*Original Article*

# Psychological Status of Patients Referred for Orthognathic Correction of Skeletal II and III Discrepancies

**Donald J. Burden[a]; Orlagh Hunt[b]; Chris D. Johnston[c]; Michael Stevenson[d]; Ciaran O'Neill[e]; Peter Hepper[f]**

**ABSTRACT**

**Objective:** To establish the extent of psychological problems among patients who require orthognathic treatment.

**Materials and Methods:** Five aspects of psychological functioning were assessed for 162 patients who required orthognathic treatment and compared with 157 control subjects.

**Results:** Analysis of variance did not detect any significant difference in the five psychological scores recorded for the skeletal II, skeletal III, and control groups. The proportion of subjects with one or more psychological measure beyond the normal range was 27% for skeletal II subjects, 25% for skeletal III subjects, and 26% for control subjects. One skeletal II subject (1.5%), three skeletal III subjects (3%), and five control subjects (3%) required referral for psychological counseling.

**Conclusions:** The orthognathic patients did not differ significantly from the control subjects in their psychological status. (*Angle Orthod* 2010;80:43–48.)

**KEY WORDS:** Orthognathic; Psychological status; Skeletal II; Skeletal III

## INTRODUCTION

Most patients who seek orthognathic treatment do so because of concerns about their dentofacial esthetics.[1] Despite the fact that orthognathic treatment is now routinely used for those patients for whom growth modification or orthodontic camouflage is not possible,[2,3] there is very little evidence that orthognathic treatment improves psychological well-being.[4] Indeed, it is not clear how much subjects seeking orthognathic treatment differ from the normal population in their psychological profile. An early study found that a significant proportion of patients seeking a treatment consultation for orthognathic treatment were experiencing psychological distress, with nearly a quarter of the subjects qualifying as having a positive diagnosis for a psychiatric disorder.[5] Although some subsequent studies did not find a high level of psychological distress among orthognathic patients,[6] a recent controlled study found significantly more psychological problems among orthognathic patients than was present in control patients.[7] It has been reported that patients with elevated psychological distress prior to orthognathic surgery tend to experience more difficulties and more discomfort after surgery.[8] Psychological screening to identify these individuals followed by appropriate evaluation and counseling has been proposed to help these patients cope with the additional stress of surgery.[8]

There is some indication that differences might exist in the psychological profile of patients with different types of skeletal discrepancy. A comparative study of skeletal II and skeletal III orthognathic patients found that skeletal III patients had stronger feelings of insecurity regarding their facial appearance.[9] Indeed, it has been suggested that subjects with skeletal II discrepancy are less likely to experience psychological problems than those with skeletal III discrepancy because it is possible

[a] Professor/Consultant Orthodontist, Department of Orthodontics, School of Medicine, Dentistry and Biomedical Science, Queen's University, Belfast, Northern Ireland.

[b] Lecturer, School of Medicine, Dentistry and Biomedical Science, Queen's University, Belfast, Northern Ireland.

[c] Senior Lecturer/Consultant Orthodontist, Department of Orthodontics, Queen's University, Belfast, Northern Ireland.

[d] Senior Lecturer in Medical Statistics, School of Medicine, Dentistry and Biomedical Science, Queen's University, Belfast, Northern Ireland.

[e] Professor of Health Economics, National University of Ireland, Galway, Northern Ireland.

[f] Professor, School of Psychology, Queen's University, Belfast, Northern Ireland.

Corresponding author: Dr Donald J. Burden, Department of Orthodontics, School of Dentistry, Queen's University, Belfast BT12 6BP, Northern Ireland.

Accepted: April 2009. Submitted: February 2009.

for skeletal II subjects to disguise their skeletal discrepancy by protruding their mandible.[10]

The present investigation was carried out to establish the extent of psychological problems among patients who require orthognathic treatment and to establish if the type of skeletal discrepancy (skeletal II or skeletal III) influences the patient's psychological status.

## MATERIALS AND METHODS

### Patient Sample

Ethical approval for this study was received from the Northern Ireland ethics committee. Over a 3-year period, a convenience sample of all patients seen in a university teaching hospital orthodontic department, who were considered to require orthognathic treatment, were invited to participate in the study. Each patient was initially examined by one of two consultant orthodontists who specialized in orthognathic treatment. Patients with serious medical conditions, anterior open bites, and syndromal conditions such as cleft lip and palate were excluded. Routine orthodontic clinical records were collected for these patients, including study casts, extraoral and intraoral photographs, and, when appropriate, radiographs. After all the patients were recruited, the two consultant orthodontists used the clinical records (study casts and intraoral and extraoral photographs) to independently confirm that orthognathic treatment was required.

### Control Group

Control subjects were recruited by using posters on notice boards on both university and hospital premises and through staff newsletters. Subjects with craniofacial anomalies and/or serious medical conditions were excluded from the control group. Standard orthodontic extraoral and intraoral photographs were taken. Furthermore, two experienced consultant orthodontists (who had not been involved in selecting the orthognathic surgery cases) independently reviewed the photographs of all the control group subjects and excluded subjects who had a dentofacial appearance that might justify orthognathic treatment.

### Psychological Measures

Five aspects of psychological functioning were assessed for the patient and control groups.

*State and trait anxiety.* The State Trait Anxiety Inventory for Children[11] and the State Trait Anxiety Inventory[12] were used to measure the level of anxiety in participants aged between 11 and 12 years, and aged 13 years and over, respectively.

*Self-esteem.* The Self Esteem Index (SEI)[13] was used to assess self-esteem among participants aged 11 to 18 years and attending secondary school. The Rosenberg Self Esteem Scale (RSES)[14] was used to measure self-esteem in those aged 16 years and older and no longer attending secondary school. For both the SEI and the RSES, a higher score indicates greater self-esteem.

*Depression.* Depression was measured using the Children's Depression Inventory (CDI)[15] for participants aged 11 to 17 years and attending secondary school. The Beck Depression Inventory II (BDI-II)[16] was administered to those participants aged 16 years and older who were no longer attending secondary school. In both the CDI and BDI-II, a higher score indicates a greater number of symptoms of depression.

*Behavior problems.* Behavior problems were assessed using the syndrome profile of either the Youth Self Report (YSR)[17] or Adult Self Report (ASR).[18] Adolescents aged 11 to 17 years completed the YSR, whereas adults aged 18 and older completed the ASR.

*Age adjustment of the psychological measures.* Each psychological measure was assessed using one of two possible components, used for each subject depending on their age and educational stage. Regression analysis revealed that age had an effect on the scores recorded for all the psychological measures. For each measure, an appropriate adjustment was made to allow for this age effect and to produce a standardized age-adjusted outcome score for each of the five psychological measures. This age adjustment required the state anxiety and trait anxiety scores for the younger age group to be reduced by $-0.26$ and $-0.21$, respectively. The scores among the older age groups for self-esteem, behavior, and depression were adjusted by $-0.54$, $+0.35$, and $+0.29$, respectively. These age-adjusted standardized scores were then used in the subsequent analysis.

Each completed questionnaire was examined by a health psychologist (Dr Hunt), and where there was cause for concern (eg, thoughts or actions of self-harm), onward referral, with the subject's consent, for professional psychological support was made.

## RESULTS

A total of 162 white patients deemed to require orthognathic treatment and 157 control subjects who did not require orthognathic surgery were recruited. Among the orthognathic cases, 30 patients (18%) had also previously received conventional orthodontic treatment. None had previously undergone orthognathic surgery. Among the control group subjects, 57 (36%) had previously received conventional orthodontic treatment.

The orthognathic sample was composed of 95 cases with skeletal III discrepancy and 67 cases with skeletal

**Table 1.** Number of Males and Females, Mean Age, and Age Range of Each Group

| | Skeletal II Group | Skeletal III Group | Control Group |
|---|---|---|---|
| Male | 22 (33%) | 44 (46%) | 62 (40%) |
| Female | 45 (67%) | 51 (54%) | 95 (60%) |
| Total | 67 | 95 | 157 |
| Mean age, y | 25.4 | 19.6 | 22.5 |
| Age range, y | 14–53 | 11–53 | 10–58 |

II discrepancy (Table 1). The three groups (orthognathic skeletal II, orthognathic skeletal III, and control) did not differ significantly in the proportion of males and females (chi-square, $P = .25$). Analysis of variance (ANOVA) revealed that there were no significant differences between the age of the control group and the age of the skeletal III group, or between the skeletal II group and the control group (Table 1). However, patients in the skeletal III group were significantly younger than the skeletal II patients, $F(1, 2) = 7.06$, $P = .001$.

### Psychological Measures

The mean age-adjusted scores for the five psychological measures are reported in Table 2. When the age-adjusted scores for each of the five psychological measures were analyzed using ANOVA, no significant differences were detected among the three groups (Table 2). The mean differences and 95% confidence intervals for the three groups (control, skeletal II, and skeletal III) are highlighted in Table 3. For nearly all of the psychological measures, the scores recorded by the skeletal II group and skeletal III group were poorer than those recorded by the control group. The only exception was the behavior problem scores recorded by the skeletal III group, which were lower (better) than the control group (Table 2). The skeletal II group recorded poorer scores than the skeletal III group for all the measures. This was particularly evident for state anxiety, trait anxiety, and self-esteem, which were closer to statistical significance than the other psychological measures (Tables 2 and 3).

### Psychological Scores Outside the Normal Range

Table 4 reveals the proportion of subjects in each group who had scores outside the normal ranges in one or more of the psychological measures. Approximately a quarter of the subjects in each group fell into this category; however, only a relatively small number were considered to require onward referral for professional psychological support.

**Table 3.** Mean Differences in the Age-Adjusted Scores and the 95% Confidence Intervals for the Five Psychological Measures

| | Mean Difference | 95% Confidence Interval |
|---|---|---|
| Depression | | |
| Skeletal II vs control | 0.15 | −0.14, 0.45 |
| Skeletal III vs control | 0.06 | −0.21, 0.32 |
| Behavior | | |
| Skeletal II vs control | 0.02 | −0.28, 0.32 |
| Skeletal III vs control | −0.15 | −0.42, 0.13 |
| State anxiety | | |
| Skeletal II vs control | 0.27 | −0.02, 0.55 |
| Skeletal III vs control | 0.18 | −0.08, 0.44 |
| Trait anxiety | | |
| Skeletal II vs control | 0.27 | −0.02, 0.55 |
| Skeletal III vs control | 0.15 | −0.11, 0.40 |
| Self-esteem | | |
| Skeletal II vs control | −0.28 | −0.59, 0.03 |
| Skeletal III vs control | −0.19 | −0.47, 0.09 |

## DISCUSSION

At the time of data collection, all patients were considered to be at the stage of seeking and deciding on treatment options. For adolescent patients, the final decision about whether to proceed with orthognathic treatment is not usually made until facial growth has ceased. Phillips et al[5] highlighted the importance of studying subjects who are seeking orthognathic treatment rather than only those who have already commenced treatment. In the present study, approximately two-thirds of the patients being considered for orthognathic treatment were female, which agrees with previous studies of patients referred for or in receipt of orthognathic treatment.[1–3,5,6,10]

The wide age range of the recruited patients reflects the age range of patients referred to this specialist unit. Although for both the skeletal II and skeletal III groups most of the patients were young adults, these groups also contained patients in early and late adolescence as well as older patients. A similar wide age range and

**Table 2.** Mean Age-Adjusted Scores for the Five Psychological Measures

| | Control Group | Skeletal II Group | Skeletal III Group | *df* | *F* Value | Significance |
|---|---|---|---|---|---|---|
| Depression | 0.14 | 0.29 | 0.19 | 2 | 0.53 | .59 |
| Behavior | 0.25 | 0.26 | 0.10 | 2 | 0.67 | .51 |
| State anxiety | −0.11 | 0.16 | 0.07 | 2 | 2.00 | .14 |
| Trait anxiety | −0.11 | 0.15 | 0.04 | 2 | 1.88 | .16 |
| Self-esteem | −0.54 | −0.83 | −0.73 | 2 | 1.93 | .15 |

**Table 4.** Number and Proportion of Subjects in Each Group Who Had Scores Outside the Normal Range for One or More of the Psychological Measures and the Number of Subjects Considered to Require Onward Referral for Psychological Support

| | Skeletal II (%) | Skeletal III (%) | Control (%) |
|---|---|---|---|
| Subjects with one or more psychological measure outside normal range | 18 (27%) | 24 (25%) | 41 (26%) |
| Subjects requiring professional psychological support | 1 (1.5%) | 3 (3%) | 5 (3%) |

mean age were reported by Philips et al[5] among 194 patients being considered for orthognathic treatment.

A systematic review[4] has shown that the conclusions of most previous studies in this field have been compromised by a consistent methodological flaw, whereby the control groups recruited patients who actually required orthognathic treatment but who had declined this treatment. In the current study, however, the control group was recruited to reflect the general population of individuals who do not have severe skeletal discrepancies and therefore do not require orthognathic treatment. In the present study, one-third of the control group had previously received conventional orthodontic treatment. Previous studies have shown that approximately one-third of the UK population receives orthodontic treatment, and the control group can therefore be considered to be representative of the normal population.[19]

For the clinician, the interpretation of previous research in this area is difficult because of the wide variety of psychological measures used. A commonly used instrument in previous studies has been a self-administered generic psychological questionnaire, the SCL-90-R,[5,6] which is designed as a screening tool for psychological distress and psychological disorders. Although the SCL-90-R has subscales that evaluate depression and anxiety, the present study used specific individual questionnaires to precisely measure depression, anxiety, behavior, and self-esteem. This approach provides a much more in-depth, detailed, and comprehensive evaluation of the subjects' psychological status. Other researchers have also used these more specific measures in psychological studies of orthognathic patients.[7,20] However, most previous studies have not used control groups but have instead used previously published reference values for comparison with patient data. Although this is an acceptable practice, it is generally agreed that psychological research studies are more robust when appropriate control groups are used for comparison.[4]

Although no statistically significant differences were found, it is interesting to note that compared with the control group and the skeletal III patients, the skeletal II patients had poorer scores for all of the psychological measures, particularly for anxiety and self-esteem. *Trait anxiety* refers to levels of anxiety proneness, which remain relatively stable within individuals.[12] The higher scores among the skeletal II patients suggest that they may have a tendency toward being generally more anxious. The stronger the anxiety trait, the more probable it becomes that an individual will experience more intense elevations of anxiety in threatening situations.[11] State anxiety is a transitory, emotional condition characterized by subjective feelings of tension and apprehension. The results suggest not only that skeletal II patients have a general tendency toward greater anxiety but also that they expressed increased anxiety at the time of assessment.

The differences observed in the current study between the mean scores recorded by the skeletal II and skeletal III patients in their psychological status may be related to societal expectations of facial attractiveness. In a previous study, more than 100 laypeople were asked to rate the facial attractiveness of a series of silhouettes representing skeletal II and skeletal III profiles.[21] It was found that for equivalent levels of skeletal discrepancy, skeletal II profiles were rated as more unattractive than skeletal III profiles. It is conceivable that compared with individuals who have severe skeletal III profiles, those who have a severe skeletal II profile receive greater negative feedback about their dentofacial appearance, and this might explain why the skeletal II patients had poorer psychological scores. It is known that psychosocial stress can be influenced either directly by teasing or indirectly by societal stereotyping.[5] The higher trait anxiety scores recorded for the skeletal II group could be explained by the fact that this skeletal discrepancy is present from an early age and these individuals experience hurtful teasing and are therefore more anxious.

In the only other study to compare the psychological status of orthognathic cases with a nonsurgery control group, Cunningham et al[7] used similar standardized measures of state and trait anxiety, depression, and self-esteem. The authors found that compared with a control group, the orthognathic group displayed significantly higher levels of state anxiety. Self-esteem was also found to be lower but did not quite reach a level of statistical significance. These trends are similar to those found in the current investigation, although Cunningham et al[7] did not analyze the influence of skeletal classification. The current investigation indicates that among orthognathic patients, skeletal classification may have an influence on psychological status. However, further studies incorporating larger sample sizes are required to provide definitive evidence to support this hypothesis.

One of the key questions that clinicians face is whether there is a need to routinely screen patients

referred for orthognathic surgery to identify those with psychological problems. Phillips et al[5] proposed that it is important to identify patients who exceed the clinical thresholds for symptom reporting of psychological or psychiatric problems. Our study revealed that although a quarter of orthognathic subjects were outside the normal range in at least one of the psychological measures, this was also true for the control group. The interpretation of standardized psychological questionnaires is complex, and a score outside the normal range in an individual component of a psychological assessment does not necessarily mean that professional psychological intervention is needed for that patient. In a separate arm of this study, which will be reported in a future publication, all of the subjects completed a semistructured interview. These semistructured interviews were also used to inform the decision about the need for professional psychological intervention. When the individual questionnaire results in the current study were assessed by an experienced health psychologist, most of those subjects with elevated scores were considered to be at the subclinical level and therefore deemed to not require any professional psychological counseling. However, a small number were considered to need support, mainly because of reports of or thoughts of self-harm. Again, it is interesting to note that the numbers requiring professional psychological help were almost the same in the control group as in the orthognathic patient group.

Health screening has been defined as the presumptive identification of unrecognized disease or defect by the application of tests, examinations, or other procedures that can be applied rapidly.[22] While many screening programs have been considered by the medical profession to be worthwhile, this assessment has usually been based on subjective opinion rather than objectively applied criteria.[23] Therefore, before screening programs are introduced, they require rigorous evaluation not only to prevent wasting of resources and manpower as a result of ineffectiveness but also to avoid the potential harm caused by unnecessary worry due to referrals and procedures that incorrectly identify individuals.[24] The assessment of any proposed screening program includes the cost of case finding (including diagnosis and treatment) and needs to be economically balanced in relation to possible expenditure on medical care as a whole.[22–24] When the findings of the current study are scrutinized using modern evaluation criteria for screening programs, it would appear unlikely that routine psychological screening of patients referred for orthognathic treatment could be justified. However, this study has shown that individual variation does exist and that some prospective orthognathic patients will be experiencing severe psychological distress that requires treatment.

## CONCLUSIONS

- Compared with the control group, for nearly all of the psychological measures, less good mean psychological scores were present in both skeletal II and skeletal III subjects. However, these scores did not reach a level of statistical significance.
- The worst mean scores for all of the psychological measures were found in the skeletal II patients, particularly for anxiety and self-esteem.
- Only a small number of orthognathic subjects needed professional psychological support, and the number was similar to those needing professional psychological support among the control subjects.
- The results of this study do not support the routine psychological screening of all patients referred for orthognathic surgery.

## ACKNOWLEDGMENT

The authors acknowledge the financial support of the Northern Ireland Research and Development Office.

## REFERENCES

1. Stirling J, Latchford G, Morris DO, Kindelan J, Spencer RJ, Bekker HL. Elective orthognathic treatment decision making: a survey of patient reasons and experiences. *J Orthod*. 2007;34:113–127.
2. Johnston C, Burden D, Kennedy D, Harradine N, Stevenson M. Class III surgical-orthodontic treatment: a cephalometric study. *Am J Orthod Dentofacial Orthop*. 2006;130:300–309.
3. Burden D, Johnston C, Kennedy D, Harradine N, Stevenson M. A cephalometric study of Class II malocclusions treated with mandibular surgery. *Am J Orthod Dentofacial Orthop*. 2007;131:7.e1–7.e8.
4. Hunt OT, Johnston CD, Hepper PG, Burden D. The psychosocial impact of orthognathic surgery: a systematic review. *Am J Orthod Dentofacial Orthop*. 2001;120:490–497.
5. Phillips C, Bennett ME, Broder HL. Dentofacial disharmony: psychological status of patients seeking treatment consultation. *Angle Orthod*. 1998;68:547–556.
6. Hatch JP, Rugh JD, Bays RA, Van Sickels JE, Keeling SD, Clark GM. Psychological function in orthognathic surgical patients before and after bilateral sagittal split osteotomy with rigid and wire fixation. *Am J Orthod Dentofacial Orthop*. 1999;115:536–543.
7. Cunningham SJ, Gilthorpe MS, Hunt NP. Are orthognathic patients different? *Eur J Orthod*. 2000;22:195–202.
8. Phillips C, Kiyak HA, Bloomquist D, Turvey TA. Perceptions of recovery and satisfaction in the short term after orthognathic surgery. *J Oral Maxillofac Surg*. 2004;62:535–544.
9. Gerzanic L, Jagsch R, Watzke IM. Psychologic implications of orthognathic surgery in patients with skeletal Class II or Class III malocclusion. *Int J Adult Orthod Orthognath Surg*. 2002;17:75–81.
10. Nurminen L, Pietila T, Vinkka-Puhakka H. Motivation for and satisfaction with orthodontic-surgical treatment: a retrospective study of 28 patients. *Eur J Orthod*. 1999;21:79–87.
11. Spielberger CD. *State-Trait Anxiety Inventory for Children—Preliminary Manual*. Menlo Park, CA: Mind Garden; 1973.

12. Spielberger CD. *Manual for the State-Trait Anxiety Inventory (STAI)*. Palo Alto, CA: Consulting Psychologists Press; 1983.
13. Brown L, Alexander J. *Self-Esteem Index: Examiner's Manual*. Austin, TX: Pro-Ed; 1991.
14. Rosenberg M. *Society and the Adolescent Self-Image*. Middletown, CT: Wesleyan University Press; 1989.
15. Kovacs M. *Children's Depression Inventory Manual*. New York, NY: Multi-Health Systems; 1992.
16. Beck AT, Steer RA, Brown GK. *Manual for the Beck Depression Inventory-II*. San Antonio, TX: Psychological Corporation; 1996.
17. Achenbach TM. *Manual for the Youth Self Report and 1991 Profile*. Burlington, VT: University of Vermont, Department of Psychiatry; 1991.
18. Achenbach TM, Rescorla LA. *Manual for ASEBA Adult Forms & Profiles*. Burlington, VT: University of Vermont, Research Centre for Children, Youth, & Families; 2003.
19. Burden DJ, Holmes A. The need for orthodontic treatment in the child population of the United Kingdom. *Eur J Orthod*. 1994;16:395–399.
20. Kindelan JD, Sheard CE, Nashed RR. A comparison of patients requiring orthognathic treatment who subsequently refused or accepted surgery. *Int J Adult Orthod Orthognath Surg*. 1998;13:115–118.
21. Johnston C, Hunt O, Burden D, Stevenson M, Hepper P. The influence of mandibular prominence on facial attractiveness. *Eur J Orthod*. 2005;27:129–133.
22. Commission on Chronic Illness. *Chronic Illness in the United States; Vol 1*. Cambridge, MA: Harvard University Press; 1957.
23. Hall DMB. *Health for All Children—A Programme for Child Health Surveillance*. Oxford, UK: Oxford Medical Publications; 1989.
24. Cross AW. Health screening in schools, Part 1. *J Paed*. 1985;107:487–494.