

1 **Social Anxiety in Orthognathic Patients**

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39 Social anxiety, orthognathic, fear of negative evaluation, psychology, dentofacial  
40 deformity.

41

42 **ABSTRACT**

43 There is evidence that patients seeking orthognathic treatment may be motivated by social  
44 anxiety disorder (SAD). The aim of this study was to investigate SAD in orthognathic  
45 patients using the Brief Fear of Negative Evaluation Scale (BFNES) and compare these  
46 findings with the general population. This was a cross-sectional, questionnaire study  
47 conducted in two parts. Firstly, a national survey was conducted to yield data for the  
48 BFNES from a large, random sample of the UK general population. Secondly, orthognathic  
49 patients completed the BFNES. The BFNES scores are reported in two formats; the original  
50 12-item scale (O-BFNES) and a shorter 8-item version (S-BFNES). With regards to the  
51 national survey, 1196 individuals participated. The mean O-BFNES score was 29.72 (SD  
52 9.39) and S-BFNES score was 15.59 (SD 7.67). With regards to the orthognathic sample,  
53 61 patients participated. The mean O-BFNES score was 39.56 (SD 10.35) and mean S-  
54 BFNES score was 24.21 (SD 8.41). Orthognathic patients had significantly higher scores  
55 than the general UK population ( $P<0.001$ ) and multiple linear regression revealed that age,  
56 gender, and patient status were all independent predictors of BFNES scores. From the  
57 results of this study, orthognathic patients experience significantly higher levels of social  
58 anxiety than the general population.

59

## 60 INTRODUCTION

61 It has been estimated that approximately one in 100 people in the UK have a significant  
62 visible facial defect, and that over 400,000 people will acquire a facial disfigurement in the  
63 period of a year<sup>1</sup>. Concerns about physical appearance are often associated with social  
64 anxiety, with individuals who perceive themselves as being unattractive exhibiting greater  
65 levels of social anxiety<sup>2</sup>. This may result in problems in social interaction, leading to  
66 lowered self-esteem and a tendency to become introverted and reclusive<sup>3</sup>. In addition, in a  
67 clinical setting, individuals who seek surgical intervention for their problem may be  
68 motivated by social anxiety and this could have negative implications for satisfaction and  
69 psychological outcomes, as physical treatment may not alleviate psychological issues.

70 Social anxiety disorder (SAD) has been defined as ‘an enduring fear of social situations  
71 where the individual may be subject to evaluation by others’<sup>4</sup>. It is the most common type  
72 of anxiety disorder, with a prevalence of up to 18 per cent in the general population<sup>5</sup>. Fear  
73 of negative evaluation is said to be the trademark of social anxiety, as this fear often leads  
74 to an illogical and exaggerated anxiety in social situations<sup>6,7</sup>. This may be a factor in  
75 orthognathic patients’ motivation for treatment<sup>8</sup>.

76 Orthognathic patients have been shown to suffer from higher levels of state anxiety but  
77 there is a paucity of information regarding social anxiety<sup>9</sup>. Indeed, there is only one  
78 published study to date assessing the level of social anxiety in patients receiving  
79 orthognathic treatment for non-cleft or craniofacial conditions<sup>10</sup>. The authors of that study  
80 found that there was a small improvement in social avoidance and distress following  
81 orthognathic treatment, but no statistically significant change in fear of negative evaluation.

82 A small number of studies have investigated social anxiety and fear of negative evaluation  
83 in patients with clefts and other types of facial deformity and generally found that patients  
84 exhibited higher levels of social anxiety than unaffected groups<sup>11,12</sup>. Thus, the available  
85 evidence suggests that patients who are visibly different, with either acquired or congenital  
86 dentofacial conditions, may well exhibit higher levels of social anxiety than the general  
87 population and this may have implications for treatment outcomes.

88 The aim of this study was to ascertain the extent and severity of fear of negative evaluation  
89 in orthognathic patients compared with the general population. However there are limited  
90 general population data available and the majority of these study samples have been  
91 relatively small, restricted to college students/undergraduates, and have not been nationally  
92 recruited; thus have limited generalisability<sup>13,14</sup>. Therefore a range of general population  
93 values for the Brief Fear of Negative Evaluation Scale stratified on the basis of key  
94 demographic data in a large, randomly recruited, national community population was  
95 required first. The null hypothesis for this study was that there was no difference in mean  
96 social anxiety, as measured by the Brief Fear of Negative Evaluation Scale, in orthognathic  
97 patients and the general UK population.

98

## 99 **SUBJECTS AND METHODS**

### 100 **Instrument**

101 The Brief Fear of Negative Evaluation Scale (BFNES) measures the core construct in social  
102 anxiety and is thought to be the most commonly used measure of social anxiety in clinical  
103 studies<sup>4,13,14</sup>. It is a self-report questionnaire, consisting of 12 items related to worrying or

104 fearful cognition<sup>15</sup>. Eight of the items are positively scored and 4 are negatively scored, in  
105 order to reduce the risk of response bias<sup>16</sup>. However, the reverse worded items have caused  
106 some problems with the reliability and validity of the scale and, therefore, recent research  
107 has suggested using the original 12 item scale (O-BFNES) but only including the 8  
108 straightforward (S-BFNES) items in calculating the final score<sup>4,16</sup>. Despite the reservations  
109 mentioned, most researchers continue to use the scale in its original format. This may be  
110 because there are limited general population data available for the revised scale and this  
111 restricts its use<sup>16</sup>.

112

## 113 **Part 1: General population sample**

### 114 **Participants**

115 Ethical approval for this study was granted by the relevant research ethics committee (ref:  
116 2035/001). In order to obtain an unbiased, large, representative, random sample of the  
117 general population, a national survey was conducted. This was undertaken via the Office  
118 for National Statistics (ONS), which runs an omnibus survey in the UK called the Opinions  
119 Survey. The ONS uses the Royal Mail's Postcode Address File to draw the sample and  
120 over 2000 addresses are selected for each survey (17). This file contains the addresses for  
121 approximately 27 million private households in the UK and is updated every three months.  
122 It is the most up-to-date and complete address database in the UK<sup>17</sup>. By using this method  
123 of random sampling, there is an equal chance of any individual being selected and thus bias  
124 is reduced. Rigorous methodology was used to achieve the best possible response rate and  
125 sample size, including making up to 8 attempts at face-to-face participant contact at

126 different times of the day, followed by telephone contact. Participants were asked to  
127 complete the Brief Fear of Negative Evaluation Scale (BFNES) questions themselves  
128 (Appendix 1). Demographic data including age, gender, and ethnicity were also collected  
129 during the survey.

## 130 **Part 2: Clinical Cohort**

131 Ethical approval was granted by the relevant research ethics committee (09/H0719/10). All  
132 participants were recruited from one major teaching hospital site and had been accepted for  
133 orthognathic treatment but had not yet commenced pre-surgical orthodontics. Inclusion  
134 criteria were any patient undergoing combined orthodontics/orthognathic surgery, aged 16  
135 years and over, and able to give informed consent. Exclusion criteria were patients with  
136 congenital craniofacial anomalies (e.g. due to syndromes or clefts of the lip and/or palate),  
137 patients with acquired facial defects, and those who had previously received orthognathic  
138 treatment. As for the general population sample, patients were given the BFNES to  
139 complete and demographic data, including age and gender, were also collected.

## 140 **Statistical analysis**

141 Statistical analysis was undertaken using the Statistical Package for Social Sciences  
142 (version 19.0; SPSS Inc., Chicago, IL, USA). Demographic data were analysed  
143 descriptively and the results from the 12-item scale (O-BFNES) and the 8-item  
144 straightforward worded scale (S-BFNES) were tested for normality. All analyses were  
145 conducted at the 0.05 level of significance. Comparisons between groups were made using  
146 Student *t*-tests and one-way Analysis of Variance (ANOVA) with Bonferroni *post-hoc*

147 tests. Multiple linear regression was undertaken to investigate the influence of group, age,  
148 and gender on the BFNES score and to assess if there was an age/gender interaction.

149 The Opinions Survey data were weighted to correct for selection bias and non-response  
150 bias. This weighting system has been developed by the Office for National Statistics based  
151 on Census data. In addition, weightings were applied to the raw data to correct for response  
152 bias. The weighted data were used for descriptive analyses in order to estimate population  
153 parameters, whereas the unweighted data were used in the analytical statistical tests in order  
154 to compare groups.

155 An *a priori* sample size calculation was performed using nQuery Advisor<sup>®</sup> (version 7.0;  
156 Statistical Solutions Ltd., MA, USA) using data from a similar study<sup>16</sup>. The calculation  
157 assumed unequal sized groups, with an anticipated minimum of 1000 participants in the  
158 general population group. This estimate was based on the minimum average response rate  
159 for the monthly ONS Opinions surveys<sup>17</sup>. The clinically significant difference in the  
160 BFNES scores was set at 10% of the total score based on clinical experience as there was  
161 no supporting literature to guide this decision. A sample size of 31 orthognathic patients  
162 was needed to detect a difference in means of 10% on the O-BFNES scale (4.8 points)  
163 using an unpaired *t*-test with a power of 80% at the 5% level of significance. A sample size  
164 of 46 orthognathic patients was needed to detect a difference in means of 10% on the S-  
165 BFNES scale (3.2 points) using an unpaired *t*-test with a power of 80% at the 5% level of  
166 significance. Therefore, it was decided to recruit a minimum of 50 orthognathic patients to  
167 detect a clinically relevant difference for both scales allowing for some questionnaires to be  
168 incorrectly completed or not returned.



## 169 RESULTS

### 170 Part 1: General population sample

171 In total, 1196 individuals completed the survey, yielding a response rate of 66%. As would  
172 be expected in a population study using weighted data, the gender distribution was  
173 approximately equal, with 51.1% females and 48.9% males. The largest age group was 25  
174 to 44 year olds (33.7%), with those over 75 years making up the smallest group (9.1%).  
175 Data on 18 different ethnic groups were collected. Summary statistics were calculated for  
176 the BFNES for both the 12 item (O-BFNES) and 8 item (S-BFNES) scales. The weighted  
177 mean, standard deviation, and range for the O-BFNES and S-BFNES stratified by age,  
178 gender, and ethnicity are presented in Table 1. The overall mean score was 29.72 (SD 9.39)  
179 for the O-BFNES and 15.59 (SD 7.57) for the S-BFNES.

180 Fear of negative evaluation was significantly higher in females than males, with a  
181 difference of approximately 2 points on both scales ( $P < 0.001$ ). Fear of negative evaluation  
182 decreased with increasing age both in males and females and a univariate linear regression  
183 model showed that for every ten year increase in age, fear of negative evaluation decreased  
184 by one point when the genders were combined. The  $R^2$  values were 0.048 for O-BFNES,  
185 and 0.057 for S-BFNES (Table 2). With regards to ethnicity, Gypsies/Irish Travellers  
186 exhibited the highest BFNES scores and Chinese the lowest. However, due to the small  
187 numbers within many subgroups, statistical analysis was not possible on the basis of the 18  
188 different subgroups of ethnicity. Therefore, the ethnicity classification was collapsed into  
189 British (n=1040) and non-British (n=154). One person answered 'don't know' and one

190 refused to answer this section. There was no statistical difference in BFNES scores between  
191 the British and non-British groups.

## 192 **Part 2: Clinical cohort**

193 In total, 61 orthognathic patients were recruited, 57.4% were female and 42.6% male. The  
194 response rate was 100% and there were no missing data. The majority were in the 16 to 24  
195 age group (50.8%), followed by the 25 to 44 group (42.7%). There were no patients above  
196 the age of 64 years. The mean O-BFNES score for the whole patient group was 39.56 (SD  
197 10.35) and the mean S-BFNES score was 24.21 (SD 8.41) (Table 3). A one-way analysis of  
198 variance (ANOVA) revealed no evidence of a significant difference ( $P=0.206$ ) in BFNES  
199 scores between the different age groups. Females had higher BFNES scores than males but  
200 this was not statistically significant ( $P=0.250$  for the O-BFNES and  $P=0644$  for the S-  
201 BFNES).

## 202 **Comparison of the general population sample and orthognathic patient data**

203 When comparing orthognathic patient data with the general population, orthognathic  
204 patients had significantly higher fear of negative evaluation than the general population,  
205 with statistically significant differences of almost 10 points for the O-BFNES and almost  
206 nine points for the S-BFNES (Tables 4 and 5).

207 Multiple linear regression indicated that age, gender, and group (orthognathic patient or  
208 general population participant) were all significant independent predictors of O-BFNES.  
209 Orthognathic patients had O-BFNES scores that were 7.33 (95% CI 4.83 to 9.84) higher on  
210 average than the general population, having controlled for age and gender. With regards to

211 the S-BFNES, again multiple linear regression indicated that age, gender, and group were  
212 all significant independent predictors of S-BFNES. Orthognathic patients had S-BFNES  
213 scores that were 6.38 (95% CI 4.36 to 8.40) higher on average than the general population,  
214 having controlled for age and gender (Table 6).

215 Therefore, the null hypothesis that there is no difference in BFNES scores in orthognathic  
216 patients and the general UK population was rejected.

## 217 **DISCUSSION**

218 The presence of FNE and the implications for clinical populations have not been  
219 thoroughly investigated in orthognathic patients to date. The aim of this study was  
220 therefore to investigate fear of negative evaluation in an orthognathic patient population. As  
221 there were no general population data for FNE in the UK, it was necessary to initially  
222 conduct a study to obtain these data.

223 The Brief Fear of Negative Evaluation Scale (BFNES) was used in this study (13). Due of  
224 the lack of consensus about using the long or short form of the scale, the results of this  
225 study were presented in both formats (O-BFNES and S-BFNES). This gives the reader and  
226 other researchers the option of using either set of norms and to allow comparison with  
227 previous published work using both scales.

228 The total mean BFNES score for the general population sample was 29.72 (SD 9.39) for the  
229 O-BFNES and 15.59 (SD 7.67) for the S-BFNES. The closest comparable community  
230 sample is from a US study of 489 volunteers recruited from a community volunteer registry  
231 and the local university psychology department<sup>16</sup>. In this study, the total mean O-BFNES

232 score was 30.55 and the S-BFNES was 15.91, which are similar to the results of the current  
233 study. Duke and co-workers<sup>15</sup> observed a higher mean O-BFNES score of 32.3 (SD 7.34) in  
234 a community sample of 355 people recruited at religious meetings and in large retail centres  
235 in the US, but the differences may be due to the more restricted sampling methodology  
236 used.

237 Females exhibited significantly higher BFNES scores on both scales (2.12 points on the O-  
238 BFNES and 1.73 on the S-BFNES) which is contrary to the findings of Rodebaugh and  
239 colleagues who found no statistical difference in BFNES scores between the genders.  
240 However, it must be borne in mind that the data from the Rodebaugh study was not  
241 randomly or nationally obtained and thus may not be generalisable to the whole  
242 population<sup>16</sup>. In addition, females were over-represented in that study, with 72% of the  
243 sample being female. The findings of the current study were in agreement with Duke and  
244 co-workers who also found that scores were, on average, two points higher for females<sup>15</sup>.  
245 The finding of higher social anxiety in females is in keeping with other published literature  
246 that has found higher lifetime prevalence in females<sup>5,18,19,20</sup>.

247 There was a trend that BFNES score decreased with increasing age in the current study,  
248 which is supported by the findings of Rodebaugh and colleagues<sup>16</sup>. However, the  
249 magnitude of this effect was small, with a one point BFNES decrease for every decade  
250 increase in age when the genders were combined, and this is unlikely to be clinically  
251 relevant.

252 With regards to ethnicity, it was not possible to statistically examine the effects of each  
253 different subgroup due to the small number of participants recruited in some of the 18

254 different subgroups. Instead, the data were categorised into British origin and non-British  
255 origin and there were no statistically significant differences between the two groups. This is  
256 similar to the findings of a national US study on social anxiety disorders that found similar  
257 ethnic distributions<sup>5</sup>.

258 The mean O-BFNES score for the whole patient group was 39.56 (SD 10.35) and the mean  
259 S-BFNES score was 24.21 (SD 8.41). Female orthognathic patients had higher BFNES  
260 scores than males but this was not statistically significant. The majority of studies  
261 examining FNE and dentofacial deformity do not supply data on the effect of age and  
262 gender, however, in the study on patients with amelogenesis imperfecta it was found that  
263 females had higher BFNES scores than males but this difference was not statistically  
264 significant<sup>21</sup>. It may be that the current study and the one by Coffield and co-workers  
265 lacked the power to detect a significant difference between the genders if one existed. Age  
266 had no statistically significant effect on BFNES scores for the orthognathic patients and this  
267 is similar to the findings of Coffield and colleagues<sup>21</sup>. However, the age range in the current  
268 study was narrow, and the sample size modest.

269 When the orthognathic patients were compared with the general population data, the  
270 patients had significantly higher BFNES scores than the population values, with patient  
271 scores eight to nine points higher than the general population. The only other study  
272 assessing FNE directly in orthognathic patients found that patients had *lower* FNE than  
273 norms, however, this study used the original 30-item Fear of Negative Evaluation Scale  
274 (FNES) and thus the results are not directly comparable with those of this study<sup>10</sup>.  
275 Additionally, their normative mean values were based on the US college sample from

276 which the FNES was devised<sup>22</sup>. Another normative UK mean has been reported to be 14.26  
277 (SD 7.72), however, this was also based on a student population and is probably not  
278 representative of the general population<sup>23</sup>.

279 When comparing the two samples directly, multiple linear regression showed that age,  
280 gender, and whether the participant was a patient or member of the general public were all  
281 significant independent predictors of BFNES score. Orthognathic patients had a mean O-  
282 BFNES score seven points higher and mean S-BFNES score 6 points higher than the  
283 general population, having controlled for age and gender. Thus, we can conclude that the  
284 orthognathic patients in this study did exhibit statistically significantly higher levels of fear  
285 of negative evaluation than the general population. The magnitude of the difference is  
286 considerable and it is likely to be clinically meaningful.

287 A clinically useful cut-off score of 38 when using the O-BFNES has been suggested by  
288 Carleton and co-workers to diagnose social anxiety disorder<sup>4</sup>. When applied to the current  
289 study results, 56% of the orthognathic patient cohort in this study met the criteria for a  
290 positive diagnosis of social anxiety disorder (mean 39.56). However, the range of scores  
291 reported was 16 to 60 and, thus, when examined on an individual basis, some patients did  
292 not meet the cut-off point while others had very high scores. This variability has been  
293 previously reported in populations with anxiety associated with disfigurement<sup>24</sup> and  
294 highlights the importance of examining each patient on an individual basis and not making  
295 assumptions based on average values.

296 The limitations of this study should be borne in mind when interpreting the results. The  
297 individuals in the general population sample were not screened for the presence of

298 dentofacial deformity. This was due to the fact that the national survey was conducted by a  
299 third party (Office for National Statistics) who have the resources and access to an  
300 unbiased, representative sample of the UK general population. However, it was not possible  
301 to train the surveyors to diagnose dentofacial discrepancy requiring orthognathic correction.  
302 Therefore, it is possible that some potential orthognathic patients could have been recruited  
303 into this sample. However, bearing in mind that the prevalence of dentofacial deformity is  
304 relatively low and the sample was large, it is unlikely to have had a significant effect. In  
305 addition, the orthognathic patients studied had higher BFNES scores than the general  
306 population and thus their inclusion in the latter sample would only serve to underestimate  
307 the actual difference in the populations studied. Another potential limitation of this research  
308 was the relatively small size of the clinical sample, which precluded further in-depth  
309 analysis. Future multicentre studies could be conducted to increase the generalisability of  
310 the results.

311 Based on the results of this study and a review of the literature, it appears that the presence  
312 of a facial disfigurement may be associated with elevated FNE and orthognathic patients  
313 could be at increased risk of social anxiety disorder, regardless of age, gender, and severity  
314 of the defect. Therefore, patients with facial disfigurement should be screened prior to  
315 orthognathic treatment to assess baseline FNE levels, using the BFNES, which is quick and  
316 acceptable to use chair-side. There is evidence that patients with visible facial  
317 disfigurement with high FNE want psychological assistance and surgical correction alone  
318 may not alleviate psychological symptoms<sup>25</sup>. A combination of cognitive behavioural  
319 therapy and social skills training has been suggested to enable patients to develop a

320 satisfactory body image and deal with others' evaluations<sup>25,26</sup>. Future longitudinal clinical  
321 trials are needed to ascertain if FNE changes following orthognathic treatment and ideally  
322 comparisons made with a similar group who are treated with psychological intervention  
323 only. This study has established general population values for fear of negative evaluation,  
324 as a measure of social anxiety, based on a large randomly selected general population  
325 sample that can now be used in other studies.

326

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335

## 336 **REFERENCES**

- 337 1. Partridge J, Julian D. The incidence and prevalence of disfigurement. Changing  
338 Faces, London: 2008
- 339 2. Leary MR, Kowalski RM. Social Anxiety. Guilford Press, NY, 1995.



- 340 3. Newell R, Marks I. Phobic nature of social difficulty in facially disfigured people.  
341 British Journal of Psychiatry 2000; 176: 177–181.
- 342 4. Carleton RN, Collimore KC, McCabe RE, Antony MM. (2011) Addressing  
343 revisions to the Brief Fear of Negative Evaluation scale: measuring fear of negative  
344 evaluation across anxiety and mood disorders. *Journal of Anxiety Disorders* 2011;  
345 25(6): 822-828.
- 346 5. Kessler RC, Chiu WT, Demler O, Walters EE. (2005) Prevalence, severity, and  
347 comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey  
348 Replication. *Archives of General Psychiatry* 2005; 62: 617-627.
- 349 6. Rapee, R.M., Heimberg, R.G. (1997) A cognitive-behavioral model of anxiety in  
350 social phobia. *Behaviour Research and Therapy*, 35, 741-756.
- 351 7. Weeks, J.W., Heimberg, R.G., Fresco, D.M., Hart, T.A., Turk, C.L., Schneier, F.R.,  
352 Liebowitz, M.R. (2005) Empirical validation and psychometric evaluation of the  
353 Brief Fear of Negative Evaluation Scale in patients with social anxiety disorder.  
354 *Psychological Assessment*, 17, 179-190.
- 355 8. Rumsey, N., Harcourt, D. (2004) Body image and disfigurement: issues and  
356 interventions. *Body Image*, 1, 1, 83-97.
- 357 9. Cunningham, S.J., Gilthorpe, M.S., Hunt, N.P. (2000) Are orthognathic patients  
358 different? *European Journal of Orthodontics*, 22, 195-202.
- 359 10. Lovius, B.B., Jones, R.B., Pospisil, O.A., Reid, D., Slade, P.D., Wynne, T.H. (1990)  
360 The specific psychosocial effects of orthognathic surgery. *Journal of*  
361 *Craniomaxillofacial Surgery*, 18, 8, 339-342.

- 362 11. Berk, N.W., Cooper, M.E., Liu, Y.E., Marazita, M.L. (2001) Social anxiety in  
363 Chinese adults with oral-facial clefts. *Cleft Palate and Craniofacial Journal*, 38, 2,  
364 126-133.
- 365 12. Versnel, S.L., Duivenvoorden, H.J., Passchier, J., Mathijssen, I.M. (2010)  
366 Satisfaction with facial appearance and its determinants in adults with severe  
367 congenital facial disfigurement: a case-referent study. *Journal of Plastic and*  
368 *Reconstructive Aesthetic Surgery*, 63, 10, 1642-1649.
- 369 13. Leary, M.R. (1983) A brief version of the Fear of Negative Evaluation Scale.  
370 *Personality and Social Psychology Bulletin*, 9, 371-375.
- 371 14. Rodebaugh, T.L., Woods, C.M., Thissen, D.M., Heimberg, R.G., Chambless, D.L.,  
372 Rapee, R.M. (2004) More information from fewer questions: the factor structure  
373 and item properties of the original and Brief Fear of Negative Evaluation scale.  
374 *Psychological Assessment*, 16, 169-181.
- 375 15. Duke, D., Krishnan, M., Faith, M., Storch, E.A. (2006) The psychometric properties  
376 of the Brief Fear of Negative Evaluation Scale. *Journal of Anxiety Disorders*, 20, 6,  
377 807-17.
- 378 16. Rodebaugh, T.L., Heimberg, R.G., Brown, P.J., Fernandez, K.C., Blanco, C.,  
379 Schneier, F.R., Liebowitz, M.R. (2011) More reasons to be straightforward:  
380 Findings and norms for two scales relevant to social anxiety. *Journal of Anxiety*  
381 *Disorders*, 25, 623-630.
- 382 17. Office for National Statistics. (2011) *Opinions (Omnibus) Survey Information*  
383 *Guide*. Office for National Statistics, London.

- 384 18. Schneier, F.R., Johnson, J., Hornig, C.D., Liebowitz, M.R., Weissman, M.M.  
385 (1992) Social phobia: Comorbidity and morbidity in an epidemiological sample.  
386 *Archives of General Psychiatry*, 49, 282-291.
- 387 19. Offord, D.R., Boyle, M.H., Campbell, D.C., Goering, P., Lin, E., Wong, M.,  
388 Racine, Y.A. (1996) One-year prevalence of psychiatric disorders in Ontarians 15 to  
389 64 years of age. *Canadian Journal of Psychiatry*, 41, 559-563.
- 390 20. Ruscio, A.M., Brown, T.A., Chiu, W.T., Sareen, J., Stein, M.B., Kessler, R.C.  
391 (2008) Social fears and social phobia in the USA: results from the National  
392 Comorbidity Survey Replication. *Psychological Medicine*, 35, 15-28.
- 393 21. Coffield, K.D., Phillips, C., Brady, M., Roberts, M.W., Strauss, R.P., Wright, J.T.  
394 (2005) The psychosocial impact of developmental dental defects in people with  
395 hereditary amelogenesis imperfecta. *Journal of the American Dental Association*,  
396 136, 5, 620-630.
- 397 22. Watson, D., Friend, R. (1969) Measurement of social-evaluative anxiety. *Journal of*  
398 *Consulting and Clinical Psychology*, 33, 448-457.
- 399 23. Stopa, L., Clark, D.M. (2001) Social phobia: Comments on the viability of an  
400 analogue research strategy and British norms for the fear of negative evaluation  
401 questionnaire. *Behavioural and Cognitive Psychotherapy*, 29, 423-430.
- 402 24. Rumsey, N., Harcourt, D. (2012) *The Oxford Handbook of the Psychology of*  
403 *Appearance*. Oxford University Press, Oxford.

- 404 25. Kent, G., Keohane, S. (2001) Social anxiety and disfigurement: The moderating  
405 effects of fear of negative evaluation and past experience. *British Journal of*  
406 *Clinical Psychology*, 40, 23-34.
- 407 26. Clarke, A., Thompson, A.R., Jenkinson, E., Rumsey, N., Newell, R. (2014) *CBT for*  
408 *appearance anxiety: Psychosocial interventions for anxiety due to visible difference.*  
409 Wiley Blackwell, UK.
- 410
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412 **TABLES**

413 **Table 1.** Population weighted means, standard deviations and ranges for the original 12  
 414 item BFNES (O-BFNES) and the straightforward 8 item (S-BFNES) from the ONS  
 415 Opinions survey within major classification categories.  
 416

Classification	O-BFNES			S-BFNES		
	Mean score	SD	Range	Mean score	SD	Range
All responders	29.72	9.39	12-60	15.59	7.67	8-40
<b><u>GENDER</u></b>						
Male	28.64	8.84	12-59	14.72	7.20	8-40
Female	30.76	9.79	12-60	16.43	8.00	8-40
<b><u>AGE GROUP (in years)</u></b>						
16 to 24	32.28	9.07	12-60	17.62	7.99	8-40
25 to 44	31.03	10.22	12-60	16.86	8.14	8-40
45 to 54	29.61	8.52	12-58	15.48	6.95	8-40
55 to 64	28.65	9.06	12-57	14.92	7.47	8-39
65 to 74	27.33	8.14	12-60	12.80	6.49	8-40
75 and over	25.44	7.71	12-55	12.14	5.72	8-36
<b><u>ETHNICITY</u></b>						
Combined (English, Welsh, Scottish, Northern Irish, British)	29.64	9.49	12-60	15.55	7.73	8-40
Irish	26.58	8.05	14-45	13.86	6.13	8-32
Gypsy or Irish Traveller	46.05	8.48	37-54	27.92	6.49	21-34
Any other White background	30.91	10.13	12-52	17.00	7.11	8-32
White and Black Caribbean	24.69	3.78	19-31	10.59	2.88	8-18
White and Black African	30.11	0.88	29-31	15.66	3.30	10-19

<b>White and Asian**</b>	29.62	7.88	12-34	14.20	3.20	8-18
<b>Any other mixed/multiple ethnic background</b>	32.85	3.55	27-35	17.46	0.89	16-18
<b>Indian</b>	29.10	9.03	12-44	15.53	8.34	8-30
<b>Pakistani</b>	34.75	7.12	17-49	18.70	6.86	8-32
<b>Bangladeshi</b>	30.32	7.01	17-34	20.18	5.36	10-23
<b>Chinese</b>	23.53	1.31	22-25	12.48	4.69	8-19
<b>Any other Asian background</b>	30.03	5.90	20-43	14.47	5.17	8-23
<b>African</b>	28.63	5.38	18-39	15.40	3.82	9-22
<b>Caribbean</b>	29.76	5.67	19-42	13.96	6.67	8-32
<b>Any other Black/African/Caribbean background</b>	30.81	8.65	16-42	15.57	6.91	8-25
<b>Arab</b>	33.51	2.50	31-36	14.52	3.50	11-18
<b>Any other ethnic group</b>	33.05	13.4	16-51	18.63	10.45	8-34
<b>Refusal</b>	34.00	*	34-34	17.00	*	17-17
<b>Do not know</b>	25.00	*	25-25	8.00	*	8-8

417 \*Standard deviation could not be calculated due to small sample number.

418 \*\*Asian refers to individuals of South Asian descent.

419

420 **Table 2.** Linear regression demonstrating effect of age on O-BFNES and S-BFNES scores.  
 421 [Note: Dependent variable: O-BFNES and S-BFNES respectively. Predictor: respondent's  
 422 age.

Scale	Model	R <sup>2</sup>	Age coefficient (B)	95% Confidence interval of B	P-value
O-BFNES	(Constant) Respondent's age	0.048	-0.114	-0.144 to -0.084	<0.001
S-BFNES	(Constant) Respondent's age	0.057	-0.100	-0.124 to -0.076	<0.001

423

424

425 **Table 3.** Means, standard deviations and ranges for the original BFNES (O-BFNES) and  
 426 the straightforward (S-BFNES) for the orthognathic patient cohort within major  
 427 classification categories.

Classification	Number	O-BFNES			S-BFNES		
		Mean	SD	Range	Mean	SD	Range
<b>All responders</b>	61	39.56	10.35	16-60	24.21	8.41	8-40
<b>Gender</b>							
<b>Male</b>	26	38.15	10.01	17-60	24.04	7.88	8-40
<b>Female</b>	35	40.60	10.63	16-59	24.34	8.90	8-39
<b>Age group</b>							
<b>16 to 24</b>	31	41.16	10.40	16-57	25.42	8.64	8-37
<b>25 to 44</b>	26	38.50	10.52	17-60	23.35	8.26	8-40
<b>45 to 54</b>	3	35.33	9.07	27-45	20.33	9.50	11-30
<b>55 to 64</b>	1	30.00	*	30-30	21.00	0.00	21-21

428 [\*Standard deviation could not be calculated due to small sample number].

429



430 **Table 4.** Distribution of BFNES scores in the ONS Opinions Survey data and the  
431 orthognathic study for the original 12-item BFNES (O-BFNES) and the straightforward 8-  
432 item (S-BFNES).

Classification	O-BFNES			S-BFNES		
	Mean	SD	Range	Mean	SD	Range
Orthognathic patients	39.56	10.35	16-60	24.21	8.41	8-40
ONS survey	29.72	9.39	12-60	15.59	7.67	8-40

433

434

435 **Table 5.** Comparison of BFNES scores between the ONS Opinions Survey data (ONS) and  
 436 the orthognathic patient data (OG) for the original 12-item BFNES (O-BFNES) and the  
 437 straightforward 8-item (S-BFNES).

Scale	Source	N	Score	Mean difference	95% CI of the mean difference	P-value
<b>O-BFNES</b>	ONS	1136	29.72	-9.84	-7.63 to -12.58	<0.001
	OG	61	39.56			
<b>S-BFNES</b>	ONS	1149	15.59	-8.62	-6.78 to -10.79	<0.001
	OG	61	24.21			

438  
 439

440 **Table 6.** Multiple linear regression to assess the effect of group, age, and gender on O-  
 441 BFNES and S-BFNES.

Scale	Model	R <sup>2</sup>	Coefficient (B)	95% CI of B	P-value
<b>O-BFNES</b>	(Constant)	0.107			
	Group		-7.33	-9.84 to -4.83	<0.001
	Respondent's age		-0.11	-0.14 to -0.09	<0.001
	Respondent's gender		2.10	1.04 to 3.16	<0.001
<b>S-BFNES</b>	(Constant)	0.119			
	Group		-6.38	-8.40 to -4.36	<0.001
	Respondent's age		-0.10	-0.12 to -0.08	<0.001
	Respondent's gender		1.63	0.78 to 2.49	<0.001

442 [Dependent variable: O-BFNES and S-BFNES respectively. Independent variables: Group  
 443 (survey participant or patient), respondent's gender, respondent's age].