Research review

Oro-facial manifestations in patients with eating disorders

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Abstract
Studies have reported that the oral health status is jeopardized in patients with eating disorders. The aim was to review the oro-facial manifestations in patients with eating disorders. The address the focused question was “What is the oro-dental health status in patients with eating disorders?” MEDLINE/PubMed and Google Scholar databases were searched from 1948 to March 2012 using the following terms in various combinations: “Anorexia nervosa”, “bulimia nervosa”, “eating disorders”, “dental”, “oral health status”. Letters to the editor, unpublished data and articles published in languages other than English were excluded. Dry lips, burning tongue and parotid gland swelling are common manifestations in patients with eating disorders as compared to medically healthy controls. The association of dental caries and periodontal disease in patients with eating disorders remains debatable. Temporomandibular disorders have also been reported to be more prevalent in patients with eating disorders as compared to healthy controls. The association of dental caries and periodontal disease in patients with eating disorders remains debatable. Temporomandibular disorders have also been reported to be more prevalent in patients with eating disorders as compared to healthy controls. A critical oral-dental examination during routine dental check-ups may reveal valuable information regarding the presence or absence of eating disorders in routine dental patients. This may be important information, updating the medical history, supporting the role of the physician.

Introduction
The most common forms of eating disorders (EDs) include anorexia nervosa (AN) and bulimia nervosa (BN). AN is characterized primarily by malnutrition and food restriction; whereas BN is characterized by binge eating followed by inappropriate compensatory behaviors such as self-induced vomiting, use of laxatives and...
excessive exercise (Johansson, Norring, Unell, & Johansson, 2012; Swinbourne et al., 2012) (Figs. 1 and 2). Within the diagnostic category of AN, the issue of sub-typing based on the presence or absence of binge eating/purging is relevant. The Diagnostic and Statistical Manual of mental disorders, 4th Edition (DSM-IV, American Psychiatric Association, 1994) includes restricting versus binge/purge subtypes of AN. It has been proposed that these subtypes of AN are associated with varying degrees of impulsivity and personality psychopathology (Vitousek & Manke, 1994). EDs not otherwise specified, are a heterogeneous blend of AN- and BN-like EDs (Johansson et al., 2012).

A limited number of studies have reported the prevalence of EDs (Garner & Garfinkel, 1980; Makino, Tsuboi, & Dennerstein, 2004). However, most of these studies focused on single samples selected at local level, or assessed distribution of symptoms using questionnaires rather than personal interviews (Hoek & Van Hoeken, 2003; Miotto, De Coppi, Frezza, & Preti, 2003; Smink, van Hoeken, & Hoek, 2012). Point prevalence of AN has been reported nearly 0.3% in American and European studies (Favaro, Ferrara, & Santonastaso 2004; Hoek & van Hoeken, 2003). In the United States, EDs are a major health issue among children and adolescents of all ethnic groups (Nicholls & Viner, 2005). According to the American Dietetic Association (2001), EDs are dominant among adolescent females with prevalence rates of up to 5%. Lifetime estimated prevalence of AN, BN, binge eating disorder, sub-threshold binge eating disorder and any binge eating have been reported to be 0.48%, 0.51%, 1.12%, 0.72%, and 2.15%, respectively, which were up to eight times higher among females as compared to males with EDs (Preti et al., 2009). The average age of onset of AN and BN has been reported to be between 17.1 and 20.8 years and 17.7 and 21 years, respectively (Beaumont, George, & Smart, 1976; Fairburn & Cooper, 1984). Cultural, genetic and psychiatric factors have been associated with the etiology of EDs (Little, 2002; Mazzeo & Bulik, 2009). All EDs have high morbidity and mortality risks; however, these risks are most striking in patients with AN (Hoek, 2006).

The association between EDs and systemic illnesses (including psychiatric disorders) is well documented (Grilo, White, & Masheb, 2009; Petribu, Ribeiro, Oliveira, et al., 2006); however, the inappropriate compensatory behaviors exhibited by patients with EDs (particularly BN) may also sabotage the oral health status of affected individuals (Johansson et al., 2012). In a recent study, Johansson et al. (2012) compared the oral health status of patients with EDs, with age and gender matched controls. The results demonstrated that dental erosions, dry/cracked lips and burning tongue syndrome were more present in patients with EDs as compared to controls (individuals without EDs) (Johansson et al., 2012). Likewise, signs and symptoms of temporomandibular disorders, such as dizziness, headache, facial pain, jaw tiredness, tongue thrusting and lump feeling in the throat, concentration difficulties and sleep disturbances have also been reported to be more frequent in patients with EDs as compared to controls (Johansson, Johansson, Unell, Norring, & Carlsson, 2010). It has been reported that patients with EDs undergoing dental treatments (under local anesthesia) display greater levels of dental fear and anxiety as compared to those without EDs (Sirin, Yucel, Firat, & Husseinova-Sen, 2011). Individuals with EDs may also be more sensitive to auditory, contact and visual stimuli during dental treatments under local anesthesia as compared to routine dental patients. It is tempting to speculate that dental fear and anxiety in patients with EDs may play a role in worsening their oral health statuses. To our knowledge from indexed literature, there has been a dearth of publications regarding oral health status in patients with EDs.

The aim of the present review was to assess the pertinent literature and provide evidence-based information on the oro-facial manifestations in patients with EDs.
Methods

Rationale and focused question

Since the oral health status is jeopardized in patients with EDs; the addressed focused question was “What is the oro-dental health status in patients with EDs?”

Eligibility criteria

The following eligibility criteria were imposed: (a) individuals with medically diagnosed EDs; (b) use of control individuals (medically healthy individuals) and (c) assessment of oral health in patients with and without EDs. Letters to the editor, historical reviews and unpublished articles were excluded.

Search strategies

As a first step, the authors searched the National Library of Medicine, Washington, DC (MEDLINE-PubMed) and Google-Scholar databases for appropriate articles addressing the focus question. Databases were searched from 1948 up to and including March 2012 using the following terms in different combinations: “anorexia nervosa”, “bulimia nervosa”, “dental”, “eating disorders” and “oral health”. The second step was to hand-search the reference lists of original and review studies that were found to be appropriate in the first step. Titles of research articles containing words suggesting EDs as adjuncts to oro-dental disorders were also sought. After final selection, studies that fulfilled the selection criteria were processed for data extraction.

Since a limited number of studies have investigated the impact of EDs on oro-dental health, the pattern of the present review was customized to primarily summarize the pertinent information.

Oro-dental manifestations of eating disorders

Dental erosion

Dental erosion is defined as the chemical dissolution of dental hard tissues. It is the most common oral manifestation in patients with EDs, who practice self-induced vomiting that causes regurgitation of gastric contents into the oral cavity thereby making them more susceptible to enamel demineralization and erosion (Robb, Cruwys, & Smith, 1991). Factors that may influence the severity of dental erosion in patients with EDs include duration and frequency of purging incidents per day, oral hygiene habits (particularly after a vomiting incident), the degree of acid dilution by means of water rinsing or drinking neutralizing liquids, such as milk and timings of tooth cleaning. A chronic insult of acidic gastric contents from purging may cause erosion of tooth surfaces particularly on the lingual/palatal and occlusal surfaces (Parry, Shaw, Arnaud, & Smith, 1991).

In a recent study, dental erosion was clinically graded using an ordinal scale that assigned a score to each degree of erosion of the maxillary incisors and canines (Johansson et al., 2012). In this study, dental erosion extended into the dentin or close to dentinal exposure and significantly higher in patients with EDs (36%) as compared to healthy individuals (11%) (Johansson et al., 2012).

It is notable that dental erosion associated with EDs differs from that caused by habitual vomiting. An excessive consumption of highly acidic foods may cause erosion of the buccal or facial surfaces of teeth (Milosevic, Brodie, & Slade, 1997). This is particularly manifested in patients with AN who consume excessive raw citrus fruits to maintain their low-calorie diets (Milosevic et al., 1997).

However, in patients with BN (who consume low acid diets) initially exhibit dental erosion on the occlusal and palatal surfaces of maxillary teeth. Other studies have also emphasized that location of enamel demineralization plays an essential role in making a differential diagnosis in patients with EDs (Frydrych, Davies, & McDermott, 2005; Valena & Young, 2002).

Effect on salivary glands and salivary profile

Dry and/or cracked lips, burning sensation in the mouth (particularly on the tongue) and parotid gland swellings have been reported to be significantly more common in patients with EDs as compared to control individuals (Johansson et al., 2012). This reflects a negative effect on the salivary glands, possibly caused by frequent vomiting or starvation that resulted in hypo-salivation. Enlargement in front of the ear and at the anatomical region of the parotid gland is and occasionally the submandibular gland is a well-recognized sequitur in patients with BN (Buchanan & Fortune, 1994; Johansson et al., 2012); however, the secrecy with which patients with BN hide their vomiting habits may complicate diagnosis of BN-associated parotid hypertrophy. It has been reported that salivary stones and reduced resting salivary flow rates are more often observed in patients with BN compared to healthy controls (Riad, Barton, Wilson, Freeman, & Maran, 1991). The incidence of parotid swelling has been estimated to range between 10% and 66% and may be either uni- or bilateral (Coleman, Altini, Naylor, & Richards, 1998; Mandel & Kaynar, 1992). However, controversial results have also been reported (Price, Schmidt, Adam, & Lacey, 2008).

It has been hypothesized that patients with BN may harbor high proportion of acidic organisms in the saliva due to acid regurgitation (Bretz, Krahn, Drewnowski, & Loesehe, 1989). High prevalence of salivary microbes including Streptococcus (S.) mutans, S. sobrinus, Lactobacilli and yeasts have been reported in patients with BN than those without BN (Bretz et al., 1989). An increased salivary colonization of S. sobrinus may be a marker for a history of vomiting in patients with BN.

Dental caries

A number of studies have investigated the association between dental caries and EDs (Bretz et al., 1989; Johansson et al., 2012; Ohrn, Enzell, & Angmar-Mansson, 1999). It has been demonstrated that the frequency distribution of aciduric microbes (including S. mutans, Lactobacilli and yeasts) were significantly higher in patients with BN and compared to medically healthy individuals with dental caries (Bretz et al., 1989). It has been reported that most people with EDs consume high-sugar diets several times daily (Student-Pavlovich & Elliott, 2001), which may in turn provide a source of nourishment to the cariogenic microbes residing in the oral cavity. Simultaneously, the use of anti-depressants by several psychiatric patients may induce xerostomia in these individuals. It is noteworthy that a dry oral environment (coupled with poor oral health maintenance) may allow dental plaque to stagnate on teeth surfaces thereby facilitating the activity and multiplication of cariogenic microbes on fermentable carbohydrates.

Although the issue of dental caries in patients with EDs has been investigated (Crisp, 1967; Hurst, Lacey, & Crisp, 1977; Johansson et al., 2012), the outcomes remain conflicting. Johansson et al., 2012 investigated the dental caries status of patients with by clinically examining the occlusal, buccal, and lingual surfaces of teeth and taking bitewing radiographs for visualizing interproximal caries (Johansson et al., 2012). The results showed no significant differences between the decayed, missing or filled teeth (DMFT) and decayed, missing or filled surfaces counts, among teeth in the test (patients with BN) and control- (individuals without
EDs) groups (Johansson et al., 2012). Similar results have been reported elsewhere (Crisp, 1967; Hurst et al., 1977; Milosevic et al., 1997). A possible explanation in this regard may be extracted from the composition of daily diets consumed by patients with BN. During an eating binge, individuals with BN have been reported to consume fats as well as sugars (Abraham & Beumont, 1982); and studies have shown that consumption of fats, such as in dairy products with regular diets has a protective effect towards dental decay (Harper, Osborn, Clayton, & Hefferren, 1987; Silva, Burgess, Sandham, & Jenkins, 1987). It may therefore be assumed that the fat content of foods consumed during eating binges exerts a protective effect towards dental caries; however, further studies are warranted in this regard.

Periodontal disease

Periodontal disease is characterized by inflammation of the supporting structures of teeth including gingiva, periodontal ligament, root cementum and alveolar bone with poor oral hygiene maintenance (Javed, Altamash, Klinge, root cementum and alveolar bone with poor oral hygiene maintenance (Javed, Altamash, Klinge, & Engström, 2008). Since the prevalence and severity of periodontal disease is directly associated with advancing age (Javed et al., 2007; Javed, Sundin, Altamash, Klinge, & Engström, 2008). Since the prevalence and severity of periodontal disease is directly associated with advancing age (Javed et al., 2007); it is rather an uncommon manifestation in patients with EDs, who are relatively young individuals.

Vitamin deficiency has been reported to jeopardize periodontal health (Alfano, Miller, & Drummond, 1975; Cabrini & Carranza, 1963; Follis, 1948; Hamilton, 1996). Hamilton, 1996). It has been suggested that vitamin-C deficiency in patients with EDs may play a role in eliciting and aggravating periodontal disease in these individuals (Hamilton, 1996). Severe vitamin-C deficiency has been associated with the development of a periodontal syndrome called “scorbutic gingivitis” that is characterized by rapid periodontal pocket development and ulcerative gingivitis. Some studies (Alfano et al., 1975; Cabrini & Carranza, 1963; Follis, 1948) have investigated the mechanisms that may be associated with alterations in the periodontal status in patients with EDs. A histological study (Alfano et al., 1975) showed that vitamin-C deficiency results in lack of collagen formation by affecting hydroxylation of proline and increasing the permeability of endotoxins from the oral mucosa. Other studies have also reported that vitamin-C deficiency is associated with loss of integrity of the periodontal microvasculature, increased permeability of crevicular epithelium to bacterial products and enhanced tissue histamine sensitivity (Alfano et al., 1975; Cabrini & Carranza, 1963; Follis, 1948; Hamilton, 1996). Studies (Goetzl, Wasserman, Gigli, & Austen, 1974; Sandler, Gallin, & Vaughan, 1975) have also reported that vitamin-C deficiency decreases the host immune responses the repressing the motility of polymorphonuclear leukocytes.

Vitamin-D plays an essential role in bone immunity and bone maintenance (Bashutski et al., 2011); therefore, it is tempting to speculate that hypovitaminosis-D (vitamin-D deficiency) in patients with EDs may jeopardize the periodontal apparatus including the alveolar bone. Studies (Haagensen, Feldman, Ringelheim, & Gordon, 2008; Rigotti, Nussbaum, Herzog, & Neer, 1984; Soyka, Grinspoon, Levitsky, Herzog, & Klibanski, 1999) have investigated the association between vitamin-D deficiency and AN. Fonseca et al. (1988) investigated the serum vitamin-D levels in 17 young English patients with AN. In this study, the patients’ daily dietary intake was less that 50 international units and a merely single subject was on vitamin-D supplementation therapy (Fonseca et al., 1988). The study concluded that hypovitaminosis-D is relatively uncommon in patients with AN. Similar results were reported by other studies (Grinspoon, Thomas, Miller, Herzog, & Klibanski, 2002; Kirike et al., 1992). From the most updated indexed literature, there is no clear relationship between EDs (AN and BN) and vitamin-D deficiency.

It is worth mentioning that use regular use of anti-depressant medications (as in patients with psychiatric disorders) may expose the consumer to chronic xerostomia. A dry oral environment particularly in subjects with poor oral hygiene may facilitate stagnation of dental plaque (an adherent deposit of cariogenic and periodontopathogenic microbes) on teeth surfaces thereby inviting periodontal inflammatory conditions. However, the Milosevic study reported similar scores of dental plaque and gingival bleeding indices among individuals with AN and BN (Milosevic et al., 1997).

A recent study from Sweden (Johansson et al., 2012) reported that gingival bleeding is significantly less in patients with EDs as compared to controls, which is in contradiction to earlier reports (Hamilton, 1996; Hurst et al., 1977) that have shown increased gingival inflammation in patients with EDs. Since majority of Swedish children, adolescents and young adults are managed by the Public Dental Health of the country, it may be postulated patients with EDs participating in this study were stricter towards oral hygiene maintenance as compared to healthy controls. This could be an explanation for the reduced gingival bleeding in patients with EDs as compared to healthy controls in a Swedish study (Johansson et al., 2012). It is however notable that the young individuals participating in this study were not inquired about tobacco habits (Johansson et al., 2012). It has been reported that nicotine in tobacco smoke constricts the gingival blood vessels thereby masking the clinical signs of gingival inflammation (bleeding on probing) in tobacco smokers as compared to non-smokers; however, issue remains debatable (Black et al., 2001; Palmer et al., 1999). The fact that some patients with EDs in the Johansson study (Johansson et al., 2012) might be habitual tobacco-smokers that could have provided biased results regarding gingival bleeding cannot be disregarded. Further studies are warranted in this regard.

Disorders of the temporomandibular joint

Temporomandibular disorders (TMDs) refer to several clinical conditions that involve muscles of mastication and temporomandibular joint (TMJ) or both (Keller et al., 2012). Mechanical pressure exerted during frequent episodes of self-triggered vomiting may cause damages similar to those sustained during intubations for general anesthesia, such as dislocation or subluxation of the mandibular condyle/s caused by excessive mouth opening (Keller et al., 2012). To our knowledge from indexed literature, only a few studies have investigated the association between TMDs and EDs. A study assessed the prevalence and symptoms of TMDs between young females with chronic EDs and a group of age-matched healthy women (Emodi-Perlman et al., 2008). The results demonstrated that sensitivity to muscle palpation, prevalence of intense gum chewing and psychological distress were more often observed in females with EDs as compared to their medically healthy counterparts (Emodi-Perlman et al., 2008). In a study, females with and without EDs underwent a comprehensive TMD questionnaire and clinical examination (Johansson et al., 2012). Reported symptoms, such as facial pain, headache, jaw tiredness, tongue thrusting and lump feeling in the throat as well as dizziness and sleep disturbances were significantly more prevalent among females with EDs as compared to controls (Johansson et al., 2010). Chronic teeth clenching and bruxism are common manifestations in patients with psychological disorders (Panek et al., 2012). It is hypothesized that chronic self-induced vomiting coupled with habits, such as bruxism and teeth clenching may further aggravate TMDs in patients with EDs. However, another study reported no association between chronic bruxism and TMDs in patients with EDs (Emodi-Perlman et al., 2008).
Limitations

It is worth mentioning that individuals with EDs usually tend to live their condition in secret, therefore the total number of subjects included in clinical studies is usually limited. This problem becomes much more complicated when the subgroups of ED are included. As a consequence, most of the studies lack sufficient statistical power to prove their hypothesis. Another limitation of the studies used in this review was that there was no standardized criterion (such as the American Psychiatric Association, 1994) used for the categorization of control individuals. It may therefore be hypothesized that there might be further studies (based on power analysis and utilizing diagnostic criteria of the American Psychiatric Association, 1994) are warranted to assess the oral health status in patients with EDs.

Conclusion

In conclusion, dry lips, burning tongue and parotid gland swelling are common manifestations in patients with EDs; however, oral healthcare professionals should be aware that the feature of parotid gland swelling is not consistent and an absence of enlargement does not exclude the presence of a significant vomiting behavior. A critical oral-dental examination during routine dental check-ups may reveal valuable information regarding the presence or absence of EDs in routine dental patients. This may be important information, updating the medical history, supporting the role of the physician.

References
