation to the AC have found that clinicians are more likely than children to recommend treatment (Lindsay and Hodgkins, 1973; Shaw *et al.*, 1975; Prahl-Anderson *et al.*, 1979; Stenvik *et al.*, 1996; Mandall *et al.*, 2001; Hamdan, 2004).

Photographs AC 2 and 3 were allocated a median rank of 3; photographs 5 and 6 a rank of 6, 7, and 9 a rank of 7. This suggests that subjects found little difference in dental aesthetics between these grades. The AC may therefore benefit if it was modified to include only five photographs; the present 1, 4, 6, 8, and 10, numbered sequentially 1–5. A previous attempt to improve the reliability of the AC by reducing the number of photographs was made by Burden (1995), who used anchor photographs at each end of the scale. Unfortunately, the results showed a tendency to underscore and agreement suffered.

Perceptions of orthodontic treatment need

AC grades of 4 and above were assessed as needing treatment by more than 50% of subjects. The jump of 34.7 per cent between grades 3 and 4 was especially marked ($P < 0.001$). These assessments are based upon the views of children and it could be argued that the views of Specialist Orthodontists should prevail when treatment decisions are made. However, it is clear that this latter group tends to recommend treatment more often than children and lay people (Kerr and O'Donnell, 1990; Mandall *et al.*, 1999; Hunt *et al.*, 2002). This may contribute to failed and incomplete treatments since successful treatment depends upon a balance between the perceived need by the patient and parents and objective assessment by the orthodontist. Best practice guidelines require that the IOTN photographs are discussed with the patient before treatment is begun. The present study provides clear evidence that 10 photographs are unclear at best and potentially misleading at worst. The use of only five photographs, 1, 4, 6, 8, and 10, may improve the clarity of decision making. A further study is indicated to see how a group of subjects might rate the five photographs in comparison to the 10.

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Appendix 1

Data collection sheet

Date of birth: _____

Male/female.

You have 15 minutes to fill in this questionnaire. Please do not discuss your answers.

Have you ever had an orthodontic brace: yes/no.

1) Please arrange the 10 photos from most attractive (looks best) to the worst set of teeth?
2) Then write down the order of your photos from 1 to 10, 1 being the most attractive and 10 the least attractive.
3) Keeping the photos in order please look at each of the photos and write down if you think they need treatment with a brace or not.

Most attractive/best	Letter on photo	Do these teeth need braces?	
1		Yes	No
2		Yes	No
3		Yes	No
4		Yes	No
5		Yes	No
6		Yes	No
7		Yes	No
8		Yes	No
9		Yes	No
10 Worst		Yes	No