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Original Scientific Paper

ORAL CHANGES IN PEDIATRIC PATIENTS WITH EATING DISORDERS

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SUMMARY – Numerous oral changes develop as a result of dysfunctional eating behavior in patients with eating disorders (ED). The aim of this study was to evaluate the correlation among oral manifestations, age, disease duration and nutritional status in pediatric patients with ED. The study included 50 female ED patients, median age 14 (range 10-18) years and median disease duration 9 (range 1-42) months. Nutritional status was expressed as z-score for body mass index (BMI). Mean BMI z-score was -2.10±1.64. The most commonly observed oral findings were dental plaque, marginal gingivitis, morsicatio, dental calculus, caries, pharyngeal erythema, exfoliative cheilitis and angular cheilitis. Dental plaque and pharyngeal erythema were correlated with shorter disease duration (p=0.048; p=0.040), while frictional keratosis of tongue was correlated with longer disease duration (0.011). Linea alba and pain in the temporomandibular joint were associated with younger age (p=0.012; p=0.024), and tooth impression on tongue with lower degree of nutrition (p=0.030). This study showed that there was a link among oral manifestations, age, disease duration and degree of nutritional disorder, although further investigations comparing the groups of ED patients with different age, disease duration and nutritional status would give better, concrete and precise conclusions.

Key words: *Eating disorders; Oral manifestations; Adolescent; Nutritional status*

Introduction

Eating disorders (ED) are psychiatric diseases which are according to the Diagnostic and Statistical Manual of Mental Disorders (DSM V) classified in anorexia nervosa (AN) restrictive type (RT) or binge/purge type (BP), bulimia nervosa (BN), binge eating (BE), other specified feeding or eating disorder (OSFED) and unspecified feeding or eating disorder (UFED). The last two ones, OSFED and UFED, came from what used to be called eating disorders not otherwise specified (EDNOS) in DSM IV[1]. ED are relatively rare in the general population. According to DSM IV criterion, the lifetime prevalence estimates of anorexia nervosa, bulimia nervosa, and binge-eating disorder in the USA were 0.3%, 0.9%, and 1.6%, respectively. There are no data on EDNOS[2,3]. In the Netherlands study, according to DSM V criteria, the prevalence of AN in the female population is 1.2%, and the prevalence in 19-year-old females is 1.7%[4]. There are no accurate data on the prevalence of ED in

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Croatia. However, there are a few studies showing that a significant number of adolescents exhibit abnormal eating habits, and even though ED usually occur in early puberty, we are witnessing a shift towards younger age groups[5-7].

Disturbed attitude towards food and eating in patients suffering from ED results in numerous medical complications involving all organic systems. There is a lack of studies investigating the impact of ED on oral health. The most commonly described oral findings are dental plaque, marginal gingivitis, dental calculus, caries, exfoliative cheilitis, angular cheilitis, and burning tongue[8,9]. Enamel erosions on the lingual surface of the maxillary teeth and salivary gland swelling are described in patients with ED with self-induced vomiting[10,11]. These lesions can develop within six months of the onset of ED[12]. They are not pathognomonic or specific for ED, but if there are other symptoms such as malnutrition and dehydration, they can lead to ED diagnosis. Considering that the majority of ED patients conceal their illness and avoid professional help, the role of a dentist as the first one who could recognize these signs might be highly important.

Therefore, the aim of this study was to evaluate the correlation among oral findings, age, disease duration and nutritional status in pediatric patients with ED and to point to the possibly significant role of the dentist in early diagnosis of ED.

Patients and Methods

This cross-sectional study was carried out from September 2016 to November 2017 at the Department of Pediatric Gastroenterology, Sestre milosrdnice University Hospital Center and School of Dental Medicine, Zagreb, Croatia, in accordance with the Declaration of Helsinki and approved by the Hospital Ethics Committee and Ethics Committee of the School of Dental Medicine, University of Zagreb. The patients included in the study and their parents received both written and oral information about the study, and parents signed a written informed consent form.

The study included 50 female patients aged 10-18 years, diagnosed with ED according to DSM V. Disease duration was established through questionnaires completed by the patients upon admission to the hospital, in which the patient indicated when the disease started. Body weight and height were measured on the first day of hospital admission using a scale for weight and height, with patients in their underwear and without shoes. Body mass index (BMI) was calculated by dividing weight and height square (kg/m^2). Nutritional status was expressed in z-score for BMI since the values of BMI change with age in children. Clinical oral examination was performed within five days of hospital admission by oral medicine/oral pathology specialist at the Department of Oral Medicine, School of Dental Medicine, University of Zagreb/Department of Oral Diseases, Dental Clinic, Zagreb University Hospital Center and Department of Removable Prosthodontics, School of Dental Medicine, University of Zagreb. The extraoral and intraoral soft tissue examination involved visual observations and palpation. Enlargement of the parotid gland was assessed by visual inspection and palpation. Temporomandibular joint (TMJ) pain and existence of headache were also recorded.

Statistical analysis was performed using Statistica software version 13.3[13]. The value of $p<0.05$ was considered statistically significant. Descriptive statistics (mean ± SD, median, minimum, maximum, n, percentage) were calculated for all variables analyzed. The normality of distribution was tested by Kolmogorov-Smirnov test and homogeneity of variance by Leven test. Differences in distributions of continuous data were determined by ANOVA or Kruskal-Wallis test. Dunn-Bonferroni post-hoc test was used. Differences in distributions of categorical data were evaluated by χ^2-test. Post-hoc multiple comparisons were done with and without Bonferroni correction. With Bonferroni correction, the level of significance was set at $p<0.016$, since 3 possible comparisons were undertaken (0.05/3). Pearson's correlation test was used to assess the strength of associations.

Results

This study included 50 female ED patients, median age 14 (range 10-18) years and median disease duration 9 (range 1-42) months according to self-reported duration of changes in eating behavior. Their mean BMI was 16.03±2.49 kg/m^2 and mean BMI z-score -2.10±1.64.

According to the type of ED, patients were divided into three groups, as follows: AN (n=27; 54%), BN (n=6; 12%) and EDNOS (n=17; 34%). Table 1 shows descriptive statistics of their basic characteristics. EDNOS patients were youngest and had the shortest disease duration, while AN patients

Table 1. Basic characteristics of patients divided into three groups according to type of eating disorder

	AN (n=27)	BN (n=6)	EDNOS (n=17)	H[a] F[b]	p
Age (years)*	14 (12-17)	17 (13-18)	13.5 (10-17)	7.185[a]	**0.027**
Disease duration (months)*	9 (2-42)	26 (9-40)	5 (1-25)	7.193[a]	**0.027**
BMI z-score**	-2.66±1.46	-0.01±0.90	-1.85±1.56	7.341[b]	**0.002**
BMI percentile*	1.1 (0-31.9)	45.7 (8-92)	2.5 (0-55.5)	11.702[a]	**0.029**

*median (min-max); **mean ± standard deviation; [a]Kruskal-Wallis test df=3; [b]ANOVA df=3; AN = anorexia nervosa; BN = bulimia nervosa; EDNOS = eating disorder not otherwise specified; BMI = body mass index

had the worst nutritional status. However, post hoc Dunn-Bonferroni test showed that EDNOS patients were significantly younger (p=0.044) and had a significantly shorter disease duration (p=0.024) than BN patients only. No significant differences in age and disease duration were found among other groups. A statistically significant difference in BMI z-score was only found between AN and BN patients (p=0.002).

The most commonly observed oral findings were dental plaque, marginal gingivitis, morsicatio, calculus,

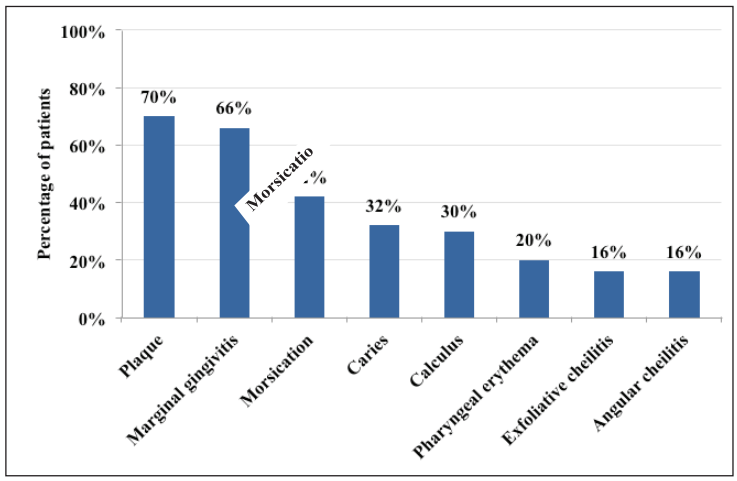

Fig. 1. Most commonly observed oral problems in patients with eating disorders.

Fig. 2. Marginal gingivitis and plaque.

Fig. 3. Morsicatio.

Fig. 4. Calculus.

Fig. 5. Exfoliative cheilitis and angular cheilitis.

caries, pharyngeal erythema, exfoliative cheilitis, and angular cheilitis (Figs. 1-5). *Foetor ex ore* was found in five (10%), linea alba in four (8%), salivary gland enlargement in three (6%), oral ulcerations, geographic tongue, frictional keratosis of the tongue in two (4%) patients each, and mucosal erosion in only one (2%) patient. Fifteen (30%) patients had headache, six (12%) had TMJ pain, and three (6%) patients had oral pain (toothache, painful gingiva, palate or buccal mucosa).

Three (6%) patients did not have any oral changes or symptoms, six (12%) patients had just one manifestation, and the remaining 41 (82%) patients had more than one oral manifestation. The largest number of patients had three to five manifestations simultaneously, including 8 patients with three, 14 patients with four and 9 patients with five oral manifestations. It should be noted that two patients had six manifestations, one had seven, and one even eight oral manifestations.

Table 2 shows the prevalence of oral findings in patients divided into three groups according to the type of ED. The occurrence of salivary gland swelling (p=0.045), pain in TMJ (p=0.002) and headache (p<0.001) was significantly different among the groups, yet this was not the case for other oral findings. EDNOS patients had salivary gland swelling significantly more often than AN and BN patients (18% *vs.* 0%, p<0.001 and 18% *vs.* 0%, p<0.001; also significant at the Bonferroni corrected significance level of p<0.016). No difference in the rate of salivary gland swelling was observed between AN and BN patients (0% *vs.* 0%). Pain in TMJ occurred more frequently in BN patients than in EDNOS and AN patients (50%

Table 2. Oral findings in patients divided into three groups according to type of eating disorder

	AN (n=27)	BN (n=6)	EDNOS (n=17)	χ^2	p
Plaque*	18 (67)	4 (67)	13 (76)	0.514	0.774
Marginal gingivitis*	15 (56)	5 (83)	13 (76)	2.946	0.229
Morsicatio*	12 (45)	4 (67)	5 (29)	2.671	0.263
Dental calculus*	6 (22)	1 (17)	8 (47)	3.641	0.162
Caries*	8 (30)	4 (67)	4 (23)	3.944	0.139
Erythematous pharyngitis*	6 (22)	2 (33)	2 (12)	1.471	0.479
Exfoliative cheilitis*	5 (19)	1 (17)	2 (12)	0.356	0.837
Angular cheilitis*	5 (19)	0 (0)	3 (18)	1.305	0.521
*Foetor ex ore**	3 (11)	1 (17)	1 (6)	0.654	0.721
Linea alba*	1 (4)	0 (0)	3 (18)	3.348	0.187
Salivary gland swelling*	0 (0)	0 (0)	3 (18)	6.195	**0.045**
Oral ulcerations*	2 (7)	0 (0)	0 (0)	1.775	0.412
Lingua geographica*	0 (0)	1 (17)	1 (6)	3.789	0.150
Hyperkeratosis of tongue*	1 (4)	0 (0)	1 (6)	0.413	0.813
Mucosal erosions*	0 (0)	0 (0)	1 (6)	1.981	0.371
Pain in oral cavity*	0 (0)	1 (17)	2 (12)	3.935	0.139
Pain in TMJ*	0 (0)	3 (50)	3 (18)	12.399	**0.002**
Headache*	6 (22)	6 (100)	3 (18)	16.013	**<0.001**

*n (group %) χ^2-test df=3; AN = anorexia nervosa; BN = bulimia nervosa; EDNOS = eating disorder not otherwise specified; TMJ = temporomandibular joint

vs. 18%, p<0.001 and 50% *vs.* 0%, p<0.001), as well as in EDNOS than in AN patients (18% *vs.* 0%, p=0.006); all comparisons were significant at the Bonferroni corrected significance level of p<0.016. BN patients had headache more often than AN and EDNOS patients (100% *vs.* 22%, p<0.001 and 100% *vs.* 18%, p<0.001; also significant at the Bonferroni corrected significance level of p<0.016), while no significant difference in the rate of headache was observed between AN and EDNOS patients (22% *vs.* 18%, p=0.294).

Table 3. Correlation among oral problems, age, disease duration and level of nutrition

		Age	Disease duration	BMI z-score
Plaque	r	-0.006	-0.289	-0.175
	p	0.967	**0.048**	0.239
Morsicatio	r	0.207	0.245	0.008
	p	0.161	0.057	0.956
Pharyngeal erythema	r	-0.041	-0.422	-0.014
	p	0.783	**0.040**	0.950
Tooth impression on tongue	r	0.187	-0.114	-0.444
	p	0.209	0.595	**0.030**
Frictional keratosis of the tongue	r	0.210	0.509	-0.186
	p	0.435	**0.011**	0.385
Linea alba	r	-0.363	0.308	0.462
	p	**0.012**	0.247	0.052
Geographic tongue	r	0.158	-0.213	0.452
	p	0.289	0.429	0.059
Pain in TMJ	r	-0.926	-0.008	0.436
	p	**0.024**	0.960	**0.002**
Headache	r	-0.175	0.023	0.376
	p	0.414	0.879	**0.009**

BMI = body mass index; TMJ = temporomandibular joint

Correlations among oral manifestations, age, disease duration and degree of nutrition are shown in Table 3. Disease duration was significantly negatively correlated with dental plaque (p=0.048) and pharyngeal erythema (p=0.040), and significantly positively with frictional keratosis of tongue (p=0.011). Age was significantly negatively associated with linea alba (p=0.012) and pain in TMJ (p=0.024), while degree of nutrition expressed by BMI z-score was significantly negatively associated with tooth impression on tongue (p=0.030), and significantly positively with pain in TMJ (p=0.002) and headache (p=0.009). These results indicated that some oral manifestations occurred more often in younger patients, some in patients with shorter disease duration, others in those with longer disease duration, in patients with lower degree of nutrition, or in those with a higher level of nutrition. It is obvious that there is a link among oral manifestations, age, disease duration and level of nutrition; however, better, concrete and precise conclusions would be achieved by comparing the groups of ED patients with different age, disease duration and nutritional status.

Discussion

Eating disorders are often diagnosed late. They most commonly develop during adolescence (15-19 years)[4,14,15]. Considering better treatment results if the disease is diagnosed early, this study aimed to point to the early signs that could be recognized by dentist.

Romanos *et al.* presented a review of the literature published from 1948 to 2012 on oral manifestations in patients with ED[16]. According to that review, exfoliative cheilitis, burning tongue and salivary gland swelling were the most common manifestations in patients with ED. They also showed marginal gingivitis, periodontitis, reduced salivation and saliva changes

to be more common in ED patients than in healthy controls. Frydrych *et al*. found that dental erosions and caries were more common in ED patients, especially in patients with BN[17]. In the study by Johansson *et al*., multivariate analysis identified significantly higher ORs in ED patients presenting dental problems (OR=4.1), burning tongue (OR=14.2), dry/cracked lips (OR=9.6), dental erosion (OR=8.5), and less gingival bleeding (OR=1.1) compared with healthy controls[8]. Panico *et al*. showed that oral lesions were more common in ED patients than in healthy controls (94% *vs.* 18.5%). The most common lesions were labial erythema, exfoliative cheilitis, orange-yellow palate, hemorrhagic lesions, lip-cheek biting, and non-specific oral atrophies. Only two patients had dental erosions, and no case of major salivary gland swelling was described[9]. A group of Brazilian authors, who investigated the prevalence, strength and etiology of dental wear in patients with ED, found that it was more evident on molars[18].

In this study, the most commonly observed oral manifestations were dental plaque, marginal gingivitis, morsicatio, calculus, caries, pharyngeal erythema, exfoliative cheilitis and angular cheilitis, which is consistent with the data published so far.

Salivary gland enlargement was determined in only three EDNOS patients. The reason for this could be late onset of salivary gland enlargement in the course of illness. The finding of salivary gland enlargement in EDNOS patients rather than bulimic patients, which was expected according to the previously mentioned study[16], could probably be explained by the known fact that the same patients often experience different types of ED diagnosis during the illness.

The results of different studies showed a high prevalence of masticatory myofascial pain, pain in TMJ, and complaints of chronic facial pain among ED patients[19-22], which is in accordance with the results of this study. In the study by Johansson *et al*., TMJ pain was diagnosed in 28 out of 57 (48%) ED patients[20]. In this study, the prevalence of TMJ pain was 12%. The highest prevalence of 50% was observed in BN group, but due to the small number of BN patients, this result might be overestimated.

Some of the described changes, such as exfoliative cheilitis, marginal gingivitis and morsicatio could be early clinical markers of ED since some of these changes may occur very early during the course of disease, unlike dental erosion and salivary gland enlargement, which take months to years to become apparent[8,12,21]. With this in mind, dentists might have an important role in the identification of oral lesions related to ED. They should look out for symptoms and signs which could be indicative of a patient with ED. However, studies showed insufficient sensitization, knowledge and inadequate involvement of dentists in the multidisciplinary approach to detection and treatment of ED patients[9,23,24]. Identifying oral changes might be the first step towards early diagnosis of ED and prevention of further complications caused by the disease. Therefore, there is a great need to encourage dentists to engage in early detection of ED.

This study may have suffered some limitations because of its cross-sectional design, which could not show causal association between the identified oral manifestations and ED, and because of the relatively small sample size in some groups, as well as the fact that the study did not include healthy controls. Moreover, patients were divided into groups only according to the type of ED without further division into subgroups according to age, disease duration and nutritional status.

Conclusion

This study showed that there is a link among oral manifestations, age, disease duration and level of nutrition in ED patients. Therefore, the presence of oral manifestations could indicate the existence of ED and dentists might have an important role in the identification of oral lesions related to ED. Further studies that would include a large number of ED patients, divided not only according to the type of disease but also according to age, disease duration and nutritional status, and healthy controls are necessary to determine whether our observations might contribute to better understanding of the relationship between oral manifestations and ED, which could lead to new approaches to early diagnosis and treatment of these severe pediatric diseases of modern era.

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Sažetak

ORALNE PROMJENE KOD PEDIJATRIJSKIH BOLESNIKA S POREMEĆAJIMA U JEDENJU

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Poremećen odnos prema jelu u sklopu poremećaja u jedenju rezultira brojnim promjenama u usnoj šupljini. Cilj ovog istraživanja je bio utvrditi postoji li korelacija između pojavnosti promjena u usnoj šupljini, dobi, duljine trajanja poremećaja te stupnja uhranjenosti u pedijatrijskih bolesnika s poremećajima u jedenju. U istraživanju je sudjelovalo 50 bolesnica s poremećajem u jedenju prosječne dobi od 14 (raspon 10-18) godina i prosječnog trajanja bolesti od 9 (raspon 1-14) mjeseci. Stupanj uhranjenosti izražen je standardnom devijacijom indeksa tjelesne mase (ITM z-vrijednost). Srednja ITM z-vrijednost bila je -2,10±1,64. Najčešće promjene u usnoj šupljini bile su zubni plak, marginalni gingivitis, morsikacije, kamenac, karijes, eritem farinksa, eksfolijativni heilitis i angularni heilitis. Zubni plak i eritem farinksa bili su povezani s kraćim trajanjem poremećaja (p=0,048; p=0,040), a frikcijska keratoza jezika s duljim trajanjem poremećaja (0,011). Linea alba i bolovi u temporomandibularnom zglobu su bili povezani s mlađom dobi (p=0,012; p=0,024), a impresije zubi na jeziku s nižim stupnjem uhranjenosti (p=0,030). Ovo istraživanje je pokazalo da postoji povezanost između promjena u usnoj šupljini, dobi, trajanja poremećaja i stupnja uhranjenosti, no daljnja istraživanja koja će uspoređivati skupine bolesnika različite dobi, trajanja bolesti i različitog stupnja uhranjenosti dat će bolje, konkretnije i preciznije zaključke.

Ključne riječi: *Poremećaji u jedenju; Oralne manifestacije; Adolescent; Uhranjenost*