The influence of mandibular prominence on facial attractiveness

Chris Johnston*, Orlagh Hunt*, Donald Burden*, Mike Stevenson** and Peter Hepper***

*Orthodontic Division, Oral Healthcare Research Centre, School of Clinical Dentistry, ***School of Psychology, Queen's University Belfast, **Clinical Research Support Centre, Royal Hospitals, Belfast, Northern Ireland, UK

SUMMARY This study examined the attractiveness of facial profiles. One hundred and two social science students (28 males and 74 females) rated the attractiveness of a series of silhouettes with normal, Class II or Class III profiles. A random sequence of 10 images included an image with the Eastman normal SNB value of 78 degrees, and images with SNB values of 2.5, 5, 7.5 and 10 degrees above and below normal. A duplicate image in each sequence was used to assess reproducibility. The participants scored the attractiveness of each image and also indicated whether they would seek treatment if each image was their own profile.

The profile with the normal SNB angle of 78 degrees was rated as the most attractive. Attractiveness scores reduced as the mandibular profile diverged from the normal SNB value. The +5 degree profile (SNB = 83 degrees) was rated as significantly more attractive than the -5 degree profile (SNB = 73 degrees; P = 0.004). No other significant differences between the scores for Class II and Class III profile pairs of equal severity were found. At 10 degrees below the normal SNB (Class II), 74 per cent of the sample would elect to have treatment, while 78 per cent would elect to have treatment at 10 degrees above the normal SNB (Class III).

Introduction

In non-growing patients with skeletal discrepancies, the orthodontist is often faced with the choice of carrying out either orthodontic camouflage treatment or more complex surgical orthodontic treatment. The decision is partly influenced by the risks of surgical orthodontic treatment known to outweigh those of camouflage orthodontics. The magnitude of skeletal discrepancy is another important factor, with surgical treatment being used for the correction of the most severe skeletal discrepancies (Proffit and Fields, 2000). However, there remains a significant proportion of subjects who are regarded as borderline and for whom treatment planning is difficult. In these cases, although cephalometric analysis can be helpful, the decision-making process is largely based on subjective clinical judgement. Unfortunately, however, there is a lack of scientific evidence to guide the clinician on the range of skeletal discrepancy that is aesthetically acceptable.

Phillips *et al.* (1995) reported that subjects with Class I profiles were rated as more attractive than those with Class II or Class III profiles, by patients and their peers as well as by orthodontists and oral surgeons. Kerr and O'Donnell (1990) also found that dental professionals and lay people rated the facial profiles of subjects with Class I malocclusions as significantly more attractive than those with Class II or Class III profiles. There is also evidence that Class II profiles are regarded as less attractive than Class III profiles (Czarnecki *et al.*, 1993; Michiels and Sather, 1994; Cochrane *et al.*, 1999).

A common limitation of previous investigations is that the influence of the severity of skeletal discrepancy on perceived attractiveness has not been evaluated objectively. While some studies have investigated the relationship between changes in skeletal discrepancy and attractiveness, the relationship between the size of the profile changes and attractiveness has not been fully examined. Arpino et al. (1998) examined the perception of patients' actual and modified profiles by the patients themselves, clinicians, family and partners. In that study, profile images were modified to produce various degrees of antero-posterior discrepancy. While the preferred amount of discrepancy was similar for patients and professionals, it was found that the patients had a significantly lower tolerance for deviation from the preferred image.

The aim of the current investigation was to determine the facial profile relationship that is regarded as most attractive by lay people. The study was also designed to allow comparison between Class II and Class III profile relationships.

Methods and methods

Methods

Attractiveness ratings were obtained from visual assessment of a series of facial profile silhouettes representing various degrees of mandibular deficiency and excess.

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Profile images

The profile images were generated from a cephalometric film of a patient whose main dentoskeletal cephalometric measurements matched the Eastman normal values (Mills, 1987). The film was digitized using the Opal Image software (COGSOFT, British Orthodontic Society, London, UK) and a silhouette profile image was produced. Using the Opal Image software and based on this original digitized image, a series of nine images was then generated using SNB values within a range of ± 10 degrees from the Eastman normal value of 78 degrees (i.e. 68-88 degrees), with the range divided into equal intervals of 2.5 degrees. This range was chosen as it represented a variation in the ANB angle from -5 to +5standard deviations from the Eastman normal value. The SNA value remained constant between images. The cephalometric measurements of the anteroposterior skeletal discrepancy for the nine images are shown in Table 1 and examples of the profile images in Figure 1.

Nine different series of profile images were then prepared, each of which consisted of the nine different profile images in a random order together with a duplicate of the second image of that series. The duplicate images were used to assess intra-examiner repeatability.

Judges

One hundred and two first-year social science students participated as judges in the study (28 males and

 Table 1
 Values of SNA, SNB and ANB for profile images.

Image	SNA (degrees)	SNB (degrees)	ANB (degrees)
В	81	85.5	-4.5
С	81	83	-2
D	81	80.5	0.5
E (Eastman normal)	81	78	3
F	81	75.5	5.5
G	81	73	8
Н	81	70.5	10.5
I	81	68	13



Figure 1 Examples of profile images used in the study.

74 females, with a mean age of 20.4 years and a range of 17–40 years). Each judge was randomly allocated one of the nine possible printed profile sequences. The participants were asked to rate each image on a numerical scale of 1 to 10, with 1 representing very unattractive and 10 very attractive. For each image, the participants were also asked to indicate, using the response choices of yes or no, whether they would seek treatment if that image represented their own profile.

The questionnaire also recorded other details regarding the participant's orthodontic history, including whether they had ever received orthodontic treatment, whether a family member had received treatment, and whether they thought they needed orthodontic treatment at the present time. The participants were also asked to rate the importance of having a nice smile (very unimportant, unimportant, important, very important) and the attractiveness of their own smile (very unattractive, unattractive, attractive, very attractive). Data analysis was performed using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, USA).

Results

Repeatability analysis

The single measure intra-class correlation was calculated as 0.53, indicating a moderate or acceptable level of intra-examiner agreement for the duplicated images.

Attractiveness of profiles

A quadratic equation was fitted where the person (block) effect was taken out, thereby eliminating individual variation. On examining the relative change across participants, values of SNB closest to the Eastman normal of 78 degrees were viewed as the most attractive. However, when the data were considered together, there was a slight bias towards the SNB values greater than 78 degrees. Therefore, Class III profiles were preferred to those representing a more Class II profile (Figure 2).



Figure 2 Mean scores for attractiveness of images.

The profile considered the most attractive was the image representing the normal value for SNB of 78 degrees. The results of matched paired *t*-tests demonstrated that the participants considered the 83 degree profile to be more attractive than the 73 degree profile (P = 0.004). No other significant differences were established.

Desire for treatment

Twenty-one participants (20.5 per cent) failed to fully complete this section and were therefore excluded from this part of the analysis. Of the remaining 81 respondents with completed questionnaires, 19 (23.5 per cent) indicated that they would not seek treatment if their profile was represented by any of the Class II images (SNB less than 78 degrees). Eighteen participants (22.2 per cent) said that they would not seek treatment if their profile was represented by any of the Class III images (SNB greater than 78 degrees). Two participants (2.5 per cent) stated that they would seek treatment if their profile resembled the image represented by the mean. The data are summarized in Figure 3.

The participants were asked a number of questions regarding their orthodontic history. Forty-three participants (42.2 per cent) had previously received orthodontic treatment and 53 (52 per cent) had a family member who had received orthodontic treatment. Twenty-eight participants (27.5 per cent) perceived a need for orthodontic treatment now. Of the 43 students who had previously received orthodontic treatment, 14 (33 per cent) felt that they still needed treatment.

The participants were also asked about the importance of having a nice smile (very unimportant, unimportant, important, or very important) and to rate the attractiveness of their own smile (very unattractive, unattractive, attractive, or very attractive). The vast majority of the sample thought it was important or very important to have a nice smile (83.3 per cent). The majority of



Figure 3 The percentage of participants who would seek treatment if the images represented their profile.

respondents rated their own smile as attractive or very attractive (79.4 per cent).

Linear regression analysis was used to determine whether any of the participant's characteristics had influenced their scoring. The dependent variable was the point at which the respondents indicated that they would seek treatment (i.e. the mean of both positive and negative sides). Independent variables included age, gender, whether or not the participant or a family member had ever received orthodontic treatment, whether the participant felt they needed treatment now, the importance of having a nice smile and the participant's opinion regarding the attractiveness of their own smile. These variables did not prove to be significant.

Discussion

Cephalometric normal values

Cephalometric normal values are commonly used for providing guidance to clinicians during diagnosis and treatment planning and for monitoring the progress and outcome of treatment. However, it is generally accepted that normal values should not always be used as individual treatment goals. The use of normal values was first suggested by Downs (1948), who based his values on measurements from a small group of subjects with untreated but excellent occlusions. Hamdan and Rock (2001) reviewed the origins of the normal values used with various cephalometric analyses and reported that most are based on subjects with clinically normal or acceptable occlusions and good facial appearance (Riedel, 1957; Taylor and Hitchcock, 1966; Peck and Peck, 1970; Broadbent et al., 1975; Bishara, 1981; McNamara and Ellis, 1988). The current study used the Eastman normal value for SNB of 78 degrees (Mills, 1987). These values are the most widely used by UK orthodontists and their derivation by Ballard (1956) has been reviewed by MacAllister and Rock (1992) and Hamdan and Rock (2001).

The most attractive profile

The main finding of the current study was that the Eastman normal value for SNB of 78 degrees was considered by the lay judges to be associated with the most attractive profile relationship when the SNA value was at the Eastman normal of 81 degrees. This finding therefore supports the appropriateness of using the Eastman normal SNB in clinical practice, with less than 3 per cent of the lay judges indicating that they would seek treatment if they had a profile with a normal SNB value. This finding is not surprising in view of the method of selection of the original Eastman sample and that of other analyses with a similar normal SNB value (Downs, 1948).

Adjustment of SNB only

The current study was based on the alteration of mandibular prominence only, with maxillary prominence and the vertical dimensions remaining unchanged. This approach ensured that the possible confounding influence of variables such as the nasolabial angle and lower face height were adequately controlled.

Changes in attractiveness with severity

The changes in reported attractiveness for Class II and Class III images as the SNB angle diverged from normal were similar. When the changes in attractiveness ratings were examined in relation to the initial severity of the antero-posterior discrepancy, a law of diminishing returns was evident. While improving more extreme skeletal discrepancies brings greater reward in terms of improved attractiveness ratings, similar changes applied to more modest skeletal discrepancies do not produce the same level of improvement. Figures 2 and 3 reveal this trend, with steeper changes in the attractiveness ratings and the desire for treatment when the SNB values are further away from the normal value of 78 degrees. The greatest reduction in attractiveness scoring was seen in the intervals between 73 and 70.5 degrees for Class II and between 83 and 85.5 degrees for Class III. From a clinical perspective, these findings indicate that even a relatively small correction of SNB discrepancies within these ranges is likely to be associated with clinically significant changes in attractiveness.

Two-thirds of the judges would not seek treatment for profiles with a SNB value in the range 73–83 degrees, and the Class III data indicate that correction of a SNB value of 83 degrees to the normal SNB of 78 degrees is associated with relatively small improvements in attractiveness. These findings are interesting and indicate that for lay people there is a wider range of acceptable skeletal discrepancy than orthodontists might suppose. Orthodontists commonly use a narrower range of one standard deviation from the mean as their definition of the acceptable range for SNB, i.e. 75–81 degrees.

Class II versus Class III

In the current study, Class II profiles were rated overall as less attractive than Class III profiles, although the difference was small. This has also been reported by other authors (Czarnecki *et al.*, 1993; Michiels and Sather, 1994; Cochrane *et al.*, 1999) and this pattern was also seen when judges were asked whether they would seek treatment if the profiles represented their own, with judges being less likely to seek treatment for the Class III profiles overall. The analysis revealed that this decision was not significantly influenced by the judges' gender. Although the majority of judges in the study were female (72.5 per cent), the analysis revealed that gender did not affect scoring. Furthermore, this proportion of females approximates that of the typical surgical orthodontic caseload (Bailey *et al.*, 2001). The age range of the judges in the current study was relatively narrow, and 42 per cent had previously received orthodontic treatment. However, it is proposed that the sample of judges chosen was a representative peer group for patients who are making the choice of whether or not to undergo surgical correction of profile discrepancies.

Conclusions

- 1. In this study, the profile representing the Eastman normal SNB value (78 degrees) was rated as the most attractive.
- 2. A Class III profile was considered to be more attractive than a Class II profile with a similar amount of skeletal discrepancy.
- 3. At least two-thirds of lay people would not seek treatment for correction of their profile until the SNB was less than 73 degrees or greater than 83 degrees.
- 4. Even at the most extreme values of SNB (68 and 88 degrees), more than 20 per cent of judges would still not seek profile correction.

Address for correspondence

Chris Johnston Orthodontic Division School of Clinical Dentistry Queen's University Belfast Royal Victoria Hospital Grosvenor Road Belfast BT12 6BP Northern Ireland, UK Email: c.d.johnston@qub.ac.uk

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