

Are orthognathic patients different?

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SUMMARY This questionnaire-based study investigated the psychological profile of orthognathic patients prior to starting treatment and compared the findings with a control group of non-patients. Comparison of the data used multivariate multiple regression analysis where outcome variables and independent variables were studied simultaneously. Some differences were found in the psychological profile of the orthognathic patient. They displayed higher levels of state anxiety ($P < 0.001$), higher numbers of individuals in their social support network ($P < 0.05$), and lower body image and facial body image ($P < 0.001$). Self-esteem was also found to be lower, but only at borderline levels of significance ($P = 0.052$).

Introduction

As orthognathic treatment has become more readily available and more socially acceptable, the demand for treatment has increased considerably. Interest in the psychological aspects of combined orthodontic and surgical treatment has also increased, although the psychological issues are still not fully understood.

A review of the literature suggests a very high level of satisfaction and fewer post-operative problems following orthognathic surgery in contrast with studies involving cosmetic surgery patients, which in this context includes rhinoplasty, breast augmentation, and breast reduction (Heldt *et al.*, 1982). A number of reasons have been proposed for these findings, including a lower level of psychiatric disorders in those seeking orthognathic surgery (Heldt *et al.*, 1982). This, in turn, may lead to greater levels of post-surgical satisfaction.

Several authors have investigated the psychological profile of patients undergoing orthognathic treatment. Generally, these studies have been undertaken prior to surgery, rather than at the start of treatment (i.e. prior to the pre-surgical orthodontics). Flanary *et al.* (1990) investigated psychological adjustment and self-concept in 61 patients pre- and post-surgery. The patients were found to be relatively healthy and well

adjusted, both pre- and post-operatively. However, significant improvements after surgery were noted in the following areas: psychoses, neuroses, personality disorders, and integration. A positive effect was also observed in all subscales of self-concept. Cunningham *et al.* (1996) looked at levels of depression, anxiety, and self-esteem before and after surgery, but found no significant difference at the two time periods.

The aim of this study was to assess the psychological profile of orthognathic patients prior to any active treatment and to compare these values with a control group. It is reasonable to assume that some changes may take place in the psychological profile during the pre-surgical orthodontic phase and it is for this reason that the patients were assessed prior to this treatment.

Materials and methods

A questionnaire was developed which assessed various aspects of the respondent's psychological profile. Areas were selected which it was felt may play a part in the individual's responses during treatment and also their satisfaction with the outcomes of treatment:

- (1) anxiety (two measures: one each for state and trait anxiety);
- (2) depression;

- (3) perception of social support (two measures: the number of individuals in the support network and the respondent's satisfaction with their support network);
- (4) self-esteem;
- (5) body image (two measures: one for general body image and one for facial body image).

Components of the questionnaire

Anxiety. Anxiety was assessed using the State-Trait Anxiety Inventory, which was developed during the 1960s and revised in 1983 (Spielberger *et al.*, 1983). The questionnaire was developed from a large pool of statements and was extensively tested on college students. Although there are a number of instruments to measure anxiety, this is one of the most widely used in psychological and clinical research. Anxiety is generally viewed as taking two forms—the state form (transitory feelings of fear/worry) and the trait form (the stable tendency to respond anxiously to stressful situations). The instrument consists of 40 items, 20 of which measure state anxiety and 20 that measure trait anxiety. Each item is scored on a 4-point scale. The use of the instrument in this study ensured that it was used on a population with a similar age range as those for which it was developed.

Depression. The Beck Depression Inventory (BDI) was used to assess depression (Beck *et al.*, 1988). The BDI covers a wide range of items from sadness and sense of failure to self-dislike, social withdrawal, and indecisiveness. There are 21 items with scores ranging from 0 to 3. The BDI has been shown to have good psychometric properties and to be sensitive to change (Beck *et al.*, 1988).

Social support. Social support was included because there is now a widely held belief that social support affects outcomes of health intervention (Cohen and Wills, 1985). Social support is commonly seen as a resource, which can be mobilized in times of crisis to protect against health threats. Social support is a broad term—referring to social, emotional, and other supports that are provided by an individual's social contacts (Cohen and Wills, 1985). A study by

Holman *et al.* (1995) showed that general social support was important immediately post-surgery for orthognathic patients and the reactions of individuals in the social support network were important in the later post-operative periods as the patient integrates the changes into their body image.

There are a number of social support measures available, but these are greatly reduced if those that are lengthy and time-consuming to complete are excluded. The Short Form Social Support Questionnaire (Sarason *et al.*, 1987) was selected for use as it is relatively quick and easy to complete. It is a 6-item questionnaire, which measures perceived levels of support and satisfaction with this support.

Self-esteem. The concept of self-esteem or perceived self-worth is part of the wider construct of self-concept. It is a personal resource that may moderate the effects of conditions or events, including conditions such as disfigurement. Self-esteem is a dimension of life satisfaction and is an important part of general assessment of life (Andrews and Withey, 1976).

This study utilized the Rosenberg Self-Esteem (RSE) Scale, which was developed by Rosenberg (1965) for a study of students in New York. It is a 10-item scale with a 4-point scale of agreement with half the items being expressions of positive self-esteem and half negative.

Body image. Body image may be a source of distress for individuals of all ages. 'Body image' is a concept which has become more of an issue with the large amount of research in recent years focusing on those individuals with eating disorders (Lautenbacher *et al.*, 1993; Nelson and Gidycz, 1993). Body image is considered as a complex psychological concept related to the mental representation of self and it is therefore reasonable to assume that a change in body image resulting from surgical procedures must have an impact. It is possible that this may be influenced by the surgery itself and the response of others to the surgical outcome. Body image is also thought to be related to self-esteem. A body or facial defect may affect self-esteem directly by negative feedback from others or indirectly by affecting the ability to master

certain developmental tasks (Belfer *et al.*, 1982).

A revised version of Secord and Jourard's Body Cathexis Scale with a specific section asking about facial features was selected for use in the study (Kiyak *et al.*, 1986; Finlay *et al.*, 1995). The whole scale was analysed for body image and 10 items concentrating on facial features were also looked at in isolation.

Subjects

This study was part of a larger longitudinal investigation into the psychological profile of orthognathic patients during treatment. Ethical approval was received from the Joint Research and Ethics Committees of all centres involved. All participants signed a consent form, and it was stressed that responses were confidential and would not affect treatment in any way.

The questionnaire was distributed to 84 patients in three different centres. All patients had attended the Joint Orthodontic Maxillofacial Clinic with a view to starting orthognathic treatment. Patients were asked to complete the questionnaire at home as it took in the region of 30–40 minutes to complete. They were provided with a stamped addressed envelope and asked to return the questionnaire within 1 week following the appointment. Respondents who did not reply within 2 weeks were contacted by telephone. All patients approached agreed to take part in the study and only three failed to return the questionnaire, leaving a total number of 81 respondents (response rate 96 per cent).

A control group was recruited from local colleges and offices and was matched by age, sex, and ethnic group as closely as possible with the experimental group. As with the experimental group, a stamped addressed envelope was provided. A total of 106 individuals were approached and 95 questionnaires were returned (response rate 90 per cent).

Components of the questionnaire that were not fully completed or were incorrectly completed were excluded from the analysis. Data was complete for the Beck Depression Inventory, but all other scales had some data missing. One respondent failed to answer for state anxiety,

three for trait anxiety, 10 failed to complete the social support questions, and self-esteem and body image questions were omitted by four respondents. The non-completion of the social support measure was felt to reflect the additional effort required for its completion.

Statistical analysis

The data were analysed using the MLwiN regression analysis programme (Multilevel Models Project, Institute of Education, University of London, UK). In view of the fact that each control group respondent was not individually matched (one-for-one) for age, gender, and ethnic group with a comparable respondent in the experimental group, multiple regression analysis was undertaken where these patient characteristics were considered simultaneously for their impact on the eight-outcome measures. The outcome measures were analysed simultaneously using multivariate techniques. This method allowed any underlying demographic differences to be accounted for whilst evaluating the impact of dentofacial deformity (i.e. whether the patient was in the experimental or control group).

Age was treated as a continuous variable and the mean age of all 176 respondents was subtracted from individual age in order to centre the variable. This provided a meaningful interpretation of the regression coefficient when the age variable adopts the value of zero. Gender and dentofacial groups were binary variables, and were therefore allocated values of 1 or 0 for male or female, and experimental or control group. Ethnic group was introduced into the regression analysis separately and each group was contrasted with the largest group (white). The ethnic groups recorded were white, South Asian (Bangladeshi, Bengali, Indian, and Pakistani), black (black African, black Afro-Caribbean and black other), and other (including Moroccan, Cypriot and Persian).

Each outcome variable was assessed for normality, as this distributional property was required prior to undertaking regression analysis. Values that were skewed or kurtosed were transformed to produce a more normal distribution using functions of the natural logarithm.

All outcome measures were then standardized in order to convert deviations from the mean to units of standard deviations. This permitted comparison across all outcome measures of the relative differences in psychometric score between the two dentofacial groups.

The multivariate method yields eight simultaneous regression equations:

$$y^{(k)} = \beta_0^{(k)} + \beta_1^{(k)} \times \text{facial group} + \beta_2^{(k)} \times \text{gender} + \beta_3^{(k)} \times \text{centred age} + \beta_4^{(k)} \times \text{ethnic 1} + \beta_5^{(k)} \times \text{ethnic 2} + \beta_6^{(k)} \times \text{ethnic 3} \quad (1)$$

where $k = 1, \dots, 8$ and each outcome variable is normally distributed.

Parameters in equation 1 that were not significant at the 95 per cent level were removed from the final regression model. Correlations between the outcome measures were also studied.

Results

The results are shown in Tables 1–4.

Table 1 illustrates the values for the experimental and control groups prior to transformation and standardization. Only the first five psychometric scales required logarithmic adjustment prior to standardization.

The point estimates and 95 per cent confidence intervals for the multivariate regression analysis are shown in Table 2. Facial group was left in the model for self-esteem, although it was of borderline significance.

Group

Table 2 illustrates a number of interesting findings with respect to the groups (experimental or control). The experimental group showed a higher level of state anxiety than the control group, this value being on average 3.2 points higher. In addition, the experimental group reported a higher number of individuals in their social support network (mean difference of 0.7 people), and less satisfaction with their overall and facial body image (mean differences of 9.32 and 8.89, respectively). Self-esteem was of borderline significance, with the experimental group showing lower self-esteem.

Socio-demographics

The age of the respondent was significant for only one of the outcome variables—facial body image. For every 10 year increase in age, dissatisfaction with facial body image increased by 1.3 points.

Table 1 Values prior to transformation and standardization.

	Experimental				Control			
	Min	Max	Mean	SD	Min	Max	Mean	SD
State anxiety (range 0–80)	20	77	41.7	10.6	20	65	36.4	9.9
Trait anxiety (range 0–80)	25	78	43.8	11.9	24	66	40.9	10.7
Depression (range 0–63)	0	39	9.4	9.1	0	22	6.6	5.3
Social support (number) (range 0–9)	0.3	9.0	4.2	2.0	0.0	9.0	3.6	2.4
Social support (satisfaction) (range 0–6)	1.0	6.0	4.9	1.0	1.0	6.0	5.1	1.0
Self-esteem (range 10–40)	11.0	37.0	21.3	5.8	10.0	34.0	19.0	5.3
Body image (range 27–135)	34.0	123.0	82.1	17.6	27.0	108.0	70.3	18.4
Facial body image (range 10–50)	16.0	47.0	33.3	6.2	10.0	37.0	23.5	6.8

NB: Scoring for all scales

Anxiety	Increasing anxiety	= higher scores
Depression	Increasing depression	= higher scores
Social support	Increasing social support	= higher scores
Self-esteem	Increasing self-esteem	= lower scores
Body image	Increasing body image	= lower scores

Table 2 Results of multivariate analysis (confidence intervals in parenthesis).

	Constant*	Group	Gender	Age (per 10 years)
State anxiety	35.6 (34.0,37.3)	3.2 (1.2,5.4)	—	—
Trait anxiety	40.8 (39.2,42.5)	—	—	—
Depression	5.8 (5.0,6.7)	—	—	—
Social support (number)	2.5 (1.3,3.9)	0.7 (0.1,1.3)	−0.6(−1.0,−0.1)	—
Social support (satisfaction)	4.7 (5.3,3.8)	—	—	—
Self-esteem	20.3 (19.3,21.4)	1.1 (−0.0,2.1)	−2.7 (−3.8,−1.6)	—
Body image	74.5 (70.7,78.4)	9.3 (4.8,13.8)	−8.5 (−13.1,−4.0)	—
Facial body image	27.3 (24.6,30.0)	8.9 (7.2,10.6)	−1.9 (−3.6,−0.2)	1.3 (0.3,2.3)
	Ethnic 1 (South Asian)	Ethnic 2 (black)	Ethnic 3 (other)	
State anxiety	—	—	—	
Trait anxiety	—	—	—	
Depression	—	—	—	
Social support (number)	1.3 (−0.1,2.9)	0.3(−1.0,1.9)	0.2 (−1.2,1.9)	
Social support (satisfaction)	0.7 (0.1,1.0)	0.3 (−0.7,0.8)	0.4 (−0.5,0.9)	
Self-esteem	—	—	—	
Body image	—	—	—	
Facial body image	−2.9 (−5.3,−0.5)	−3.8 (−6.5,−1.0)	−3.5 (−6.3,−0.6)	

*Baseline values are those for white female controls aged 22 years.

Table 3 Significant parameters for each outcome variable.

	Significant parameters			
	Group	Gender	Age	Ethnic group
Anxiety (state)	***	NS	NS	NS
Anxiety (trait)	NS	NS	NS	NS
Depression	NS	NS	NS	NS
Social support (number)	*	*	NS	**
Social support (satisfaction)	NS	NS	NS	**
Self-esteem	NS	***	NS	NS
Body image	***	***	NS	NS
Facial body image	***	*	**	*

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Gender was significant for four outcome variables—number of individuals in the social support network, self-esteem, body image, and facial body image. With respect to females, males were likely to report fewer individuals for social support (mean difference of 0.6 people). Males also reported higher self-esteem (i.e. lower

psychometric scores), and greater satisfaction with their body image and facial body image (also indicated by lower psychometric scores).

There were some significant differences between white and minority ethnic respondents, even though not all individual minority ethnic group terms were significant. Ethnic group was

Table 4 Correlations for the model.

	State anxiety	Trait anxiety	Depression	Social support (number)	Social support (satisfaction)	Self-esteem	Body image	Facial body image
State anxiety	1.00							
Trait anxiety	0.73	1.00						
Depression	0.56	0.74	1.00					
Social support (number)	–	–	–	1.00				
Social support (satisfaction)	–0.27	–0.29	–0.22	0.21	1.00			
Self-esteem	0.54	0.71	0.62	–	0.35	1.00		
Body image	0.39	0.49	0.46	–	0.23	0.58	1.00	
Facial body image	0.47	0.44	0.41	–	0.26	0.51	0.82	1.00

significant for both the number of people in their social support network and satisfaction with this area of their life. However, for social support (number) no individual minority ethnic group attained significant differences and for social support (satisfaction) only the South Asian group differed significantly (mean difference of 0.7 points). All minority ethnic groups reported more individuals offering social support and greater satisfaction with this support than the white group. Minority ethnic groups also reported greater satisfaction with facial body image than white subjects, with black respondents reporting the greatest satisfaction of all four groups.

The significant parameters for each outcome measure are shown in Table 3. Group was significant for state anxiety, social support (number), body image, and facial body image with borderline significance for self-esteem.

Table 4 gives the pre-model (or crude) outcome variable correlations. These did not alter significantly after modelling (not presented). The most notable correlations were for trait and state anxiety (0.73), depression and trait anxiety (0.74), self-esteem and trait anxiety (0.71), self-esteem and depression (0.62), and body image and facial body image (0.82).

Discussion

The results show that there are several parameters that affect the eight outcome variables. The only significant parameter affecting the difference in the state anxiety scores was whether

the respondent was in the experimental or control group. As state anxiety is defined as transitory feelings of fear or worry, it is perhaps not surprising that the experimental group achieved a higher score in this variable. In contrast, in the dentofacial group there was no significant effect with respect to trait anxiety—the stable tendency to respond anxiously to stressful situations. Thus, the experimental and control groups did not differ fundamentally in their stable tendency to respond to anxious situations, although they exhibited different transitory levels of anxiety. This supports the concept that the two forms of anxiety should be assessed separately.

The dentofacial group was not significant for the BDI. This is encouraging in that orthognathic patients do not show higher levels of depression at the start of treatment. Therefore, the depression experienced by some patients following surgery is likely to be a reactive depression as a result of the treatment, rather than endogenous depression. The report of higher numbers in the support network of the experimental group may be relevant during treatment, even though satisfaction with social support did not show significant differences. Holman *et al.* (1995) noted the importance of social support, particularly in the post-operative period and this may influence satisfaction following treatment.

Although the dentofacial group only showed borderline significance for self-esteem values, this is an interesting area that could be studied further, possibly with a larger sample size. The

parameters that affect self-esteem are still largely unknown. The dentofacial group findings regarding body image are not surprising, as it is reasonable to assume that a patient who is prepared to go through extensive treatment to change their appearance probably has lower body image, particularly with respect to their facial features. The facial body image variable revealed the largest number of significant independent variables in the regression model. Satisfaction with facial body image decreased with age. It may therefore be interesting to study a group of older patients requesting orthognathic surgery and determine whether this is generally the case. This may also have some bearing on the success of outcome when operating on older patients.

The results regarding gender showed that males reported fewer individuals in their social support network, but interestingly satisfaction with support was not significantly different. Females showed lower self-esteem and reduced satisfaction with body image. Kiyak *et al.* (1981) reported that aesthetic improvement was important for both males and females, but it would still seem likely that females are starting from a lower baseline value than males.

Ethnic group was significant with respect to the number of individuals in the social support network, with all minority ethnic groups reporting a higher number of individuals compared with the white group. This is important because it may be that white patients need additional support during treatment and the clinician should be particularly vigilant. Satisfaction with social support was significant, with the South Asian group having the major effect. It is of interest that all minority ethnic groups reported higher scores on the facial body image scale than whites, indicating that facial appearance may be more important in the white culture.

The reason multivariate multiple regression analysis was undertaken was two-fold: to optimize the modelling for each psychometric scale through consideration of all eight variables simultaneously and to account for any residual demographic differences between the experimental and control groups, since respondents had not been matched one-for-one. Therefore, independent demographic variables that were found to be

significant may have resulted from poor matching. Alternatively, differences might be inherent demographic contrasts measured by the associated psychometric scale. However, age was shown to be significant only for facial body image, and gender differences reflected anticipated differences between males and females, both of which suggested good matching for these variables. It was anticipated that matching would be most difficult for ethnic groups. However, there is little known regarding ethnic group differences among the psychometric measures investigated, and it is likely that there was a combination of both poorer matching and some cultural variability among the psychometric scales.

Correlations in the null model differed very little from those in the final model. In conjunction with the knowledge that matching was generally good, it is therefore reasonable to conclude that the chosen psychometric variables are demographically and culturally stable. That is the measures used were robust across the age, gender, and ethnic group composition of the target study groups. This is encouraging as one of the criticisms sometimes levelled at psychometric tests is that they are not culturally diverse.

Even though state and trait anxiety were measuring different aspects of anxiety, the high correlation between state and trait anxiety is perhaps not surprising. Neither is the correlation between body image and facial body image, since the latter is a sub-component of the body image scale. However, the correlations between self-esteem and trait anxiety (0.71), and self-esteem and depression (0.62) were interesting. As trait anxiety or depression increased, self-esteem was found to decrease and *vice versa*.

There are a number of negative correlations relating to social support. For the final model, as social support (number and satisfaction) increased, state and trait anxiety, and depression were reduced. This is an encouraging finding for surgical patients in that if their social support network can be encouraged to play a part in the treatment, they may show less anxiety and depression, both during and after treatment. As social support (numbers) increased, self-esteem, body image, and facial body image values

reduced (correlations of -0.28 , -0.09 , and 0.16). However, it must be borne in mind that all the negative correlations were very low.

Conclusions

Multivariate multiple regression analysis has a number of advantages. It allows comparison of experimental and control groups, taking account of demographic composition (i.e. without the need for one-for-one matching—a process which is recognized as being both difficult and time consuming) and can model differences in several psychometric scales simultaneously.

This study showed that there were some differences in the psychological profile of orthognathic patients with respect to control group respondents. The orthognathic patient was shown to be more likely to display higher levels of state anxiety, greater social support (number), lower body image, and facial body image. It is also possible that self-esteem is lower in the experimental group, although the significance was only borderline.

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