Attractiveness ratings of anterior open bites and reverse overjets using the aesthetic component of the Index of Orthodontic Treatment Need

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SUMMARY This study was carried out to determine the level of attractiveness of anterior open bites (AOB) and reverse overjets of varying severity. A sample of 180 non-dental students (101 females and 79 males; average age 20 ± 0.75 years) and 45 dental professionals (12 females and 33 males; average age 35.5 ± 5.07 years) was asked to complete a questionnaire to rate the level of attractiveness of AOB and reverse overjets of varying severity using the aesthetic component (AC) of the Index of Orthodontic Treatment Need (IOTN). Photographs of mild and severe AOB and reverse overjets were projected onto a white screen in a lecture theatre (15 seconds each with a 5 second interval between images). The participants were asked to record the AC grade at which they thought the projected picture of the AOB or reverse overjets had similar attractiveness. Dental awareness of non-dental students was determined by asking them their opinion on how important it was to have straight teeth (very unimportant, unimportant, important, very important), about their personal or close family members' orthodontic experiences and if they thought they were in need of any orthodontic treatment. A chi-square test was applied to record any differences between sexes and between the different groups. Backward stepwise linear regression analysis was used to determine the relationship between the students' ratings of the photographs and their dental awareness.

The majority of non-dental students rated a mild AOB (93 per cent) and mild reverse overjet (96 per cent) to be aesthetically acceptable. A mild AOB and mild reverse overjet were found to be acceptable by 40 and 58 per cent of dental professionals, respectively. The differences in the ratings between dental professionals and non-dental students were significant at P < 0.001.

A severe AOB was considered unattractive by both students and dental professionals. However, dental professionals rated it at the more unattractive end of the scale (P < 0.001). A severe reverse overjet was rated by the majority of the subjects as aesthetically unacceptable (85 per cent of the non-dental students and 78 per cent of the dental professionals).

Introduction

An anterior open bite (AOB) is defined as the lack of vertical overlap of the upper and lower incisors when the posterior teeth are in maximum intercuspation. It occurs in 1–2 per cent of British children (Haynes, 1970). An AOB may result from skeletal problems, habits such as thumb sucking, soft tissue morphology and neurological factors (Mizrahi, 1978; Richardson, 1980).

A reverse overjet is defined as the lower incisor edge occluding anterior to the upper incisors. The prevalence of reverse overjet ranges from 3 per cent for British (Haynes, 1970) to 14 per cent for Chinese (Tang, 1994) populations. It may be caused by skeletal and/or dental factors (Haralabakis and Spyropoulos, 1973; Guyer *et al.*, 1986; Battagel, 1993).

Aesthetic impairment is an important reason to ask for orthodontic treatment (Tulloch *et al.*, 1984; Gosney, 1986; Birkeland *et al.*, 1999). It has been suggested that children with a malocclusion may be at greater risk of developing psychological problems (Macgreger, 1970), including unfavourable social response, negative stereotyping, and low self-esteem (Shaw *et al.*, 1980).

Psychological impairment and functional problems such as lisping and temporomandibular joint dysfunction have been reported in association with an AOB and Class III malocclusions (Riolo *et al.*, 1987; Shaw, 1994).

Because the treatment need is based on psychological concerns (Lewis *et al.*, 1982), the evaluation of malocclusions should include assessment of aesthetic impairment. Over the years, indices have been developed to assess the level of treatment need accepting the aesthetic impact of malocclusions on social and psychological well-being. The Index of Orthodontic Treatment Need (IOTN) is among the currently used indices to ascertain eligibility for orthodontic treatment.

The aesthetic component (AC) of the IOTN (Brook and Shaw, 1989) consists of a scale of 10 coloured photographs showing different levels of attractiveness, grade 1 representing the most attractive and grade 10 the least attractive dentition (Figure 1) (Evans and Shaw,



Figure 1 The aesthetic component of the Index of Orthodontic Treatment Need (reproduced with permission from Brook and Shaw, 1989).

1987). These grades were grouped to represent the need for orthodontic treatment on aesthetic grounds (Richmond *et al.*, 1995). Grades 1–4 represent no or little need, grades 5–7 a borderline need and grades 8–10 a clear need for orthodontic treatment. Various malocclusion traits are covered by the 10 photographs of the IOTN, including crowding, spacing, increased overjet, increased over bite, buccal crossbite, ectopic teeth and midline shift. However, an AOB and reverse overjet were not included among the malocclusions shown in the AC of the IOTN.

Previous investigations have suggested that dental professionals have a more critical view of malocclusions and consider that treatment is needed, whereas a lay person may consider the same malocclusion as acceptable (Shaw *et al.*, 1975; Prahl-Andresen, 1978; Stenvik *et al.*, 1997). However, this was not observed in a more recent study (Grzywacz, 2003). She reported that there was a significant agreement between professional examiners' and children's assessments considering the criterion of treatment category.

Because the AC of the IOTN does not include aesthetic assessment of AOB and reverse overjet, this study was performed to rate the level of attractiveness of AOB and reverse overjets of varying severity by lay people (non-dental students) and dental professionals using the AC of the IOTN.

Subjects and methods

One hundred and eighty general science university students (101 females and 79 males) and 45 dental professionals (12 females and 33 males) were asked to complete a questionnaire to rate the attractiveness of AOB and reverse overjets of varying severity. The average age of the non-dental students was 20 ± 0.75 years, whereas the dental professionals averaged 35.56 ± 5.07 years. The professionals were academic dental staff at Jordan University of Science and Technology in Irbid (the second largest city, in the north of Jordan).

A coloured slide of the AC of the IOTN was projected on a 2×2 m white screen in a lecture theatre throughout the questionnaire. Photographs of the AOB and reverse overjet cases were projected on another white screen one at a time (15 seconds each with a 5 second interval between images). No details were given to the participants regarding the age or gender of the subjects in the photographs. However, the participants were told to concentrate on the way the teeth occluded, ignoring other variables such as tooth morphology, oral hygiene or the colour of the photograph.

The photographs were as follows:

- Photograph 1: Mild AOB confined to the incisor region, can be treated orthodontically (Figure 2a);
- Photograph 2: Severe AOB extending to the molar area that is beyond orthodontic treatment (Figure 2b);
- Photograph 3: Mild reverse overjet not complicated by crowding, can be treated orthodontically (Figure 3a);
- Photograph 4: Severe reverse overjet which is beyond orthodontic treatment (Figure 3b).

The dental professionals were trained in the use of the AC of the IOTN 1 week before the study and it was explained to non-dental students at the beginning of the questionnaire. The participants were asked to record the AC grade at which they thought the projected picture of an AOB or a reverse overjet had similar attractiveness. Dental awareness of the non-dental students was determined by asking their opinion on how important it was to have straight teeth (very unimportant, unimportant, important, very important), about their personal or close family members' orthodontic experiences, and if they thought they were in need of any orthodontic treatment.

The effect of age on the perception of malocclusion was investigated in the dental professional group. They were divided into two groups with the median age of dental professionals (35 years) as the cut-off point: the first group consisted of those below 35 years of age (21 subjects with an average age of 30.6 ± 2.7 years); the second group consisted of those above 35 years of age (24 subjects with an average age of 39.5 ± 3.4 years).





Figure 2 (a) Mild anterior open bite, (b) severe anterior open bite.





Figure 3 (a) Mild reverse overjet, (b) severe reverse overjet.

Reliability

Ten dental professionals were asked to reassess the photographs included in this study. Intra- and interexaminer agreement were analysed with kappa statistics (Cohen, 1960).

Statistical analysis

Data analysis was performed using the Statistical Package for Social Sciences (SPSS, version 9, SPSS Inc., Chicago, Illinois, USA). Gender differences and differences between the two groups were analysed using the chi-square test. Backward stepwise linear regression analysis was used to determine the relationship between the students' ratings of the photographs and their dental awareness.

Results

Intra- and inter-examiner reliability were 0.71 and 0.65, respectively, both indicating substantial agreement (Landis and Koch, 1977).

Attractiveness of AOB and reverse overjets

Although the older age group of the dental professionals scored the same photograph to the more unattractive end of the scale, the difference in the assessment of the attractiveness of AOB and reverse overjet between the older and younger age groups was not significant.

As there were no statistically significant gender differences, the findings of the female and male participants were pooled. The medians for the AC grades for the AOB and reverse overjets are shown in Table 1 and the distribution of AC grades within the two groups in Table 2.

Mild AOB (Figure 2a). Grades 1–4 were given by 167 students (93 per cent) and 18 dental professionals (40 per cent), and grades 5–7 by nine students (5 per cent) and 22 dental professionals (49 per cent). Four students (2 per cent) and five dental professionals (11 per cent) rated the attractiveness of this AOB from 8 to 10.

 Table 1
 The median aesthetic component grades for the attractiveness rating of anterior open bites or reverse overjets of varying severity.

	Non-dental students $(n = 180)$	Dental professionals $(n = 45)$	
Figure 2a	2	5	
Figure 2b	6	8	
Figure 3a	1	4	
Figure 3b	10	9	

The differences between non-dental students and dental professionals ratings were significant at P < 0.001.

Severe AOB (Figure 2b). Only 30 non-dental students (17 per cent) scored this from grades 1 to 4, 90 (50 per cent) from 5 to 7, and 60 (33 per cent) from 8 to 10. Four per cent of dental professionals rated this from 1 to 4, 31 per cent from 5 to 7, and 65 per cent from 8 to 10. The differences between the non-dental students' and dental professionals' ratings were significant at P < 0.001.

Mild reverse overjet (Figure 3a). A mild reverse overjet was given grades 1–4 by 172 non-dental students (96 per cent) and 26 dental professionals (58 per cent). One per cent of non-dental students and 35 per cent of dental professionals rated this from 5 to 7. Grades 8–10 were given by five non-dental students (3 per cent) and three dental professionals (7 per cent). The differences between the student and dental professional groups were significant (P < 0.001).

Severe reverse overjet (Figure 3b). Only three nondental students (2 per cent) rated this from 1 to 4, 23 (13 per cent) from 5 to 7, and 154 (85 per cent) from 8 to 10. Twenty-two per cent of the dental professionals rated this from 5 to 7 and 78 per cent from 8 to 10. The differences between dental professional and non-dental student groups were not significant.

Table 2 The distribution of the aesthetic component grades for rating the attractiveness of anterior open bites and reverseoverjets in the two groups.

	Non-dental students ($n = 180$)			Dental professionals $(n = 45)$		
	1–4	5–7	8–10	1–4	5–7	8–10
Figure 2a*** Figure 2b*** Figure 3a*** Figure 3b (NS)	167 (93%) 30 (17%) 172 (96%) 3 (2%)	9 (5%) 90 (50%) 3 (1%) 23 (13%)	4 (2%) 60 (33%) 5 (3%) 154 (85%)	18 (40%) 2 (4%) 26 (58%) 0	22 (49%) 14 (31%) 16 (35%) 10 (22%)	5 (11%) 29 (65%) 3 (7%) 35 (78%)

***P < 0.001; NS, not significant.

Dental awareness of the non-dental students

Importance of straight teeth. One hundred and seventyone non-dental students (95 per cent) reported that having straight teeth was important or very important.

Personal or family orthodontic experience. Sixteen per cent of students had personal orthodontic experience and 52 per cent had a family member who had received orthodontic treatment.

Do you think you need orthodontic treatment?

Forty-five per cent of the female and 24 per cent of the male students thought that they were in need of orthodontic treatment (P < 0.01).

Stepwise backward linear regression analysis was used with the subjects' mean rating of the attractiveness of the photographs entered as the dependent variable. The questions related to dental awareness were included as the independent variables. The analysis revealed that personal orthodontic treatment had an effect on the students' rating of the photographs (P < 0.05), with those who had orthodontic treatment tending to rate the photographs as less attractive (Table 3).

Discussion

This study was performed to determine the attractiveness of AOB and reverse overjets of varying severity. The AC of the IOTN (Brook and Shaw, 1989) covers a wide range of malocclusions, but does not include AOB or reverse overjets. A reverse overjet has been found to be of concern for dental appearance in both sexes (Helm *et al.*, 1986).

Age has been reported to affect the perception of malocclusion (Espeland and Stenvik, 1991). Espeland and Stenvik (1991) reported that a more reliable selfperception is made by older subjects. In the present study, although there was a tendency towards higher critical judgement by the older age group of dental professionals, the difference in attractiveness ratings was not significant. None of the reported studies regarding the effect of age on the perception of malocclusion has compared adults in different age groups. The assessment of the attractiveness of malocclusions by dental professionals differs from that of the lay person (Prahl-Andersen, 1978; Shaw *et al.*, 1980; Grzywacz, 2003).

In this study, dental professionals were more critical in assessing mild AOB and mild reverse overjet cases. This is in agreement with Prahl-Andersen (1978) and Shaw *et al.* (1980), but contradicts the findings of Grzywacz (2003).

Mild AOB and mild reverse overjet were considered acceptable by the majority of non-dental students, whereas dental professionals scored them at the more unattractive end of the scale. There was a substantial agreement between the two groups regarding attractiveness ratings of severe AOB and severe reverse overjet. The majority of the participants in both groups considered them to be aesthetically unacceptable.

Gender difference in the demand for orthodontic treatment was detected in the non-dental student group. This is in agreement with Tung and Kiyak (1998), who found that females tend to show more concern about their dental appearance than males.

The importance of having straight teeth was relatively high for the non-dental students, especially for those who had received orthodontic treatment. The availability of dental treatment to university students might have increased the dental awareness among them.

The results of this study suggest that in subjects with mild AOB or mild reverse overjet with no functional problems, treatment may not be indicated, depending on the patient's perception of their own malocclusion.

Conclusions

- 1. A mild AOB or mild reverse overjet was considered aesthetically acceptable by lay persons.
- 2. A severe AOB or severe reverse overjet was considered unattractive by both lay persons and dental professionals.
- 3. Dental professionals of different ages perceived malocclusions similarly.

 Table 3
 Constant and regression coefficients for the independent variables.

Question	Regression coefficient	T value	Significance (P value)
Constant	5.831		
Importance of straight teeth	0.03496	0.311	0.757
Personal orthodontic treatment	-0.528	-2.344	0.021*
Family member orthodontic treatment	-0.08674	-0.484	0.629
Do you think you need orthodontic treatment?	0.315	1.874	0.064

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