Influence of anterior tooth alignment on peer perception in 8- to 10-year-old children

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SUMMARY The purpose of this research was to investigate whether anterior dental alignment in 8- to 10-year-old children influences the first impressions of their peers, and to verify the validity of the tested method.

From colour photographs of two attractive children, one male and one female, Adobe Photoshop 5.0 was used to alter the images and create three versions of each photograph: one with good anterior dental alignment (OK smile), a second with proclination of the upper incisors (P-type smile), and finally one with moderate-to-severe anterior crowding (C-type smile). The six different photographs were shown to 121 subjects with mean age of 9.2 years (65 females and 56 males). Each subject was asked to view one photograph and subsequently respond to a questionnaire, the 'Smile perception questionnaire for children between the ages of 8 and 10' (SPQ 8–10), composed of 13 questions with graded responses. The responses for each photograph were analysed using linear regression analysis to determine the questionnaires validity as a whole and to investigate five area of common interest (honesty, intelligence, personal happiness, pleasantness, and extroversion).

The results demonstrated that the questionnaire was reliable both from an internal coherence standpoint and from a test–retest reliability perspective. Data regarding the five areas of interest showed that 8- to 10-year-olds viewed their peers with well-aligned teeth more favourably as far as honesty, personal happiness, and intelligence were concerned. However, there was no statistically significant difference with regard to pleasantness and extroversion in children with harmonious, as opposed to crowded or proclined anterior teeth.

Introduction

In modern society, physical appearance plays a fundamental role in social interaction. Indeed, adult patients with a pleasing appearance are perceived to have greater socialization and intellectual capacity, they meet with more success in the world of work, they are more desirable as friends, and they are even considered less likely to commit crimes (Miller, 1970; Dion, 1973; Baldwin, 1980; Jacobson, 1984). The smile is a particularly important feature of the physical aspect of what is the cornerstone of the stereotypical perception of attractiveness and personality. According to a study of young Finnish adults (Kerosuo *et al.*, 1995), subjects with crowded dentitions or diastemas are socially disadvantaged compared with those presenting proclined or well-aligned teeth (they received negative judgements as regards physical and sexual attractiveness, social class, and intelligence).

Otta *et al.* (1996) investigated the effects of different types of smile (closed, exposing only the upper arch, or wide) on how subjects were perceived. The results from a sample of 330 Brazilian high school students indicated that cheerful behaviour received more positive judgements with regard to attractiveness and kindness, irrespective of the width of the smile. The type of smile, in contrast, influenced

the perception of the degree of happiness: test subjects perceived that a wider smile indicated a happier person. Feng *et al.* (2001), in a study of 165 Chinese adults living in the UK, found that those with better dental aesthetics were thought to be socially and intellectually advantaged.

However, orthodontists often find themselves treating malocclusions in younger patients than those involved in the above-mentioned investigations. Studies by Shaw (1981), Shaw *et al.* (1985), Gosney (1986), and Birkeland *et al.* (2000) indicated the need to consider the aesthetic expectations of patients at a young age.

Shaw (1981) showed that 11- to 13-year-olds with good dental alignment were considered to be more intelligent, less aggressive, and more desirable as friends. This finding was supported by Shaw *et al.* (1985), in which a sample of young adults judged faces with good incisor alignment more favourably in terms of sociability, social class, attractiveness, and intelligence. Shaw *et al.* (1980) further noted that the teeth are one of the most frequently used physical features in the bestowal of nicknames and, furthermore, adolescents and pre-adolescents have been found to be subjected to great media pressure to appear attractive and present a pleasant smile. According to Mattick *et al.* (2004), the majority (92.8 per cent) of fashion models

in British teenage magazines needed little or no orthodontic treatment.

The aim of this study was to examine the effect of dental alignment on peer perception in 8- to 10-year-olds and to verify the validity of the questionnaire.

Subjects and methods

A possible cohort of 157 primary school children, 8–10 years of age, was identified: 36 were excluded either because they had previously undergone or were undergoing orthodontic treatment, had systemic illnesses, or were unable to speak or adequately comprehend Italian. In addition, those who were absent, from school when the study was undertaken or from whom parental consent was not obtained, were excluded. The participation rate was 77 per cent and the study group comprised 56 males and 65 females (121 subjects) with a mean age of 9.2 years.

In order to evaluate the influence of dental alignment on peer perception, the sample groups were asked to look at one of several photographs and then complete a questionnaire. The study was carried out in a classroom environment. Firstly, because small children often need assistance (Jokovic *et al.*, 2005); secondly, to avoid parental bias (children tend to be influenced by their parents' views; Le Coq *et al.*, 2000; Jokovic *et al.*, 2002), and finally, to permit precise evaluation of test–retest reliability.

The questionnaire (Figure 1), the 'Smile perception questionnaire for children between the ages of 8 and 10' (SPQ 8–10), was created by a team composed of a paediatrician, two psychologists, two primary school teachers, and one orthodontist. They used the model of

1. **Does he/she look friendly to you?**
   - ❑ a lot
   - ❑ much
   - ❑ so-so
   - ❑ not much
   - ❑ not at all

2. **Does he/she look like a honest child?**
   - ❑ a lot
   - ❑ much
   - ❑ so-so
   - ❑ not much
   - ❑ not at all

3. **Do you think he/she has a lot of friends?**
   - ❑ a lot
   - ❑ much
   - ❑ so-so
   - ❑ not much
   - ❑ not at all

4. **Do you think he/she is a polite child?**
   - ❑ a lot
   - ❑ much
   - ❑ so-so
   - ❑ not much
   - ❑ not at all

5. **Do you think he/she is an unpleasant child?**
   - ❑ a lot
   - ❑ much
   - ❑ so-so
   - ❑ not much
   - ❑ not at all

6. **Would you say he/she is willing to lend their pens?**
   - ❑ a lot
   - ❑ much
   - ❑ so-so
   - ❑ not much
   - ❑ not at all

7. **Do you beleve he/she likes being alone?**
   - ❑ a lot
   - ❑ much
   - ❑ so-so
   - ❑ not much
   - ❑ not at all

8. **Does he/she seem like a child who likes telling jokes?**
   - ❑ a lot
   - ❑ much
   - ❑ so-so
   - ❑ not much
   - ❑ not at all

9. **Do you think that he/she make his/her parents happy?**
   - ❑ a lot
   - ❑ much
   - ❑ so-so
   - ❑ not much
   - ❑ not at all

10. **Would you say he/she is unhappy?**
    - ❑ a lot
    - ❑ much
    - ❑ so-so
    - ❑ not much
    - ❑ not at all

11. **Is he/she in your opinion good at school?**
    - ❑ a lot
    - ❑ much
    - ❑ so-so
    - ❑ not much
    - ❑ not at all

12. **Does he/she look a quiet child?**
    - ❑ a lot
    - ❑ much
    - ❑ so-so
    - ❑ not much
    - ❑ not at all

13. **Would you say he/she is a happy child?**
    - ❑ a lot
    - ❑ much
    - ❑ so-so
    - ❑ not much
    - ❑ not at all

Figure 1   Smile perception questionnaire for children between the ages of 8 and 10 (SPQ 8–10).

Jokovic *et al.* (2004). The SPQ 8–10 consisted of a sample photograph and 13 direct questions to which the children were asked to assign a preference on a scale of 1–5, from 'a lot' to 'not at all'. The language used in the questions was carefully calibrated to the age range of the subjects, and internal coherence questions were included to determine whether the responses were automatic or reasoned.

To create the photographs, 20 coloured frontal photographs of Caucasians (10 boys and 10 girls, 9 years of age) from a similar population as the study sample with a Mediterranean appearance (brown hair and eyes) and serious expressions were selected; photographs of children with features such as blue eyes or red hair were excluded. These photographs were analysed by four lay judges (primary school teachers, two males and two females, mean age 34 years), who assigned each a mark from 1 to 10 for perceived facial beauty. The two photographs, one male and one female, with the highest marks were then selected.

Photographs of the same two children taken while they were smiling were subsequently modified using Adobe Photoshop 5.0 in order to obtain three versions of each photograph:
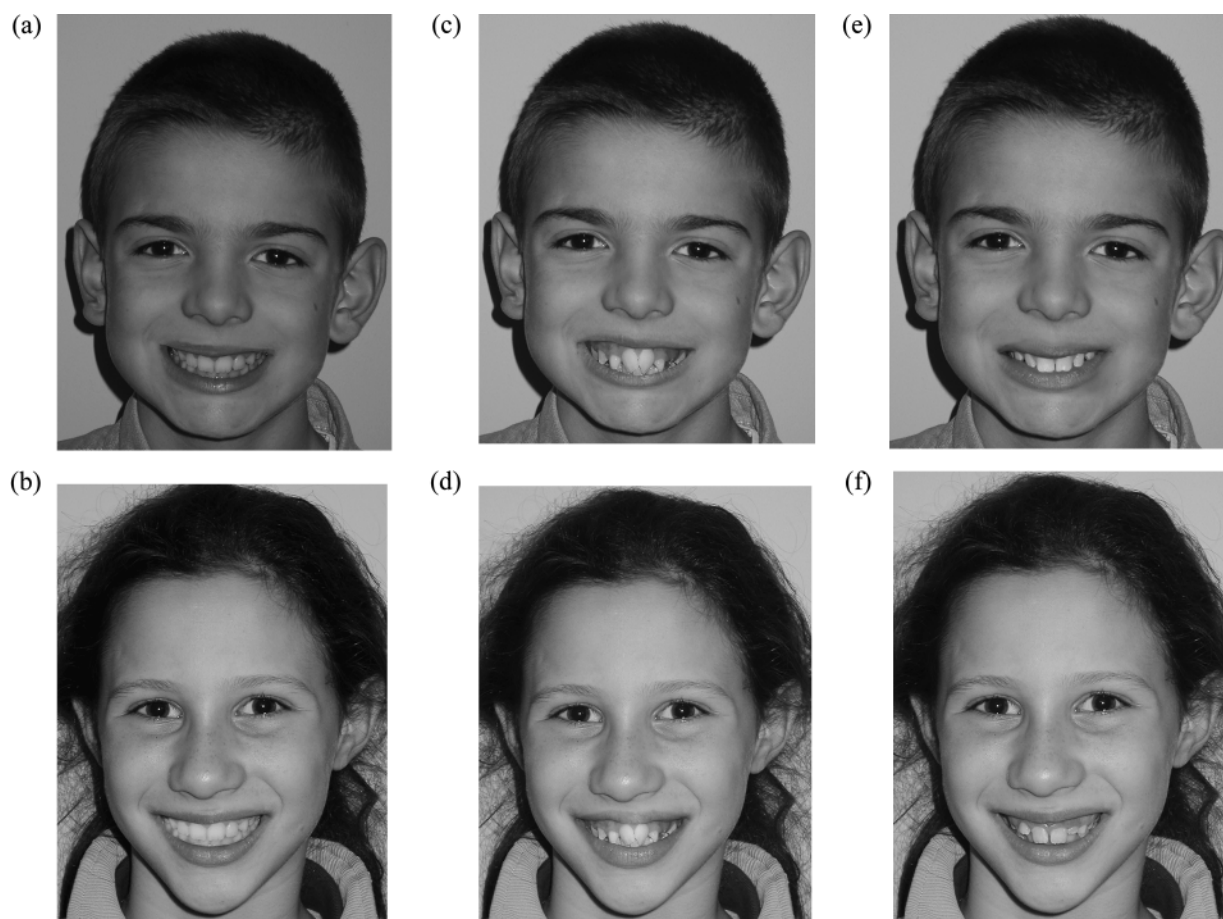
OK smile: good anterior dental alignment.
P smile: proclination of the upper incisors (overjet greater than or equal to 3 mm).
C smile: medium to severe crowding.

Thus, six colour photographs (two children with three different smiles) were produced (Figure 2).

The photographs were then numbered from 1 to 6 and distributed in such a way as to alternate male and female photographs and to ascertain that the children at neighbouring desks did not receive the same photographic subject or smile. This procedure was employed in order to avoid the risk of sampling bias.

Forty-one children analysed either photograph 2 or photograph 5 (a male or female child, respectively, with well-aligned teeth), 41 children analysed either photograph 4 or photograph 1 (a male or female child, respectively, with crowded teeth), and 39 children analysed either photograph 3 or photograph 6 (a male or female child, respectively, with proclined incisors).

Figure 2 Photographs of a male (a) and female (b) with good anterior dental alignment (OK-type smile), photograph of a male (c) and female (d) with severely crowded teeth (C-type smile) and photograph of a male (e) and female (f) with proclination of the upper incisors (P-type smile).

Statistical data analysis

The data were analysed by assigning values of 0–4 to the various responses. Score 0 was assigned to 'not at all', score 1 to 'not much', score 2 to 'so-so', score 3 to 'much', and finally score 4 to 'a lot'.

To verify whether the children had responded in an automatic manner, internal coherence questions were included in the questionnaire, i.e. the same question was posed in both negative and positive forms. In this way, questions 5, 7, 10, and 12 had inverted response values, i.e. the response 'a lot' corresponded to a value of 0 and 'not at all' to a value of 4.

The responses were then used to generate a global score for each smile type, and a logistic regression model, an extension of the linear regression model, for binary values (0 or 1) of the dependent value y was employed for statistical analysis. The independent variable x represented the global score, and the dependent value y was constructed using the following values:

$y = 1$ if the photograph analysed was number 1 or 2 (OK smile, well-aligned teeth)

$y = 0$ if the photograph analysed was number 3, 4, 5, or 6 (C or P smile types, crowding or proclined incisors).

Test–retest reliability

Once the validity of the test had been verified, 63 randomly selected children from the original sample were retested in the same way 15 days later. Each child received the same photograph as in the initial test. Although both tests were administered anonymously, correlation of the second questionnaire with the first was possible due to the children's stated date of birth.

As the research was not designed to determine precise measurements but 'translations' of categorical data, the conventional t-test for dependent variables was not applicable. Therefore, it was decided to calculate the correlations of rank between the 13 responses obtained in the first test and the 13 responses obtained in the second test.

The correlations and P values (Table 1) calculated for the null hypothesis of no correlation against the hypothesis of a certain correlation were found to be positive. The data in Table 1 (where S1 = initial questionnaire sitting and S2 = second sitting) indicate the validity of the results as a positive correlation was found in all cases.

Results

The results were significant ($P < 0.05$) only for the fields of honesty, personal happiness, and intelligence (Table 2), i.e. the children judged their peers with well-aligned teeth (OK smile) to have stronger characteristics of honesty, personal happiness, and intelligence with respect to those of smile

Table 1 Test–retest reliability: the number in the first column corresponds to the equivalent question in Figure 1. Correlation between S1 (initial questionnaire sitting) and S2 (second sitting) indicate the validity of the results, as a positive correlation was found in all cases.

Question	S1 − S2	P value
1	0.7992	0.0000
2	0.5269	0.0000
3	0.5088	0.0000
4	0.4698	0.0001
5	0.4798	0.0000
6	0.4294	0.0003
7	0.5017	0.0000
8	0.3930	0.0009
9	0.5248	0.0000
10	0.2789	0.0148
11	0.6273	0.0000
12	0.2898	0.0118
13	0.4593	0.0001

Table 2 The questionnaire was divided in five area of common interest: pleasantness, honesty, extroversion, personal happiness, and intelligence. Specifically, the questions relative to the five area of interest were: questions 1, 5, and 8: pleasantness/unpleasantness (1); questions 2, 4, and 6: honesty and altruism versus dishonesty and selfishness (2); questions 3, 7, and 12: extroversion/introversion (3); questions 9, 10, and 13: personal happiness (4); question 11: intelligence (5).

	b	P value	Significant
Pleasantness/unpleasantness	−0.053	0.1831	NS
Honesty, altruism/dishonesty, selfishness	−0.0674	0.0028	*
Extrovesion/introversion	0.0305	0.7113	NS
Personal happiness	−0.0842	0.0031	*
Intelligence	−0.2161	0.0012	*

NS, not significant. *$P < 0.005$.

types P and C. In contrast, no significant results were found for pleasantness and extroversion, indicating that these criteria were not perceived to be affected by smile type.

The logistic regression model was initially employed to analyse the validity of the questionnaire in its entirety and then in five specific area of interest. Assessment of the questionnaire by a logistic regression model is equal to (b)—0.02008, with a P value of 0.0092, indicating significance. As the logistic regression model parameter (b) was found to be negative, the higher the value of the independent variable (global score or first variable), the greater the probability that the photograph showed misaligned or crowded teeth. This means that a significant correlation existed between the analysed photographs and the responses given, thus confirming the validity of the test.

Subsequently, analysis of five areas (pleasantness, honesty, extroversion, personal happiness, and intelligence)

was carried out, in which the global score for each smile type in each area was considered as the independent variable, while the dependent value *y* was assigned a value of 1 for the OK smile-type photographs and a value of 0 for the other smile types.

Specifically, the questions relative to the five areas of interest were (Table 2); questions 1, 5, and 8: pleasantness/unpleasantness (1); questions 2, 4, and 6: honesty and altruism versus dishonesty and selfishness (2); questions 3, 7, and 12: extroversion/introversion (3); questions 9, 10, and 13: personal happiness (4); question 11: intelligence (5).

Discussion

There were three reasons for selection of the age range of 8–10 years in the present study: firstly, because it is the age at which only interceptive therapy, rather than treatment with fixed appliances, is normally started; secondly, the internal motivation for treatment at this age range has not been widely investigated, in general, children of this age comply with their parents' wishes; and finally, as eruption of the four upper incisors has normally occurred, it is possible to express judgement on this type of dental alignment.

The initial aim of this research was to examine the effect of dental alignment on peer perception in 8- to 10-year-olds and to evaluate whether a general correlation existed between the responses obtained from the questionnaire at both sittings. The data obtained indicated that the SPQ 8–10 is reliable from a test–retest reliability perspective and is thus a valid analytical tool. The SPQ 8–10 was also found to be reliable from an internal coherence standpoint since the logistic regression analysis showed a negative *b* value with a high degree of significance.

Examination of single areas of interest yielded interesting results. The values found to be significant were honesty, altruism, personal happiness, and intelligence, thus confirming that 8- to 10-year-old children associate these values with well-aligned teeth. This is in agreement with the results of Kissler and Bauml (2000), who found that children seem to prefer faces that adults have adjudged to be pleasant, although with a lower degree of preference. This would seem to indicate that the 'sense of beauty' is innate and is refined by cognitive development factors and thus growth. Furthermore, it is possible to hypothesize that media pressure is not as strong in this age range as in adults (Mattick *et al.*, 2004). This is important especially as regards analysis of the personal happiness field. This means that children with a pleasant dental alignment are seen by their peers to be happier, more loved by their parents, better mannered, more honest, and more altruistic. In other words, to an 8- to 10-year-old child, a well-aligned smile seems to be indicative of positive personality traits such as goodness, diligence, and reliability. This finding is in accordance with that noted in samples of adolescents and young adults (Shaw, 1981; Shaw *et al.*, 1985), except for in the field of

honesty. In the photographs of children in the study of Shaw *et al.* (1985), children with proclined teeth were given the highest score for these criteria.

In the pleasantness and extroversion sections, there were no significant findings. In fact, all three types of smile were given similar scores, which can hypothetically be attributed to two causes. Primarily, it is probable that, as indicated by Shaw (1981) in a study of 11- to 13-year-olds and by Shaw *et al.* (1985) in a study of young adults, 'background facial attractiveness' is associated with a high degree of social attraction, or more generically, with qualities such as pleasantness and extroversion. Secondly, it should be noted that the children were shown photographs of their peers smiling. As Morris (1967) and Otta *et al.* (1996) demonstrated, cheerful behaviour is more likely to provoke more favourable judgements as regards beauty and kindness compared with a serious face, irrespective of the width of the smile. In particular, Otta *et al.* (1996) showed that smile width (wide versus closed) increased the degree of positive judgements. In other words, the more an individual smiles, the happier he or she is perceived to be.

The present study has some limitations because it analysed only the first impression and not the following reactions. No studies have focused on this aspect in a very young population but only in an adult population (Walster *et al.*, 1966). Besides, the generic beauty in the presented photographs induced a positive opinion. Further studies could investigate the same combination of smiles on an extended number of facial backgrounds to exclude the bias caused by a pleasant facial background.

Conclusions

In this sample of 8- to 10-year-olds examined, a correlation emerged between a well-aligned smile and the degree of desirability engendered in their peers as highly significant results were obtained for qualities such as honesty, intelligence, and personal happiness. In contrast, as far as the qualities of pleasantness and extroversion were concerned, the findings were not sufficiently statistically significant to indicate a preference for well-aligned smiles with respect to crowded or proclined teeth.

Analysis of the results of this study confirm the SPQ 8–10 is valid as far as test–retest reliability is concerned, as a positive correlation between the first and second sittings was found for each response obtained. Furthermore, the test was also found to be reliable from an internal coherence perspective since logistic regression analysis showed a high degree of significance.

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