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Social perceptions of adults wearing orthodontic appliances: a cross-sectional study

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SUMMARY This study ascertained the influence of orthodontic appliances on subjective ratings for social competence (SC), intellectual ability (IA), psychological adjustment (PA), and attractiveness in young adult orthodontic patients.

A cross-sectional analytical questionnaire study was conducted with 130 undergraduates from the UK. Each participant was asked to look at a single, randomly assigned colour photograph of a young adult female and then asked to make judgements concerning her personal characteristics. Five modified photographs of the same young adult female were used: (1) no appliance, (2) stainless steel fixed orthodontic appliance, (3) ceramic fixed orthodontic appliance, (4) gold fixed orthodontic appliance, and (5) clear colourless aligner. Likert scales with higher scores indicating more positive ratings were used. The results were analysed using chi-square test, one-way univariate analysis of variance, and *post hoc* Tukey-B and Kruskal–Wallis tests.

The results showed that greater perceived IA was associated with the appearance of no appliance (mean values: 7.56) rather than steel (6.67) or ceramic appliances (6.65) but similar to the gold (7.35) and aligner (7.08) appliances. No significant differences between the different orthodontic appliance appearances were found for SC and PA. A trend existed where the no appliance image (resembling a lingual appliance) or clear aligner was considered more attractive than the visible buccal fixed appliances.

In the absence of other information, the judgements an individual young adult makes concerning the personal characteristics of a young adult are influenced by dental appearance and orthodontic appliance design. This may influence orthodontic appliance choice.

Introduction

The demand for orthodontic treatment in adults appears to be increasing (Salonen *et al.*, 1992). This is thought to be the result of improved dental and orthodontic awareness, as well as increased social acceptance of appliance therapy (Breece and Nieberg, 1986). Innovations in the aesthetics of appliances may also be a major factor in the increase in acceptability of orthodontic treatment for adults. Adults considering treatment now have a choice in the type of appliance design available including conventional steel, ceramic, and gold-plated metal buccal brackets; lingual appliances; and removable appliances, including clear plastic aligners. Innovations in treatment appliances have increased the ability to treat malocclusions that were previously untreatable without surgery or extraoral anchorage. An increase in interdisciplinary treatment planning has resulted in an increased need for orthodontics as an adjunct to other dental specialities.

Facial appearance has been shown to be used as a guide to infer a variety of characteristics about a person, including personality, integrity, social and intellectual competence, and mental health (Eagly, 1991). Individuals rated as attractive tend to earn more, have more successful life outcomes, and have greater self-worth than less attractive individuals (Dion *et al.*, 1972; Loh, 1993). An important component of facial appearance is the appearance of the mouth and teeth. In face-to-face situations, studies show that the eyes primarily scan the other person's eyes and areas of the mouth, with little time spent in observation of other features (Miller, 1970). A good dental appearance is believed to be a requirement of prestigious occupations among some professional groups (Jenny and Proshek, 1986). Extreme deviations from established norms for dental and facial appearance are viewed as unacceptable (Cons *et al.*, 1983). Poor dentofacial appearance produces negative perceptions of personal characteristics (Shaw, 1981; Shaw and Humphreys, 1982; Shaw *et al.*, 1985, Kerosuo *et al.*, 1995). Individuals with less dental disease are judged to be more socially competent, show greater intellectual achievement, and have better psychological adjustment (PA) (Newton *et al.*, 2003). In the absence of other information, the judgements an individual makes concerning the personal characteristics of others are influenced by dental appearance (Newton *et al.*, 2003).

Adult patients have been found to have pronounced attitudes to the type of appliance they wear (Tayer and

Burek, 1981), with headgear viewed most negatively. They have identified embarrassment (Lew, 1993) and negative peer reaction (Tayer and Burek, 1981) as discouraging aspects of treatment. The perception of young adults undergoing orthodontics by others is particularly important for major life events such as employment and finding a partner. Therefore, an orthodontic appliance with the most positive social judgements would be deemed best for social acceptance.

Previous research investigating the impact of dental appearance on the appraisal of personal characteristics has involved the manipulation of standardized images to vary along one dimension (Carlsson *et al.*, 1998; Eli *et al.*, 2001; Feng *et al.*, 2001; Newton *et al.*, 2003). There have been no published studies directly linking fixed orthodontic appliances to subjective ratings of the characteristics of another person.

The aim of this study was to ascertain the influence of orthodontic appliances on subjective ratings of personal characteristics, specifically, social competence (SC), intellectual ability (IA), psychological adjustment (PA), and attractiveness in an adult patient. The null hypothesis tested was that orthodontic appliances have no influence on the appraisals individuals make about an adult's personal characteristics.

Subjects and methods

Approval for this project was obtained from the Guy's Research and Ethics Committee (reference number 06/Q0704/39).

This cross-sectional study compared participant's perceptions of the personal characteristics of a young female adult in a colour photograph with the presence or absence of an orthodontic appliance. Each participant was randomly assigned an envelope containing a single photograph and asked their perceptions before the collection of other data. Each participant had an equal chance of being assigned any one of the five photographs used. Participants were not stratified. The interest of the investigator in dental appearance was concealed during the whole procedure by telling participants that the investigator was researching 'the way we look at each other'.

All participants were undergraduate students attending lectures at King's College London University, UK. Undergraduates were chosen as they represent, in terms of age, the peer group of a young adult aged 18–25 years. As the largest percentage of adult orthodontic patients are aged 18–25 years, the exclusion criteria included those outside this age range and those with severely impaired vision.

Power calculations were based on the results of judgements on IA from a study by Newton *et al.* (2003). Those authors found differences of two points (SD = 0.5) in the judgement of IA for an appearance of dental decay and no decay. This study was designed to have an 80 per cent power to detect differences of two points (SD =2) in any pairwise comparison of the five photographed conditions; for these, a minimum of 125 participants were required.

Standardized full-face colour photographs of a young adult female were obtained. The patient smiled to expose as much of the maxillary anterior teeth as possible within the bounds of natural appearance. She had no malocclusion and appeared free from oral pathology so only the effect of fixed appliances on the appearance could be studied. An upper removable appliance was used to temporarily attach the different fixed appliances to the teeth to allow the standardized photographs to be taken (Figure 1).

Computer-aided manipulation of the photographs allowed the production of five standardized images, 25 cm high and 20 cm wide, of the female volunteer in different dental states:

1. No appliance appearance (Figure 2a). This had the appearance of a lingual orthodontic appliance.
2. Stainless steel fixed orthodontic appliance (Victory Series Twin; 3M Unitek, Monrovia, California, USA; Figure 2b).
3. Ceramic fixed orthodontic appliance (Clarity Twin; 3M Unitek; Figure 2c).
4. Gold fixed orthodontic appliance (Victory Series Gold Twin; 3M Unitek; Figure 2d).
5. Clear colourless aligner. Small composite attachments were placed on the teeth to allow for better control of tooth movement. The aligner was also placed in a slightly

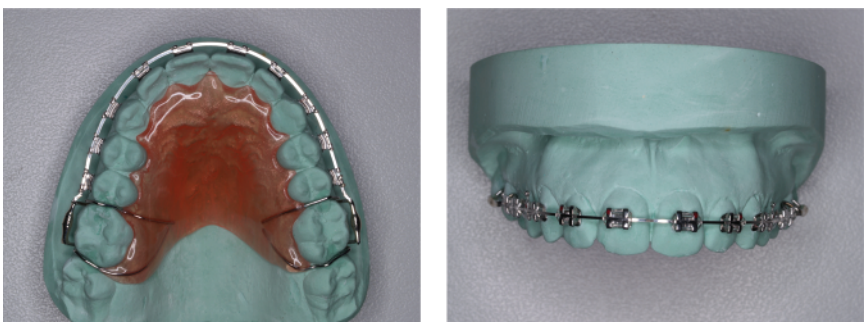

Figure 1 Upper removable appliance.

Figure 2 Photograph of young adult female with (a) unmodified appearance (lingual orthodontic appliance), (b) modified appearance with a stainless steel fixed orthodontic appliance, (c) modified appearance with ceramic fixed orthodontic appliance, (d) modified appearance with gold fixed orthodontic appliance, and (e) modified appearance with a clear aligner.

elevated position over the teeth to simulate an active appliance (Figure 2e).

A structured questionnaire enquired about categories of personal characteristics strongly associated with physical appearance: SC, IA, PA (Eagly, 1991), and attractiveness. Questions 1, 2, and 3 investigated SC; 4, 5, and 6 IA; 7, 8, and 9 PA; and 10 attractiveness.

The participants were told that the young adult female worked for a large organization and were asked:

1. How popular they thought the person was with colleagues. Ratings were made on a five-point Likert scale with anchors 'very popular' and 'very unpopular'.
2. How friendly the young adult female appeared. Responses were made on a five-point Likert scale ranging from 'very friendly' to 'very unfriendly'.
3. To indicate if they thought the young adult female had a good social life. Response options were 'yes', 'no', and 'don't know'.
4. How successful the young adult female had been at school. Responses were given on a five-point Likert scale with anchors 'very successful' and 'very unsuccessful'.
5. How intelligent the young adult female appeared. Responses were given on a five-point Likert scale with anchors 'very intelligent' to 'very unintelligent'.
6. Had the young adult female been to university or not. Response options were 'yes', 'no', and 'don't know'.
7. Whether they believed the young female was extroverted or introverted on a five-point Likert scale with anchors 'very introverted' to 'very extroverted'.
8. The extent to which the young adult female appeared to be a happy person was rated on a five-point Likert scale with anchors 'very happy' to 'very unhappy'.
9. The young adult female's degree of self-confidence on a five-point Likert scale ranging from 'very self-confident' to 'not at all self-confident'.
10. How attractive the young adult female appeared on a five-point Likert scale with anchors 'very attractive' to 'very unattractive'.

Scores were derived for the four scales, SC, IA, PA, and attractiveness, by summing individual scores. Higher scores indicated a greater rating of an attribute. Data were also collected about the participants including gender, self-identified ethnicity using categories from the Office of Population Census and Surveys (1992), dental attendance behaviour data using questions from the Adult Dental Health Survey of England and Wales (Todd and Lader, 1991), and perceived oral health. This was assessed by asking participants to rate their own oral health as excellent, very good, good, fair, or poor (Atchison and Gift, 1997).

The distribution of demographic characteristics across the five groups was compared using non-parametric statistics in order to determine whether the participants in the groups differed (Table 1). Following this, item responses across the five groups were compared using chi-square tests (Table 2). Differences in the five conditions for the three scales SC, IA, and PA were assessed by a series of one-way univariate analyses of variance (ANOVAs) (Table 3). *Post hoc* Tukey-B tests were calculated to determine the source of any significant differences (Table 3). The Kruskal–Wallis test was used as a non-parametric alternative to the one-way ANOVA to assess differences in the five conditions for attractiveness.

Results

One hundred and thirty participants were enrolled in the study out of a total of 132 undergraduates. Two were excluded for not meeting the inclusion criteria for age. The randomization method did not result in equal numbers of participants for each photograph (Figure 3). Complete data for all three perception and attractiveness measurements were available for 100 per cent of the participants. No statistically significant differences were found across the photograph groups for gender and self-rated oral health (Table 1). Significant differences were found for the distribution of the dental attendance pattern and ethnicity of the participants across the photograph groups. However, this was not found to have an effect on the final results for the three perception measurements (ANOVA model: SC, 0.75; IA, 0.22; PA, 0.4) and attractiveness scores (chi-square 0.35, significance 0.84). There were insufficient numbers within each ethnic group to investigate differences between ethnicity for each photograph. When comparing the judgements of white and non-white ethnic groups, no statistically significant difference was found (chi-square 5.49, $P = 0.24$).

A statistically significant difference was found between each of the photographs for attractiveness but not for any other single characteristic (Table 2).

Greater attractiveness was associated with the no appliance appearance (chi-square 18.8, significance 0.01). When comparing visible appliance types, a trend existed for aligner appliances to be associated with ratings of greater attractiveness than conventional appliances. A Kruskal–Wallis test showed the following: no appliance appearance, mean

Table 1 Description of sample.

	No appliance	Steel	Ceramic	Gold	Aligner	Chi-square (*P* value)
Gender						8.20 (0.09)
Male	14	7	15	10	9	
Female	11	20	11	16	17	
Ethnicity						55.50 (0.21)
White British	12	12	9	13	12	
White Irish	1	0	0	0	0	
White other	1	2	2	6	1	
White and Black Caribbean	0	0	1	0	0	
White and Asian	0	2	1	1	1	
Mixed other	1	1	0	0	1	
Indian	4	3	5	3	6	
Pakistani	3	0	0	0	1	
Bangladeshi	0	0	1	0	1	
Asian other	1	1	2	1	0	
Black Caribbean	0	0	2	0	0	
Chinese	1	6	3	0	1	
Other	1	0	0	2	1	
Attendance pattern						19.23 (0.01)
Regular check-up	7	18	9	9	9	
Occasional check-up	12	8	6	12	8	
Only if trouble	6	1	11	5	9	
Self-rating of oral health						19.09 (0.26)
Excellent	3	4	4	4	4	
Very good	10	10	6	8	15	
Good	7	12	13	10	6	
Fair	5	0	3	4	1	
Poor	0	1	0	0	0	

Table 2 Responses to each question across the five appliance groups.

	Chi-square (*P* value)
1. Popularity with colleagues	15.74 (0.20)
2. Friendly appearance	15.15 (0.23)
3. Good social life	13.90 (0.08)
4. Successful at school	13.98 (0.30)
5. How intelligent	18.78 (0.09)
6. Went to university	09.22 (0.32)
7. Extrovert	11.41 (0.78)
8. Happy person	10.77 (0.55)
9. How self-confident	22.79 (0.12)
10. How attractive	34.30 (0.01)*

*Statistically significant.

rank 44.54; aligner, mean rank 53.33; gold, mean rank 71.38; steel brace, 75.06; and ceramic brace, mean rank 80.02.

The ANOVA model for predictors of SC and PA showed no significant differences between photographs (Table 3). However, there were significant differences for IA and the type of appliance worn. Greater perceived IA was associated with the no appliance appearance (mean 7.56) rather than steel (mean 6.67) and ceramic (mean 6.65) braces. There were no significant differences between the no appliance appearance, clear aligner, and gold appliance for IA (Tukey-B tests).

Discussion

The results indicated that greater perceived IA was associated with the no appliance appearance (resembling a lingual appliance) rather than steel and ceramic appliances but similar to the gold and aligner appliances. No significant differences between the different appliances were found for SC and PA. A trend existed where the no appliance image (resembling a lingual appliance) or with a clear aligner appliance was considered more attractive than visible buccal fixed appliances. These data suggest that orthodontic appearance exerts an influence upon appraisals made in social situations.

Attempting to measure subjective judgements based on visual perception is challenging. The situation used in the present study was artificial, in that participants were constrained to make arbitrary judgements. However, participants in this artificial situation did make judgements, which demonstrated a consistent pattern for the IA of the person shown. Previous studies using this technique have shown that participants do not give random responses and their responses are influenced by dental anomalies (Newton *et al.*, 2003). However, making real-life judgements about a person is unlikely to be based on appearance alone. In this study, the artificial experimental situation excluded other factors enabling participants to focus on appearance alone. The participants involved were all undergraduate students.

Table 3 Relationship between appliance type and scale analysis.

	No appliance		Steel		Ceramic		Gold		Aligner		ANOVA F (significance)
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Social competence	7.8	1.15	6.88	1.45	6.96	1.34	7.39	1.36	7.58	1.21	2.32 (0.60)
Intellectual ability	7.56_a	1.08	6.67_b	1.33	6.65_b	1.2	7.35_{ab}	1.13	7.08_{ab}	0.98	3.12 (0.02)
Psychological adjustment	9.48	1.36	8.63	1.76	9.42	1.65	8.56	1.85	9.31	1.67	2.11 (0.08)

Different subscript letters indicate significantly different at $P < 0.05$ (Tukey-B).

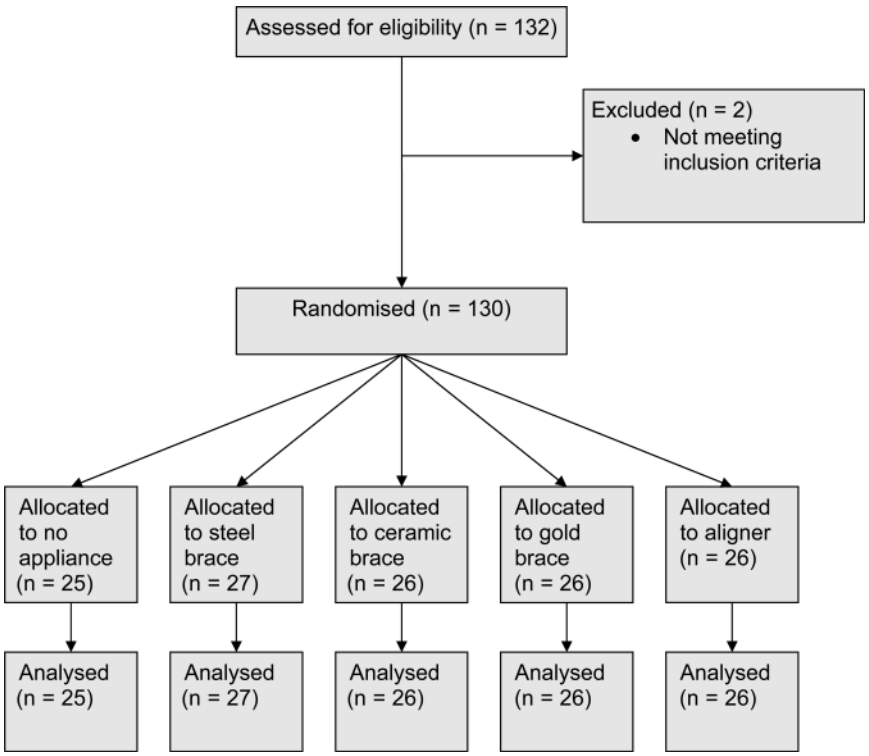

Figure 3 Flow chart of participants in study (n, number of participants).

This may have introduced bias into the results, especially with regard to their cultural and social background (Kerosuo *et al.*, 1995). However, undergraduate students represent a large number of the 18–25 age group and were thus chosen as the peer group of the young adult in the photograph and the sample base of interest. This questionnaire-based study allowed reproducible qualitative experimentation under standardized conditions, and the statistical analyses used were sufficiently powerful to test the primary hypothesis.

The findings of this research suggest that social interaction and therefore the social well-being of a young female adult are influenced by a visible orthodontic appliance. The extent to which such perceptions will influence an individual's psychological well-being is unknown. Social perceptions may exert a negative influence on an individual's self-perception (Kiesler and Baral, 1970). Many aspects of life involve social interaction and the forming of social judgements. Therefore, an orthodontic appliance with the most positive social judgements would be deemed best for social acceptance.

The photographs of the female with visible steel and ceramic appliances were judged to have a lower IA than the no appliance image. Interestingly, no significant differences were found between the steel, gold, and ceramic appliances for any of the judgements. Gold-coloured appliances are not widely used and this may have influenced the results. Unlike previous research into the impact of dental decay, the colour of the teeth or dentofacial anomalies, it would seem that an orthodontic appliance type does not follow a simple pattern for all social judgements: there were no statistical differences between appliance types for SC or PA. Hence, there is no obvious ideal choice of visible orthodontic appliance design in terms of peer group-driven judgements of personal characteristics. A trend exists where the no appliance was judged to be the most attractive, with the aligner appliance having a similar rank. The insignificant small difference between the results for the aligner and no appliance can be explained by the possibility that the former was not noticed by all participants and the differences therefore appear arbitrary. These findings indicate that the appearance of no appliance appears to be the standard for social acceptance. This is the appearance provided by lingual appliances. While lingual appliances and aligners have excellent aesthetics, they may produce a lisp that may affect social judgements, but this was not investigated in the present study.

The results demonstrated that the appraisal of the personal characteristics of a young female adult was not affected by the gender of the judge. Linn (1965) suggested that gender is not consistently important in determining the impact of facial appearance on social judgements. This is in contrast to a previous study that suggested an interaction effect where the impact of dental decay is greater when individuals rated faces of the opposite gender (Eli *et al.*, 2001).

The impact of orthodontic appliance aesthetics upon perceptions of personal characteristics may vary according to

cultural traditions and social background. The numbers for each ethnic group in the current study were not sufficient to test for differences. However, no significant difference was found when comparing the judgements of white and non-white ethnic groups. Both groups may have been influenced by living in a similar Western multicultural environment. The volunteer photographed in this study was a blonde Caucasian female. Photographs of subjects from different ethnic groups with differing appearances may, due to preconceived ideas, have produced different results.

The way in which society judges what is beautiful or acceptable has changed throughout history (Peck and Peck, 1970). This is likely to also be true for orthodontic appliances. Many factors influence the appearance of an orthodontic appliance. These include lip length, tooth exposure during smiling, oral hygiene, and type of ligation. These were all standardized during this study to allow comparison of the effects of general appliance design. Further studies could investigate the effects of these variables.

Conclusions

In the absence of other information, the judgements an individual young adult makes concerning the personal characteristics of other young adults are influenced by dental appearance and orthodontic appliance design. This in turn may have an influence on orthodontic appliance choice. Individuals with no appliance appearance or an invisible lingual brace were considered to have greater IA than those with metal or ceramic appliances. A trend exists where non-visible or clear aligner appliances are considered more attractive than visible appliances. Therefore, the null hypothesis that orthodontic appliances have no influence on the appraisals individuals make about an adult's personal characteristics was rejected.

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References

Atchison K A, Gift H C 1997 Perceived oral health in a diverse sample. Advances in Dental Research 11: 272–280

Breece G L, Nieberg L G 1986 Motivations for adult orthodontic treatment. Journal of Clinical Orthodontics 20: 166–171

Carlsson G E *et al.* 1998 An international comparative multicenter study of assessment of dental appearance using computer-aided image manipulation. International Journal of Prosthodontics 11: 246–254

Cons N C, Jenny J, Kohout F J, Freer T J, Eismann D 1983 Perceptions of occlusal conditions in Australia, the German Democratic Republic and the United States of America. International Dental Journal 33: 200–206

Dion K, Berscheid E, Walster E 1972 What is beautiful is good. Journal of Personality and Social Psychology 24: 285–290

Eagly A H 1991 What is beautiful is good, but. . .: a meta-analytic review of research on the physical attractiveness stereotype. Psychological Bulletin 110: 109–128

Eli I, Bar-Tal Y, Kostovetzki I 2001 At first glance: social meanings of dental appearance. Journal of Public Health Dentistry 61: 150–154

Feng X P, Newton J T, Robinson P G 2001 The impact of dental appearance on perceptions and personal characteristics among Chinese people in the United Kingdom. International Dental Journal 51: 282–286

Jenny J, Proshek J M 1986 Visibility and prestige of occupations and the importance of dental appearance. Journal of the Canadian Dental Association 52: 987–989

Kerosuo H, Hausen H, Laine T, Shaw W C 1995 The influence of incisal malocclusion on the social attractiveness of young adults in Finland. European Journal of Orthodontics 17: 505–512

Kiesler S B, Baral R L 1970 The search for a romantic partner: the effects of self esteem and physical attractiveness on romantic behavior. Addison Wesley, Reading

Lew K K 1993 Attitudes and perceptions of adults towards orthodontic treatment in an Asian community. Community Dentistry and Oral Epidemiology 21: 31–35

Linn E L 1965 Social meanings of dental appearance. Journal of Health and Human Behavior 30: 289–295

Loh E S 1993 The economic effects of physical appearance. Social Science Quarterly 74: 420–438

Miller A C 1970 Role of physical attractiveness in impression formation. Psychological Science 19: 231–234

Newton J T, Prabhu N, Robinson P G 2003 The impact of dental appearance on the appraisal of personal characteristics. International Journal of Prosthodontics 16: 429–434

Office of Population Census and Surveys (OPCS) 1992 County monitors. OPCS, London

Peck H, Peck S 1970 A concept of facial esthetics. Angle Orthodontist 40: 284–317

Salonen L, Mohlin B, Götzlinger B, Helldén L 1992 Need and demand for orthodontic treatment in an adult Swedish population. European Journal of Orthodontics 14: 359–368

Shaw W C 1981 The influence of children's dentofacial appearance on their social attractiveness as judged by peers and lay adults. American Journal of Orthodontics 79: 399–415

Shaw W C, Humphreys S 1982 Influence of children's dentofacial appearance on teacher expectations. Community Dentistry and Oral Epidemiology 10: 313–319

Shaw W C, Rees G, Dawe M, Charles C R 1985 The influence of dentofacial appearance on the social attractiveness of young adults. American Journal of Orthodontics 87: 21–26

Tayer B H, Burek M J 1981 A survey of adults' attitudes towards orthodontic therapy. American Journal of Orthodontics 79: 305–315

Todd J E, Lader D 1991 Adult dental health 1988 United Kingdom. Her Majesty's Stationery Office, London