

# Oral manifestations of eating disorders in adolescent patients. A review



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## Abstract

**Aim** Eating disorders (ED) are a group of psychopathological disorders that affect the patient's relationship with food and his own body and that are manifested mainly in adolescence and in young-adult age. ED include anorexia nervosa (AN), bulimia nervosa (BN) and other eating disorders as classified in the DMS-V. ED can result in several oral and dental manifestations that often occur in the early stages of ED and may allow early detection. The aim of the study is to describe the different oral and dental manifestations in patients with ED in order to offer a classification for their identification during an extra/intra-oral examination.

**Methods** A search on PubMed, Medline and Cochrane Library data bases has been performed.

**Results** Oral manifestations in ED patients include a variety of signs and symptoms, which involve the oral mucosa and perioral tissues (exfoliative cheilitis, labial erythema, atrophic glossitis, glossodynia, yellow-orange colouration of the soft palate, cheek/lip biting, candidiasis), the teeth (dental erosion, tooth hypersensitivity, dental caries), periodontal diseases, and salivary manifestations (sialadenosis, alterations in salivary flow). The oral signs are caused by a number of factors, including nutritional deficiencies and consequent metabolic changes, poor personal hygiene, altered eating habits and pharmacological therapies. There is a very specific link between oral manifestations and ED in the presence of self-induced vomiting.

**Conclusion** The paediatric dentist may be the first professional to detect the clinical signs thus improving the interception, early diagnosis, characterisation and prognosis of ED. In addition, the oral manifestations of ED can cause alterations of the oral function, discomfort, oral pain, and worsen aesthetics of the face and the quality of life.

**KEYWORDS** Anorexia nervosa; Bulimia nervosa; Eating disorders; Oral manifestations.

## Introduction

Eating disorders (ED), including anorexia nervosa (AN) and bulimia nervosa (BN) are psychiatric diseases, with a multifactorial aetiology, characterised by alterations in dietary behaviour and in the psychosocial sphere, which occur mainly in late adolescence and young adulthood [American Psychiatric Association, 2014]. The underlying causes of ED are still unknown. Genetic, cultural and psychological factors seem to play a determining role in the aetiology of these disorders.

ED prevalence is higher in industrialised countries and is increasing year on year. The incidence of AN is at least 8 new cases per 100,000 people per year among women, while for men incidence is between 0.02 and 1.4 new cases. As regards the BN, there are 12 new cases per 100,000 women per year

and approximately 0.8 new cases per 100,000 men per year [Ministry of Health, Italy, 2013].

Analysing data of ED point prevalence, the weighted means (ranges) are 4.6% (2.0–13.5%) in America, 2.2% (0.2–13.1%) in Europe, and 3.5% (0.6–7.8%) in Asia [Galmiche et al., 2019]. In addition, the National Institute of Mental Health (USA) reports that 2.7% of adolescents aged 13 to 18 years have ED [Merikangas et al., 2010]. For both AN and BN, the age group in which the onset occurs most often is the 15–19 years. Recent clinical observations have indicated an increase in early-onset cases [Ministry of Health, Italy, 2013; Ministry of Health, Italy, 2017].

Among the consequences of ED in the scientific literature several oral and dental manifestations involving the oral mucosa, teeth, periodontium and salivary glands are reported. Often, these signs appear in the early stages of ED and allow an early diagnosis of the disease [Little, 2002; Debate et al., 2006; Misra et al., 2010; Antonelli and Seltzer; 2016; Tolkachjov and Bruce, 2017; Bassiouny, 2017; Panico et al., 2018]. The dentist, especially the paediatric dentist, collecting a complete history, performing a detailed extra/intra-oral examination and interacting with the patient, may be the first professional to detect the clinical signs of ED [Kavitha et al., 2011].

The aim of this work is to provide a complete and detailed classification of the oro-dental manifestations of ED in order to intercept such pathologies earlier.

## Diagnostic criteria of ED

The diagnostic criteria for AN and BN were updated in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) published by the American Psychiatric Association [2014]. Other eating disorders have also been added to DSM-V, including: uncontrolled eating disorder (BED), pica, rumination disorder and avoidance/restriction eating disorder (ARFID). In addition, in the new classification, atypical presentations of eating disorders are included under the name of other specific eating disorder (OSFED) or unspecified eating disorder (UFED), thus eliminating the category of food disorder not otherwise specified. In DSM-V, AN and BN are described as ED. The AN is characterised by deliberate weight loss, induced and sustained by the patient. In addition, AN is subdivided into a restrictive form, in which weight loss is achieved by reducing food intake, prolonged fasting, excessive physical activity and in a purging form characterised by laxative use, diuretics and/or appetite suppressants or induction of vomiting [World Health Organization, 2015].

BN patients have an uncontrollable urge to quickly take on large amounts of food, regardless of the appetite stimulus [World Health Organization, 2015]. The BN is also distinguished in purging and non-purging forms.

## Materials and methods

A bibliographic search on data bases (PubMed, Medline and Cochrane Library) has been performed using the following terms: "oral manifestations of anorexia nervosa", "oral manifestations of bulimia nervosa", "oral manifestations of eating disorders", "oral health and nutrition". Further publications were sought by examining the reference lists of the initial studies identified and other relevant revision documents. Reviews and clinical trials were considered without language restrictions. Oral health studies of ED patients were included, many of which included a control group without ED, combined by age, gender, socioeconomic status and level of education. Studies on subjects with severe mental illness, positive to the diagnosis of alcoholism or substance abuse disorders, with severe intellectual disabilities or other psychological disorders were excluded.

All studies were examined, carefully analysed and compared.

### Oro-dental manifestations of ED

Typical oral manifestations associated with ED include: dental erosion, dental caries, periodontal disorders (gingivitis, periodontitis), salivary adenopathy, hyposalivation/xerostomia, and soft tissue disorders [Frydrych et al., 2005; Lo Russo et al., 2008; Romanos et al., 2012; Panico et al., 2018].

The oral cavity is often one of the first sites to manifest clinical signs of systemic disease and nutritional deficiency for the rapid turnover of epithelial cells in the mucous membranes (3–7 days) compared to the skin (up to 28 days) [Radler and Lister, 2013; Tolkachiov and Bruce, 2017].

Poor oral health and poor periodontal condition are common in patients with AN and BN [Chiba et al., 2019].

The association between oral diseases and ED is particularly evident in cases with frequent self-induced vomiting, regardless of whether the diagnosis is AN or BN [Frydrych et al., 2005; Misra et al., 2010; Johansson et al., 2012; Mehler and Brown, 2015]. Oral signs directly related to vomiting include dental erosion, especially of the palatal surface of the teeth [Frydrych et al., 2005; Romanos et al., 2012] and mucous changes [Lo Russo et al., 2008]. Although the association between the development of caries and the frequency of vomiting is not entirely clear, this determines the exposure of dentine resulting in symptoms of dentine hypersensitivity [Magalhaes et al., 2009; Moazzez and Bartlett, 2014; Giugliano et al., 2018]. According to a case-control study, 94% of subjects with ED had oral manifestations, compared to the control group (18.5%) ( $p<0.0001$ ) [Panico et al., 2018]. The oro-dental manifestations in patients with ED are the following.

#### Dental erosion

Dental erosion is by definition the chemical dissolution of the hard tissues of the tooth (Fig. 1) [Moazzez and Bartlett, 2014]. There are many literature studies that show that dental erosion is the most common and dramatic manifestation of the passage of stomach acid content following vomiting in patients with ED [Hermont et al., 2013; Hermont et al., 2014; Moazzez and Bartlett, 2014; Kisely et al., 2015; Lourenço et al., 2018]. According to a systematic review ED subjects are five times more likely to have dental erosion than healthy controls and the percentage is even higher if vomiting is self-induced [Kisely et al., 2015]. According to clinical studies, 69.7% of ED subjects with self-induced vomiting had dental erosion [Uhlen et al., 2014] and the degree of dental erosion was significantly greater in the ED patients ( $p<0.001$ ) [Garrido-Martínez et al., 2019].

Typical sign of self-induced vomiting is the "Russell's sign", a

callosity present on the back of the hand and fingers caused by traumatisms with the maxillary incisors during the manoeuvres to induce vomiting (Fig. 2) [Misra et al., 2010].

Loss of enamel, observed in these patients, mainly on the palatal surface of the upper teeth was defined by the term "perymolysis" in 1939 by Holst and Lange and is secondary to vomiting, gastric reflux, regurgitation and lack of protective saliva activity [Westmoreland et al., 2016].

AN subjects who do not practice self-induced vomiting as a form of weight loss, but are on a restrictive diet, are certainly less likely to have dental erosion than those with BN, but still have a higher risk of life-time injury than healthy subjects [Hermont et al., 2014]. In addition, even those who have controlled their ED may continue to be at risk of dental erosion, as a gastroesophageal reflux problem may persist over time [Prousky, 2003]. Other factors besides vomiting cause dental erosion such as frequent intake of acidic energy drinks during sports activities or intake of caffeine and/or carbonate-based drinks, in order to counteract hunger and provide energy [O'Sullivan and Curzon, 2000; Lussi et al., 2019; Marqués Martínez et al., 2019]. Frequent intake of such drinks may result in loss of dental substance on the occlusal and vestibular surfaces [Lussi et al., 2019].

It is known that moderate to severe dental erosion can cause dentinal hypersensitivity and a decrease in the vertical dimension of the teeth when it progresses in the posterior sectors [Lo Russo et al., 2008].

#### Dental caries

Studies have shown that carious disease is more frequent in patients with altered nutritional status [Costacurta et al., 2014] and suffering from ED [Jugale et al., 2014; Kisely et al., 2015; Lourenço et al., 2018] and its manifestation is not directly related to self-induction of vomiting [Lo Russo et al., 2008] while others claim that there are no statistically significant differences between anorexic, bulimic and control subjects [LoBuono, 2001; Johansson et al., 2012; Hermont et al., 2013; Garrido-Martínez et al., 2019].

Some authors claim that the increased prevalence is related to the frequent use by ED patients of sugary drinks, sweets and chewing gum in order to appease the constant feeling of hunger [Lo Russo et al., 2008], while others indicate that the risk is greatly increased in those who also have a change in salivary flow [Moazzez and Bartlett, 2014]. Undoubtedly, poor oral hygiene in ED patients, probably also resulting from a psychological component, is a predisposing factor for the onset of carious disease [Regezi et al., 2012].

In cases where ED occurred at a very early age, it could result in a nutritional deficiency. The low intake of essential micro-elements to the physiological histo-morphogenesis of hard dental tissues may have led to an alteration in the mineralisation of teeth with enamel hypoplasia [Sheetal et al., 2013].

#### Periodontal disease

In the studies there is a discrepancy in periodontal changes in patients with ED. In fact, some report a weak association or nothing [Garrido-Martínez et al., 2019]. On the contrary, other authors claim that effects on periodontal tissue in patients suffering from ED are present [Lourenço et al., 2018] and are caused by poor oral hygiene and other factors affecting bacterial composition, host defence mechanisms and tissue repair mechanisms [Prousky, 2003]. Some studies suggest that there are no differences between ED patients and healthy subjects in terms of oral hygiene habits [Lourenço et al., 2018; Garrido-



FIG. 1 Dental erosion.

FIG. 2 Russell's Sign.

FIG. 3 Soft palate trauma for self-induced vomiting.

Martínez et al., 2019]. Contrariwise in others, the ED subjects may show a reduced interest for hygiene practices and poor oral hygiene due to psychopathological /depressive conditions [Lo Russo et al., 2008]. Nutritional deficiencies may induce haematological disorders, in particular anaemia, thrombocytopenia, leukopenia, and neutropenia. These factors can contribute to the onset of periodontal disease. In particular, vitamin C deficiency can create a predisposition to periodontal diseases [Urueña-Palacio et al., 2018; Van der Velden, 2020]. This deficiency, due to a dietary deficiency, can cause a defective collagen synthesis [Lo Russo et al., 2008], which can be associated with spontaneous gingival bleeding, ulceration, dental mobility and increased periodontal infections.

Lack of intake of other micronutrients (e.g. iron, calcium, zinc, selenium, magnesium, copper) may further contribute to alter periodontal health [Prousky, 2003; Sheetal et al., 2013].

#### *Mucosal lesions*

In the literature there are several studies carried out in order to find significant associations between ED and alteration of the mucosa of the oral cavity [Lo Russo et al., 2008; Thomas and Mirowski, 2010; Panico et al., 2018; Garrido-Martínez et al., 2019]. Oral manifestations that occur are mainly caused by nutritional deficiencies and consequent metabolic impairment and are related to both local irritation factors and systemic factors including: long-term vomiting, daily imbalance in oral pH, mechanical and chemical stimulation of the oral mucosa, xerostomia, lack of macro and microelements, as well as anxiety and stress accompanying the disease [Studen-Pavlovich and Elliott, 2001; Lo Russo et al., 2008; Romanos et al., 2012].

The increased incidence of exfoliative cheilitis in ED patients may be related to dehydration and decreased salivary secretion, lack of nutritional micronutrients (including vitamins in groups A and B) for periodic fasting and parafunctions such as stress-related lip biting and emotional factors [Almazrooa et al., 2013]. Garrido-Martínez et al. [2019] show clinical signs of unilateral or bilateral cheilitis in ED patients (over 45%) compared to control group (only 10.8%) ( $p<0.001$ ).

Labial erythema is a more common oral sign in patients with BN than in patients with other ED because of the irritating chemical action of self-induced vomiting. It is seen primarily in the vermillion border of the lips and affects more commonly the lower lip. The magnitude of the affected area and redness are variable, in association with exfoliative cheilitis in severe cases. Observing at higher magnification, this erythema describes a red linear pattern, parallel between them and perpendicular to the major axis of the lip, which offers a "fence or palisading aspect" [Panico et al., 2018]. Garrido-Martínez et al. [2019] showed that the ED subjects presented erythema in the oral mucosa and soft palate and ulcers, compared with healthy control group ( $p<0.001$ ). Vitamin deficiency in group B (B1, B6, B12) in ED subjects may result in atrophic glossitis and glossodynia [Lo Russo et al., 2008]. Moreover, a yellow-orange colouration of the soft palate is easily identifiable in subjects with ED, as in this area the mucosa is thinner and allows a better visualisation of the underlying connective tissue colour. This staining is caused

by carotenemia, an increase in serum carotene level, which is described with high frequency at soft palate level in patients with ED who have a diet rich in carotenoids or who abuse vitamin A analogue supplements [Takita et al., 2006; Panico et al., 2018].

In patients with ED, oral haemorrhagic lesions (petechiae, ecchymosis, haematoma) are produced by a coagulopathy disorder or, more ordinarily, by soft tissue injury (Fig. 3), leading to vessel damage with extravasation of erythrocytes [Silverman et al., 2002]. AN and BN are typically associated with psychological/emotional disorders that include self-harm behaviours, such as cutting or burning the skin, reopening the wounds [Olatunji et al., 2015], rubbing, chronic friction or *morsicatio buccarum* (cheek/lip biting) of the lingual, geniena and labial mucosa surface resulting in the formation of mechanical trauma and frictional keratosis [Regezi et al., 2012].

Oral microflora in ED patients is found to be different in terms of composition, statistically significant when compared to oral microflora in healthy patients; whereas there is no significant difference between AN and BN patients [Back-Brito et al., 2012].

In ED subjects, the presence of candidiasis is common in bacterial microflora [Back-Brito et al., 2012; Tolkachjov and Bruce, 2017]. This could be explained by the acidic environment which would favour the colonisation of fungal species and the high consumption of carbohydrates and sucrose in particular in bulimic subjects [Back-Brito et al., 2012]. In addition, oral candidiasis has also been associated with nutritional deficiencies, particularly in subjects with low levels of iron and other water-soluble vitamins [Tolkachjov and Bruce, 2017].

#### *Alterations of salivary glands and saliva*

ED patients often have scialoadenosis (non-inflammatory enlargement of the salivary glands) on the parotid gland bilaterally (although in rare cases it is observed unilaterally) that occurs 2 to 6 days after the episode of self-induced vomiting. In the early stages of ED swelling may appear and disappear but then becomes more persistent [Studen-Pavlovich and Elliott, 2001; Mignona et al., 2004; Lo Russo et al. 2008]. The scialoadenosis can subsequently affect also the submandibular gland and the minor salivary glands [Studen-Pavlovich and Elliott, 2001; Mignona et al., 2004]. The most probable cause of this enlargement is to be found in an autonomic neuropathy with involvement of the sympathetic nerves that causes an enlargement of the acinar cells due to a stagnation of zymogen granules [Lo Russo et al. 2008].

Cases of necrotizing sialometaplasia (NS-Necrotizing Sialometaplasia) are also reported in the literature as an oral manifestation of ED [Imai and Michizawa, 2013] and predominantly of BN [Solomon et al., 2007]. It manifests with a crater ulcer with irregular margins and histologically presents a necrosis of the glandular berries and a squamous metaplasia of the epithelium of the salivary ducts with an associated inflammatory infiltrate. This state of hypertrophy of the glands could be associated with repeated episodes of binge eating and self-induced vomiting [Solomon et al., 2007].

Xerostomia is a side effect common to many psychotropic, neuroleptic, anti-depressant drugs that can be prescribed for

the treatment of patients with ED [Misra et al., 2010; Scully and Bagan, 2004; Rosten and Newton, 2017]. Several studies agree that subjects with ED show a decrease in salivary flow [Lifante-Oliva et al., 2008; Johansson et al., 2012; Kisely et al., 2015; Lourenço et al. 2018; Garrido-Martínez et al., 2019]. Hyposalivation may also be caused by fluid imbalances due to the excessive use of diuretics and laxatives to prevent weight gain, from persistent vomiting as well as from the lowering of pH at the level of the mucosa surfaces in the palate region and the respective salivary glands.

The decrease in salivary flow, affecting the saliva cleansing capacity and buffering system, could contribute to increase dental erosion and caries.

#### Other oral manifestations

Other oral manifestations related to ED are: feeling of oral burning, taste changes, unexplained oral pain. These manifestations may be independent and unrelated to the oral signs previously analysed and have a psychogenic origin or related to multiple nutritional deficiencies [Misra et al., 2010].

## Conclusion

The dentists could detect oral manifestations of ED in a routine check-up [Bassiouny, 2017; Garrido-Martínez et al., 2019] and set ED patients to a multidisciplinary management, personalised dental care [Bassiouny and Tweddale, 2017] and preventive-therapeutic protocol in order to limit the damage caused by the episodes of frequent vomiting [Lifante-Oliva et al., 2008]. For these reasons the figure of the paediatric dentist is fundamental in the recognition and prevention of oral manifestations associated with ED. Paediatric dentistry plays a major role in the management of these patients as they often meet with these patients much before compared to other health professionals. In fact, secondary prevention of ED, early diagnosis and consequently early intervention are related to a better prognosis, avoiding chronic and worsening of the disease.

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