Acta Odontologica Scandinavica. 2014; 72: 707–713

informa
healthcare

ORIGINAL ARTICLE

Orofacial esthetics and dental anxiety: Associations with oral and psychological health

VIKTOR CARLSSON[1], MAGNUS HAKEBERG[1], KLAS BLOMKVIST[2] & ULLA WIDE BOMAN[1]

[1]*Department of Behavioral and Community Dentistry, Institute of Odontology, The Sahlgrenska Academy, University of Gothenburg, Göteborg, Sweden, and* [2]*Clinic of Oral Medicine, Public Dental Service, Region Västra Götaland, Göteborg, Sweden*

Abstract

Objective. Severe dental anxiety (DA) is associated with both oral health and psychosocial consequences in what has been described as a vicious circle of DA. The aim of this study was to investigate self-rated orofacial esthetics in patients with DA and its relationship to psychological and oral health. ***Materials and methods.*** A consecutive sample of 152 adult patients who were referred or self-referred to a specialized dental anxiety clinic filled out the Orofacial Esthetic Scale (OES) as well as measurements on DA, self-rated oral health and general anxiety and depression. Clinical measures of dental status were also obtained. ***Results.*** Compared with the general population, patients with DA had lower ratings of satisfaction on all aspects of their orofacial esthetics, which included the teeth, gingiva, mouth and face, as well as a global orofacial assessment. Furthermore, the perception of the orofacial appearance was related both to dental status and self-rated oral health, as well as to general anxiety and depression. The level of dissatisfaction with the orofacial appearance was similar for both genders, but women reported more regular dental care and better dental status. ***Conclusions.*** The results of this study clearly show less satisfaction with dental and facial appearance in patients with DA, and that the self-rating of orofacial esthetics is related to both oral and psychological health. The OES can be used to assess orofacial esthetics in patients with DA.

Key Words: *dental anxiety, esthetics, oral health, depression, psychological health*

Introduction

Dental anxiety is a common condition that prevents a substantial part of the general population from receiving proper dental care. Studies from European countries show that ~4–7% of the adult population suffer from severe dental anxiety (DA) [1–3] and may avoid different dental procedures or dental care altogether, often leading to impaired oral health [4–7]. Berggren [6,8,9] proposed a vicious circle to describe how DA is maintained and related to health over time. In the model, anxiety may lead to avoidance of dental care, which causes a decline in oral health that may bring about feelings of shame and inferiority. These negative feelings, connected to one's oral health and inability to maintain dental care, may then further increase the initial anxiety and avoidance behavior.

In concordance with Berggren's model, research has associated DA with negative social and psychological consequences [6,10–12], which may, at least in part, be due to embarrassment and shame about one's appearance and oral status [13]. Research has also shown that the general psychological difficulties associated with tooth loss, which is commonly found in patients with DA, may be substantial [14,15] and that poor oral health in general is linked to impaired quality-of-life [16].

The perception of one's dental and facial appearance, also called orofacial esthetics, may be an important factor in the relationship between impaired oral health and its psychosocial consequences. To assess one's perception of one's dental and orofacial appearance, two different self-assessment measures have been developed and used in previous research, the Orofacial Esthetic Scale

Correspondence: Ulla Wide Boman, Department of Behavioral and Community Dentistry, Institute of Odontology, The Sahlgrenska Academy, University of Gothenburg, PO Box 450, SE-405 30 Gothenburg, Sweden. E-mail: ulla.wide-boman@odontologi.gu.se

(Received 22 September 2013; accepted 31 January 2014)

ISSN 0001-6357 print/ISSN 1502-3850 online
DOI: 10.3109/00016357.2014.898786

(OES) [17], and Satisfaction with Own Dental Appearance (QDA) [18,19]. The OES [17] is a recently developed self-rating questionnaire that captures how satisfied a person is with aspects of his or her teeth, mouth and face. It was originally developed for prosthodontic patients but has been standardized for use in the general Swedish population [20] and has shown good psychometric properties [21,22].

The perception of one's orofacial appearance seems to be associated both with dental status and psychological health [19,23]. In a study investigating perception of one's dental appearance in groups with differences in oral status, a small number of individuals with a high level of depression were identified. The individuals with high depression then formed a new group which were used for comparison, revealing a relationship between depression and a more negative perception of one's dental appearance [19]. The link between depression and the perception of one's appearance is also supported by a larger amount of research on body image [24–26]. A relationship has also been found between body image and anxiety [27]. The relationships found between psychological health and the perception of one's appearance is interesting, especially since previous research has linked DA to an increased prevalence of other psychological disorders [28]. A more thorough investigation regarding the relationship between psychological distress, oral status and orofacial esthetics in patients with DA is, therefore, warranted. It may be that persons with DA are especially susceptible to impairments in orofacial esthetics which may cause a substantial psychological burden for the individual. The perception of one's dental appearance may be at the heart of the many of the negative experiences associated with DA and an important part of the vicious circle of DA.

As far as we know, there have been no previous studies examining the perception of dental or facial appearance or its interplay with oral and psychological health in patients with DA. This is surprising, as orofacial esthetics may play an important role for the psychosocial consequences and determinants of DA. The aim of the present study was to investigate self-rated orofacial esthetics in patients with DA and to compare the results with normative data. Furthermore, this study aimed to investigate the relationship between orofacial esthetics and psychological and oral health in this group and the internal reliability of the OES when used in a group of patients with DA.

Materials and methods

Subjects and procedure

A consecutive sample of adult patients who were referred or self-referred to a specialized dental anxiety clinic was invited to take part in the study. The exclusion criteria were other reasons for seeking treatment than DA, the patient not understanding Swedish or the patient having a severe mental health or physical problem that made it impossible to fill out questionnaires. Of 207 patients seeking treatment at the clinic, 13 patients were excluded due to impaired mental or physical health, four due to language difficulties and two because their reasons for seeking treatment were other than DA. Thirty-three patients declined participation in the study and three patients were excluded because of more than two missing items on the OES, leaving a study group of 152 patients. Data collection was carried out as part of the clinic's standard intake procedure and included two separate visits to the dentist and a dental radiographic examination. The study was approved by the Regional Ethical Review Board at the University of Gothenburg (nr 395-10) and all the participants gave their written informed consent.

Measures

The Orofacial Esthetic Scale (OES) was developed to assess orofacial esthetics in prosthodontic patients [17]. It consists of eight questions—of which seven questions measure how satisfied a person is with the appearance of one's face, facial profile, mouth, rows of teeth, tooth shape/form, tooth color and gingiva. The answers to these seven questions make up the OES summary score and the final (number 8) question is a global assessment question. The assessment on each item is made on a 0–10 numerical rating scale (0 = 'very dissatisfied', 10 = 'very satisfied'). The OES summary score ranges from 0–70, with higher numbers indicating greater satisfaction with one's appearance. The scale has shown good reliability, with Cronbach's alpha varying between 0.86–0.93 and a test–re-test coefficient of 0.96 and has been validity-tested in prosthodontic patients, showing good discriminative validity [21,22]. Normative data for the general adult Swedish population have been provided [20]. A modified Croatian version of the OES has also shown good psychometric properties [29]. In the present study, five patients had two or fewer missing items on the OES and these items were imputed using median imputation.

Dental Anxiety was assessed with the Dental Fear Survey (DFS) [30] which is a self-report questionnaire consisting of 20 items covering anticipation anxiety, avoidance, physiological arousal and fear of specific stimuli. Each item is scored from 1 (no anxiety) to 5 (high intensity of anxiety), giving a total score of 20–100, where a higher score indicates more DA. A total score of ≥60 is often used to indicate DA [31,32] and a mean score of 76 has been reported in clinical patients with DA [33].

General anxiety and depression were measured using the Hospital Anxiety and Depression Scale

(HADS) [34], which is a screening instrument that has shown good psychometric properties and validity [35]. The scale consists of 14 items, with seven items measuring anxiety (HADS-A) and seven items measuring depression (HADS-D). Each item is rated on a 4-point scale from 0–3, giving a total score between 0–21 for each sub-scale with a higher score indicating more distress. A cut-off of ≥8 has been reported for both the HADS-A and the HADS-D for identifying potentially clinical cases [35].

The background variables of age and gender as well as regularity of dental treatment (regular [once every or every other year], more seldom, only when having acute symptoms and never) and years since last complete dental treatment (<5 years, 5–9 years, 10–14 years, 15–19 years, 20–25 years, >25 years and 'I have never had full dental treatment') were collected with the clinic's standard intake questionnaire.

The patient's subjective assessment of his or her oral health were measured with a visual analog scale with the question 'How do you rate your overall oral health?' and the answer end-points of 0 = 'worst possible' and 100 = 'best possible'.

A full-mouth radiographic examination was performed on each patient at the clinic of Oral and Maxillofacial Radiology, Public Dental Service, Region Västra Götaland. The number of decayed, missing and filled teeth was calculated with the third molars excluded. The sample was divided for comparison into three groups for decayed and missing teeth, respectively. The first group consisted of patients with no missing or decayed teeth and the remainder of the sample was split into two groups based on the median of the remaining individuals. Root remnants were included as a measure of long-standing avoidance in spite of treatment need and defined as total destruction of the tooth crown.

Statistics

All statistical analyses were made using the SPSS 19.0 (IBM Corp, Armonk, NY). The resulting statistics were descriptive and inference testing was performed using the *t*-test, ANOVA, the Kruskal-Wallis test, the Mann-Whitney U-test, the chi-square test, linear regression and the Spearman and Pearson correlation coefficients. Non-parametric tests were used if the distributions were skewed. The chosen level of significance was $p < 0.05$, except for the multiple comparisons reported in Tables I and II, in which a Bonferroni correction was included, giving a level of significance of $\alpha = 0.00079$.

Results

Characteristics of the study population

Age, attendance patterns, level of dental anxiety, depression, general anxiety, self-rated oral health and clinical oral status for the total sample and by gender are described in Table III. The mean level of dental anxiety in the study group was high. Avoidance of dental care was also high, with 75.2% ($n = 112$) reporting 5 years or longer since the last full dental treatment; data for three patients were missing on this item. A majority of the patients, 65.5% ($n = 97$), saw a dentist only in acute situations or never at all and 34.5% ($n = 51$) of the patients reported regular or more seldom dental care. Data for four patients were missing on this item. There were gender differences in the attendance patterns (χ^2, $p = 0.006$), with women reporting regular or more seldom dental care more often than men (women: 42.3%, $n = 41$; men: 19.6%, $n = 10$) and men reporting dental care only in acute situations or never at all more often than women

Table I. Comparisons of orofacial esthetics between age groups, attendance patterns and presence of anxiety and depression; mean (SD).

	Age		Attendance of dental care		General anxiety		Depression	
	20–43 years ($n = 78$)	44–81 years ($n = 74$)	Regular ($n = 51$)	Acute or never ($n = 97$)	Low ($n = 46$)	High ($n = 106$)	Low ($n = 101$)	High ($n = 51$)
Face	6.5 (2.4)	5.2 (2.5)	6.6 (2.1)	5.5 (2.5)	6.7 (2.2)	5.5 (2.6)	6.5 (2.2)*	4.8 (2.8)*
Profile	6.0 (2.5)	5.3 (2.5)	5.8 (2.5)	5.6 (2.5)	6.5 (2.3)	5.3 (2.5)	6.0 (2.3)	4.9 (2.8)
Mouth	4.4 (2.9)*	2.7 (2.6)*	4.8 (2.9)*	2.9 (2.6)*	4.6 (3.2)	3.2 (2.6)	4.0 (2.9)	2.7 (2.6)
Alignment	4.5 (3.1)*	2.4 (2.2)*	4.4 (3.1)	3.0 (2.6)	4.2 (3.0)	3.2 (2.8)	3.9 (2.8)	2.8 (2.9)
Shape	5.3 (2.9)*	3.2 (2.7)*	5.4 (2.8)	3.7 (2.9)	4.9 (2.9)	4.0 (3.0)	4.7 (2.9)	3.5 (3.0)
Color	3.3 (2.4)	2.4 (2.3)	4.1 (2.7)*	2.2 (1.9)*	3.5 (2.3)	2.6 (2.4)	3.3 (2.4)	2.0 (2.0)
Gingiva	4.4 (3.0)	2.9 (2.5)	5.2 (3.0)*	2.9 (2.4)*	4.5 (3.1)	3.3 (2.7)	4.1 (2.9)	2.8 (2.5)
Global	5.2 (2.6)*	3.4 (2.2)*	5.3 (2.6)*	3.8 (2.3)*	5.0 (2.6)	4.0 (2.5)	4.8 (2.3)*	3.3 (2.6)*
Summary score	34.5 (15.2)*	24.3 (13.4)*	36.2 (15.2)*	25.8 (13.5)*	34.9 (14.9)	27.2 (14.8)	32.6 (14.5)*	23.5 (14.8)*

Note: Anxiety and depression are measured with the Hospital Anxiety and Depression Scale, anxiety and depression sub-scales. Low anxiety and depression is a score of 0–7 and high is a score of 8–21.
*$p < 0.00079$.

Table II. Comparisons of self-rated orofacial esthetics between groups with or without root remnants and between three sub-groups of decayed and missing teeth; mean (SD).

	Root remnants		Decayed teeth			Missing teeth		
	0 (n = 91)	≥1 (n = 60)	0 (n = 25)	1–4 (n = 61)	≥5 (n = 65)	0 (n = 46)	1–3 (n = 54)	≥4 (n = 51)
Face	6.3 (2.3)	5.3 (2.7)	6.6 (2.2)	6.2 (2.0)	5.4 (2.9)	6.0 (2.6)	6.6 (1.8)	5.2 (2.9)
Profile	5.8 (2.5)	5.5 (2.6)	5.7 (2.5)	5.9 (2.2)	5.5 (2.8)	5.5 (2.5)	6.3 (2.1)	5.1 (2.7)
Mouth	4.8 (2.7)*	1.9 (2.0)*	5.0 (3.0)*	4.7 (2.5)*	2.1 (2.5)*	4.3 (2.6)	3.9 (2.8)	2.7 (3.0)
Alignment	4.6 (2.9)*	1.9 (2.1)*	4.6 (3.1)*	4.5 (2.7)*	2.2 (2.5)*	4.3 (2.8)	3.9 (2.8)	2.5 (2.7)
Shape	5.4 (2.7)*	2.7 (2.7)*	5.3 (2.7)*	5.1 (2.8)*	3.2 (2.9)*	4.6 (2.8)	4.9 (2.9)	3.4 (3.1)
Color	3.6 (2.4)*	1.9 (2.0)*	3.7 (2.7)*	3.6 (2.4)*	2.0 (1.9)*	3.2 (2.4)	2.9 (2.1)	2.6 (2.6)
Gingiva	4.5 (2.9)*	2.5 (2.3)*	4.6 (3.1)	4.3 (2.8)	2.8 (2.6)	4.3 (2.8)	4.0 (2.8)	2.9 (2.8)
Global	5.2 (2.5)*	3.0 (1.9)*	5.4 (2.5)*	5.2 (2.3)*	3.2 (2.3)*	4.9 (2.5)	4.7 (2.1)	3.4 (2.7)
Summary score	35.0 (14.5)*	21.6 (12.3)*	35.5 (15.2)*	34.2 (13.6)*	23.2 (14.2)*	32.2 (14.5)	32.5 (13.1)	24.4 (16.7)

*$p < 0.00079$.

(women: 57.7%, n = 56; men: 80.4%, n = 41). The mean level of general anxiety in the study population was above the cut-off point for potentially clinical cases. Other gender differences found in the study population were higher levels of general anxiety and fewer decayed teeth and root remnants among women than men (Table III).

Psychometric properties of the orofacial estethics scale

Cronbach's alpha was 0.90 when the seven items making up the OES summary score were included in the analysis and 0.92 when all eight items were included in the analysis. Inter-item correlations are described in Table IV. On visual inspection of the items included in the OES summary score, the two items 'face' and 'facial profile' are strongly correlated with each other (r = 0.83), but more weakly correlated with the other items describing teeth, gingiva and mouth (r = 0.28–0.55), which, instead, are more strongly correlated with each other (r = 0.66–0.82). This result may indicate two dimensions of the OES.

Table III. Characteristics of the study population.

Characteristic	Total sample (n = 152)	Female (n = 99)	Male (n = 53)
Age	41.8 (13.1)	41.3 (13.5)	42.8 (12.2)
DFS	76.2 (14.6)	77.5 (15.3)	73.7 (13.1)
HADS - D	6.0 (4.1)	6.3 (4.4)	5.4 (3.5)
HADS - A	10.4 (4.8)	11.0 (4.8)*	9.2 (4.4)*
Self-rated oral health	23.7 (22.5)	25.6 (23.1)	20.2 (21.2)
Decayed teeth[a]	6.3 (6.7)	5.4 (6.6)**	7.8 (6.6)**
Missing teeth[a]	3.3 (4.2)	2.9 (3.8)	3.9 (4.9)
Filled teeth[a]	6.9 (5.0)	7.4 (5.1)	6.1 (4.8)
Root remnants[a]	1.8 (3.5)	1.5 (3.6)*	2.4 (3.4)*

Note: All results are in the format of mean (SD). Sixty-five per cent of the total sample were female.
DFS, Dental Fear Survey; HADS-D, Hospital Anxiety and Depression Scale–Depression sub-scale; HADS-A, Hospital Anxiety and Depression Scale–Anxiety sub-scale.
[a]Total study group n = 151, male n = 52.
*$p < 0.05$. **$p < 0.01$.

Self-rated orofacial esthetics in DA patients compared with the general population

Patients with DA scored significantly lower than the general population, as reported by Larsson [20], on all OES items and on the summary score. This indicates less satisfaction with all aspects of the orofacial esthetics in the DA group (Table V).

Aspects of gender, age, regularity of treatment and dental fear survey scores in self-rated orofacial esthetics

No statistically significant differences were found between men and women in the DA group on individual items or the summary score of OES, except for the item 'facial profile', where women were less satisfied than men [women, M = 5.3 (SD = 2.5); men, M = 6.3 (SD = 2.4); $t = -2.4$, p = 0.020]. There was an effect of age and regularity of treatment, in that the older age group and patients who only visited dental services acutely or never were less satisfied with their orofacial esthetics (Table I). In the study sample only 20 patients scored below 60 on the DFS, which is a commonly used cut-off for DA. Comparisons between these 20 patients and the rest of the sample did not reveal any statistically significant differences on orofacial esthetics.

Table IV. The orofacial esthetic scale—inter-item correlation.

	Face	Profile	Mouth	Alignment	Shape	Color	Gingiva
Profile	0.83						
Mouth	0.55	0.42					
Alignment	0.47	0.38	0.79				
Shape	0.46	0.35	0.70	0.82			
Color	0.43	0.28	0.66	0.66	0.70		
Gingiva	0.46	0.32	0.67	0.69	0.68	0.66	
Global	0.73	0.58	0.77	0.75	0.67	0.65	0.70

$p < 0.001$ for all correlations.

Orofacial esthetics and psychological health

The presence of general anxiety and depression was related to lower ratings on individual OES items and the summary score, but only the relationship between depression and the assessment of facial appearance, the global assessment and the summary score were statistically significant (Table I). The correlation between the OES summary score and the HADS-A was $r = -0.27$, $p = 0.001$, and the correlation between the OES summary score and the HADS-D was $r = -0.42$, $p < 0.001$.

Orofacial esthetics and oral health

The number of decayed teeth and the presence of root remnants were associated with lower ratings on the OES, both on the summary score and on individual items, except for the items assessing face and facial profile, which were not associated with root remnants or decayed teeth. Nor were decayed teeth associated with the OES item assessing the gingiva (Table II). The OES scores were lower in the group with four or more missing teeth, but these results were not statistically significant (Table II). Correlations between the OES summary score and decayed teeth were $r_s = -0.44$, $p < 0.001$; OES summary score and missing teeth $r_s = -0.30$, $p < 0.001$, OES summary score and root remnants $r_s = -0.49$, $p < 0.001$, and OES summary score and self-rated oral health $r_s = 0.69$, $p < 0.001$. These results indicate a strong relationship between self-rated orofacial esthetics and oral health.

Table V. Self-rated orofacial esthetics in patients with DA and in the general population; mean (SD).

	DA (n = 152)	General population[a] (n = 1159)	t	p
Face	5.9 (2.5)	7.6 (2.4)	8.2	< 0.001
Profile	5.7 (2.5)	7.5 (2.5)	8.3	< 0.001
Mouth	3.6 (2.9)	7.2 (2.7)	15.3	< 0.001
Alignment	3.5 (2.9)	6.9 (2.9)	13.6	< 0.001
Shape	4.3 (3.0)	7.2 (2.7)	12.3	< 0.001
Color	2.9 (2.4)	6.3 (2.9)	13.8	< 0.001
Gingiva	3.7 (2.9)	7.6 (2.4)	18.4	< 0.001
Global	4.3 (2.5)	7.4 (2.4)	14.9	< 0.001
Summary score	29.5 (15.2)	50.3 (15.6)	15.5	< 0.001

[a]General population data from Larsson [20].

Regression analysis of psychological and dental measures

Multiple linear regression analyses using the enter method were performed with the OES summary score as the dependent variable. Based on the bivariate analyses, age, decayed and missing teeth (DMT), self-rated oral health and the HADS-D or HADS-A were included in the model as independent variables. The model produced very similar, statistically significant results regardless of whether the HADS-D or the HADS-A was used. Regression analysis with inclusion of the HADS-D resulted in the model: $F(4,146) = 56.05$, $p < 0.001$, where the model explained 59.5% of the variance. All entered variables were significant predictors and are reported in Table VI. Because of the previously mentioned statistically significant results for the HADS-A and the strong correlation between the HADS-D and HADS-A ($r = 0.71$, $p < 0.001$), the results indicate a relationship with orofacial esthetics where both depression and

Table VI. The non-standardized (B) and standardized regression (β) coefficients for the variables entered in the model with the OES summary score as the dependent variable.

Variable	B	$SE\ b$	β	t	p
Age	−0.29	0.06	−0.25	−4.68	< 0.001
DMT	−0.26	0.11	−0.14	−2.29	0.023
Self-rated oral health	0.33	0.41	0.48	7.99	< 0.001
HADS-D	−1.07	0.20	−0.29	−5.48	< 0.001

DMT, Decayed and Missing Teeth; HADS-D, Hospital Anxiety and Depression Scale–Depression sub-scale.

anxiety are important as well as age, DMT and self-rated oral health.

Discussion

The study examined self-rated orofacial esthetics in a clinical sample of patients referred or self-referred to a specialized DA clinic. Compared with the general population, patients with DA had lower ratings of satisfaction on all aspects of their orofacial esthetics, which included the teeth, gingiva, mouth and face as well as a global orofacial assessment. The level of satisfaction with the orofacial esthetics in the study group was similar to the one reported in esthetically-impaired prosthodontic patients [22]. The results of this study clearly show that decreased satisfaction with dental and facial appearance is substantial in patients with DA. Furthermore, the perception of the orofacial appearance was related both to dental status and self-rated oral health, as well as to general anxiety and depression. This is in line with previous research on other groups, which has shown that both dental and psychological factors are important in self-assessed orofacial esthetics [19,23].

In the study sample of patients with DA, we found a weaker correlation between the face and profile items and the items specifically describing the teeth and the mouth, than has been previously reported in the literature [21]. This may be due to the fact that patients with DA may have strongly impaired oral health, leading to a less positive esthetic evaluation of the mouth and teeth compared to the rest of the face.

The level of satisfaction in the study sample with the orofacial appearance was similar for both genders, but women had more regular dental care and better dental status. This indicates that both male and female patients with DA report roughly the same low level of satisfaction with their orofacial appearance, but their satisfaction is related to different levels of oral health. Furthermore, the results of this study indicate that women with DA have undergone more dental care in the past, despite similar levels of DA and a higher degree of general anxiety.

In the present study, a low level of satisfaction with one's orofacial appearance was related to depression and general anxiety as well as oral status. This may indicate that the perception of appearance is dependent on oral status and may lead to anxiety and depressive symptoms and that these states, known for their negative information processes [36,37], may further decrease the satisfaction with one's appearance. This process would be in line with the previously mentioned vicious circle of DA [6,8,9] where deterioration of oral status is supposed to lead to a variety of negative feelings. There is evidence that people make social judgment about others based on their dental appearance [38,39] and such judgment may be important in inducing these negative feelings in persons with poor oral health. Anxiety and depressive symptoms may also exist because of other personal factors unrelated to DA, which may, nevertheless, moderate the relationship between oral status and the perception of appearance.

A limitation associated with this cross-sectional study is that no conclusions about causality may be drawn. The strengths of the study are the large clinical sample and the validated measures used and the inclusion of both dental and psychological clinical measures.

The results of the present study are valuable from a clinical perspective in that they demonstrate the need to address the esthetic aspects of dental status in patients with DA. It also shows that psychological health needs to be taken into account, as it may be a consequence of, and influence, a person's perception of his/her orofacial esthetics. The results further add to the validity of the OES and that it can be used to assess orofacial esthetics in patients with DA.

In conclusion, this study shows that DA is associated with a lower level of satisfaction with one's orofacial esthetics and that the self-rating of orofacial esthetics is related to both oral and psychological health.

Acknowledgments

This research was supported by a grant from The Local Research and Development Board for Gothenburg and Södra Bohuslän, Region Västra Götaland, Sweden.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

References

[1] Hakeberg M, Berggren U, Carlsson SG. Prevalence of dental anxiety in an adult population in a major urban area in Sweden. Community Dent Oral Epidemiol 1992; 20:97–101.

[2] Oosterink FM, de Jongh A, Hoogstraten J. Prevalence of dental fear and phobia relative to other fear and phobia subtypes. Eur J Oral Sci 2009;117:135–43.

[3] Vassend O. Anxiety, pain and discomfort associated with dental treatment. Behav Res Ther 1993;31:659–66.

[4] Agdal ML, Raadal M, Skaret E, Kvale G. Oral health and oral treatment needs in patients fulfilling the DSM-IV criteria for dental phobia: possible influence on the outcome of cognitive behavioral therapy. Acta Odontol Scand 2008;66:1–6.

[5] Armfield JM, Slade GD, Spencer AJ. Dental fear and adult oral health in Australia. Community Dent Oral Epidemiol 2009;37:220–30.

[6] Wide Boman U, Lundgren J, Berggren U, Carlsson SG. Psychosocial and dental factors in the maintenance of severe dental fear. Swed Dent J 2010;34:121–7.

[7] Hakeberg M, Berggren U, Carlsson SG, Gröndahl HG. Long-term effects on dental care behavior and dental

health after treatments for dental fear. Anesth Prog 1993; 40:72–7.
[8] De Jongh A, Schutjes M, Aartman IH. A test of Berggren's model of dental fear and anxiety. Eur J Oral Sci 2011;119: 361–5.
[9] Armfield JM, Stewart JF, Spencer AJ. The vicious cycle of dental fear: exploring the interplay between oral health, service utilization and dental fear. BMC Oral Health 2007;7:1.
[10] Abrahamsson KH, Berggren U, Carlsson SG. Psychosocial aspects of dental and general fears in dental phobic patients. Acta Odontol Scand 2000;58:37–43.
[11] Cohen SM, Fiske J, Newton JT. The impact of dental anxiety on daily living. Br Dent J 2000;189:385–90.
[12] Locker D. Psychosocial consequences of dental fear and anxiety. Community Dent Oral Epidemiol 2003;31:144–51.
[13] Moore R, Brodsgaard I, Rosenberg N. The contribution of embarrassment to phobic dental anxiety: a qualitative research study. BMC Psychiatry 2004;4:10.
[14] Bergendal B. The relative importance of tooth loss and denture wearing in Swedish adults. Community Dent Health 1989;6:103–11.
[15] Nordenram G, Davidson T, Gynther G, Helgesson G, Hultin M, Jemt T, et al. Qualitative studies of patients' perceptions of loss of teeth, the edentulous state and prosthetic rehabilitation: a systematic review with meta-synthesis. Acta Odontol Scand 2013;71:937–51.
[16] Locker D. Oral health and quality of life. Oral Health Prev Dent 2004;2:247–53.
[17] Larsson P, John MT, Nilner K, Bondemark L, List T. Development of an Orofacial Esthetic Scale in prosthodontic patients. Int J Prosthodont 2010;23:249–56.
[18] Mehl C, Kern M, Freitag-Wolf S, Wolfart M, Brunzel S, Wolfart S. Does the Oral Health Impact Profile questionnaire measure dental appearance? Int J Prosthodont 2009;22:87–93.
[19] Wolfart S, Quaas AC, Freitag S, Kropp P, Gerber WD, Kern M. General well-being as an important co-factor of self-assessment of dental appearance. Int J Prosthodont 2006;19:449–54.
[20] Larsson P. Methodological studies of orofacial aesthetics, orofacial function and oral health-related quality of life. Swed Dent J 2010;(Suppl 204):11–98.
[21] John MT, Larsson P, Nilner K, Bandyopadhyay D, List T. Validation of the Orofacial Esthetic Scale in the general population. Health Qual Life Outcomes 2012;10:135.
[22] Larsson P, John MT, Nilner K, List T. Reliability and validity of the Orofacial Esthetic Scale in prosthodontic patients. Int J Prosthodont 2010;23:257–62.
[23] Matthias RE, Atchison KA, Schweitzer SO, Lubben JE, Mayer-Oakes A, De Jong F. Comparisons between dentist ratings and self-ratings of dental appearance in an elderly population. Spec Care Dentist 1993;13:53–60.
[24] Marsella AJ, Shizuru L, Brennan J, Kameoka V. Depression and body image satisfaction. J Cross Cult Psychol 1981;12: 360–71.
[25] Noles SW, Cash TF, Winstead BA. Body image, physical attractiveness, and depression. J Consult Clin Psychol 1985; 53:88–94.
[26] Rierdan J, Koff E, Stubbs ML. A longitudinal analysis of body image as a predictor of the onset and persistence of adolescent girls' depression. J Early Adolesc 1989;9:454–66.
[27] Kostanski M, Gullone E. Adolescent body image dissatisfaction: relationships with self-esteem, anxiety, and depression controlling for body mass. J Child Psychol Psychiatry 1998;39: 255–62.
[28] Locker D, Poulton R, Thomson WM. Psychological disorders and dental anxiety in a young adult population. Community Dent Oral Epidemiol 2001;29:456–63.
[29] Persic S, Milardovic S, Mehulic K, Celebic A. Psychometric properties of the Croatian version of the Orofacial Esthetic Scale and suggestions for modification. Int J Prosthodont 2011;24:523–33.
[30] Kleinknecht RA, Klepac RK, Alexander LD. Origins and characteristics of fear of dentistry. J Am Dent Assoc 1973; 86:842–8.
[31] Milgrom P, Vignehsa H, Weinstein P. Adolescent dental fear and control: prevalence and theoretical implications. Behav Res Ther 1992;30:367–73.
[32] Skaret E, Raadal M, Berg E, Kvale G. Dental anxiety among 18-yr-olds in Norway. Prevalence and related factors. Eur J Oral Sci 1998;106:835–43.
[33] Moore R, Berggren U, Carlsson SG. Reliability and clinical usefulness of psychometric measures in a self-referred population of odontophobics. Community Dent Oral Epidemiol 1991;19:347–51.
[34] Zigmond AS, Snaith RP. The hospital anxiety and depression scale. Acta Psychiatr Scand 1983;67:361–70.
[35] Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the Hospital Anxiety and Depression Scale. An updated literature review. J Psychosom Res 2002;52:69–77.
[36] Barlow DH. Anxiety and its disorders: the nature and treatment of anxiety and panic. 2nd edition. New York, NY: Guilford Press; 2002.
[37] Gotlib IH, Joormann J. Cognition and depression: current status and future directions. Annu Rev Clin Psychol 2010;6: 285–312.
[38] Kershaw S, Newton JT, Williams DM. The influence of tooth colour on the perceptions of personal characteristics among female dental patients: comparisons of unmodified, decayed and 'whitened' teeth. Br Dent J 2008;204:E9.
[39] Newton JT, Prabhu N, Robinson PG. The impact of dental appearance on the appraisal of personal characteristics. Int J Prosthodont 2003;16:429–34.