The Association Between Eating Disorders And Dental Caries: A Systematic Review And Meta-Analysis

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Abstract

Background: Dental and oral health problems are a possibility for patients with eating disorders (EDs). The relationship between EDs and dental outcomes is still not well-understood, and there are still conflicting findings. Our goal in this review is to identify the link between EDs and dental caries (DCs).

Methods: A systematic search was conducted through PubMed, Web of science (ISI), Scopus, and Embase up to August 20, 2024. The meta-analysis included any observational studies that evaluated any associations between EDs with DC using decayed missing filled teeth (DMFT) index and other tooth decay measures. Meta-analysis was performed to estimate pooled effect size for the risk of DC.

Results: The meta-analysis included eight studies that involved 844 participants after assessing eligibility. EDs increased the risk of DMFT index (DCs) in comparison with people with without EDs (0.27; 95% CI: 0.04-0.51). Although the relationship was not significant, the plaque index and dental problems were greater in individuals with EDs than in healthy individuals ($P>0.05$).

Conclusions: DCs are more common among patients with EDs, which should be taken into account during patient evaluations and in the clinical and therapeutic decision-making processes by dentists and psychiatrists. The underlying causes of dental problems in patients are addressed by this approach, which facilitates early detection.

Keywords: oral health, tooth decay, mental disorder, dental erosion.

Introduction

Eating disorders (ED) are severe disorders that are linked to tenacious eating behaviors that negatively impact both psychological and physical health [1]. Approximately 13% of adolescents experience EDs [2]. The summary lifetime and 12-months had a proportion of EDs of 91% and 43%, respectively, according to a recently conducted review [3, 4]. There are two types of eating disorders that are widely recognized; Anorexia Nervosa (AN) and Bulimia Nervosa (BN) [5]. AN's characteristic of limiting energy intake leads to a markedly lower weight compared to sex, age, and physical health. Patients are often prone to gaining or becoming fat, and their body shape and weight can negatively impact their self-assessment [5]. While BN is manifested by repeated incidents of spree eating with a professed without control to eating during these incidents, unfitting compensatory behavior such as nausea, hyperactivity and abolition to avoid weight addition, and excessive impact of body form and weightiness on self-evaluation [1, 6]. Although it can affect both genders at any time of life, ED is a common occurrence for adolescents and young females [6].

Microbial infections are major risk factors for dental and oral health[7]. However, additional risk factors, such as an unhealthy lifestyle that includes smoking and alcohol consumption, as well as metabolic syndrome diabetes mellitus, overweigh, osteoporosis, and deficiencies in vitamin D and calcium levels are important predictors of dental and oral heath [8, 9].

It has been found that patients with EDs, particularly those with AN, have a higher prevalence of decayed missing filled teeth index (DMFT) and dental caries (DC) than healthy individuals. DCs and DMFT in patients with EDs can be caused or exacerbated by inappropriate dietary patterns and excessive brushing after vomiting. [6]. In a study conducted by Shaughnessy et al., gingival recession was found to be 43% and mean DMFT score was 8.6, respectively [10]. It has been found that patients with EDs can be associated with DCs because of biological and behavioral factors, such as life style, and malnutrition [11-13]. The relationship between ED and DC has not been fully understood and remains contradictory [1, 10, 14]. Our aim was to examine the connection between EDs and DC and tooth decay.

Methods

Search strategy

The PRISMA guidelines were used to conduct this review [15, 16]. A systematic search was conducted for PubMed, Web of science (ISI), Scopus, and Embase databases up until February 19, 2025. In addition, we searched for gray literature on Google Scholar and Google free Search. To detect more relevant studies, the reference list of the found related articles was meticulously compiled. No language restrictions were imposed. Tabriz University of Medical Sciences under number 403.218 developed and followed the approved protocol guidelines during the review process.

The study searched any observational studies that evaluated any associations between EDs and dental caries/tooth decay. Medical-related words (Mesh terms) and half-synonyms, synonyms, and idioms were extracted separately from each PI/ECO component using Mesh term. Eating disorders, oral and dental problems, and diseases were among the topics covered in the initial high-sensitivity search. To form a systematic search strategy, Boolean functions, such as AND, OR, and NOT, were used to connect all the keys extracted from the mesh. The search strategy is presented in Appendix 1.

Eligibility

Inclusion criteria

1. Observational studies that have investigated the relationship between EDs and dental adverse outcomes.

2. Studies assessed at least a measure to indicate the association between EDs and dental caries such as DMFT and/or plague index.

Exclusion criteria

1. Studies that have implemented specific therapeutic or preventive interventions on individuals with EDs.

2. Review studies, editorials, and letters to the editor.

3. Animal, laboratory, or molecular studies that have solely examined the role of genes and polymorphisms.

Population

Patients with any eating disorders including AN and BN;

Exposure

Having an eating disorder

Outcomes

The study outcome was dental caries using plague and, decayed missing filled teeth index (DMFT) index.

Data extraction

Two authors (DI and HA) performed data extraction blindly. The extraction of data was done using an Excel sheet. The extracted data include the title of each study, authors, year of publication, country, sample size, study groups, study type, any outcome related to oral health among patients with eating problems including bulimia nervosa and anorexia nervosa. To obtain accurate data or adequate measurements for every outcome, we gathered all the complications related to oral problems and diseases.

Quality and risk of bias assessment

The risk of bias was evaluated using Newcastle-Ottawa Scale [17] for cross-sectional and case control studies. The tool considered the items for risk of bias assessment. 1) Using adequate, random, representativeness, and unbiased sampling methods, the correct data collection instruments, and/or present clinical assessment, adequacy of response rate, unbiased methods using appropriate inclusion and exclusion criteria, and appropriate statistical analysis. Risk of bias assessment was conducted by trained authors for review article.

Each eligible article in the final scoring system was given 11 criteria to rate different risk of bias elements from a total of 12 scores. Scale weights were suggested by the authors for each parameter of the scoring system, with unbiased sampling and data collection methods being given the highest weights, as recommended in other meta-analyses [16, 18]. The study found that there were three levels of bias risk: low risk (9-12 points), moderate risk (5-8 points), and high risk (<unk> 5 points) (**Table 1**).

Statistical analysis

STATA version 14 software was used for data analysis. To estimate the relationship between EDs and the risk of DC, the pooled effect size was estimated with 95% CIs through a random effects model. The effect size was calculated from the original included studies, when there were no measure of associations. The standard mean difference (SMD) was used to estimate and compare the pooled effect size of DMFT score between groups (with and without EDs). I^2 was used for heterogeneity between studies.

Results

Characteristics of the included studies

All together, the search technique found 116,033 records. Due to duplicate screening and overlap between databases, 71,918 studies were excluded from this list. After reviewing the titles and abstracts, a total of 21 full-text articles were included. With the inclusion of 8 articles, the meta-analysis concluded (**Figure 1**).

Baseline characteristics, concise findings, and the risk of bias assessment for the included studies are presented in **Table 1**. Among the eight final records included in the meta-analysis, all of those were case-control except one study. Regarding the quality assessment, the majority of the records (6 of 8) were rated as low risk of bias.

In terms of the publication year, the range of articles was published from 1993 to 2023. Concerning the gender distribution of the study participants, in all the articles comprised in the review, either 100% of the participants were women or the majority of the participants were female patients. Regarding the age range of the participants, most of them were teenagers and young girls, age ranged 24-25 years.

In Table 1, the main findings (conclusions) of the records were presented. Almost all eight eligible studies reported a negative association between EDs and dental caries, specifically assessed by the DMFT index. However, out of eight studies, six studies reported DMFT measurements and three studies have assessed plague index. Therefore, we performed two meta-analysis for DMFT and plague indexes between people with and without EDs.

Meta-analysis

Figure 2 compares the standard mean difference (SMD) of dental plague size among the study groups. In general, the difference in the size of dental plaque in patients with EDs was greater than that in healthy individuals. In other words, the size of dental plaque was larger in people with EDs; with no significant relation (SMD = 0.44; 95% CI: - 0.18 to -1.07).

The SMD of the DMFT scale between patients with EDs and healthy controls was compared by conducting a meta-analysis of 6 studies in Figure 3. Compared to healthy people, those with EDs saw a statistically significant increase in the DMFT scale (SMD = 0.27; 95% CI: 0.04 - 0.51).

Discussion

This review aimed to analysis the associations and adverse dental outcomes among patients with EDs. This meta-analysis was estimated pooled effect size of DMFT and plague index for the association between EDs and dental caries.

The main findings of the present review was the comparison of the DMFT scale among patients with EDs compared to healthy individuals. The current meta-analysis revealed that the DMFT scale is significantly higher in people with EDs, and in almost among all the included studies in this meta-analysis, this index was reported more in patients with EDs. In the study by Shaughnessy et al. in America [10], and the study by Touyz et al. in Australia [19], and the study by Sivolella et al. in Italy, the DMFT scale was reported to be higher in patients with EDs than in healthy individuals. Most of the available published results that have studied the patients with specific diagnoses like BN and AN are described by DMF index and erosion, which have primarily been studied in women [20-22].

EDs and tooth decay have complex pathobiological relationships. Individuals with EDs, particularly anorexia nervosa and bulimia, often experience malnutrition. Deficiencies in essential vitamins and minerals, especially calcium and vitamin D, can weaken teeth and heighten the risk of tooth decay.

EDs can also lead to gingivitis and periodontal disease. These inflammatory conditions can compromise the health of the tissues supporting the teeth and contribute to tooth decay. Changes in oral hygiene behavior: Individuals with EDs may neglect their oral hygiene, failing to brush and floss regularly. Such behaviors can result in plaque buildup and tooth decay. EDs can adversely affect saliva production. Saliva plays a protective role against tooth decay; thus, reduced salivary secretion can elevate the risk of tooth decay. EDs can also alter the pH of the oral environment. For instance, frequent nausea and vomiting, common in some eating disorders, can increase dental erosion and the risk of cavities. Vomiting associated

with eating disorders like bulimia can lead to tooth enamel erosion, as stomach acid damages the structure of the teeth.

Overall, the link between EDs and dental caries involves a combination of nutritional, behavioral, and physiological factors that can exacerbate dental issues. A thorough examination of these associations can assist doctors and dentists in providing more effective strategies to treat and prevent dental damage in these patients.

The findings of this study showed that EDs are clearly related to the oral and dental problems. In the study performed by Martinez et al. in Spain, dental erosion was the frequent oral problem in patients with EDs compared to healthy individuals [23]. The same result was obtained in a case-control study in Poland [24]. Dental erosion is a common and widespread event caused by the source of acids from the external and the existence of acids from inside. However, most of the studies are limited to the group of women, so the comparison of the obtained results is not completely possible. Erosion on the palatal surfaces of the upper incisor teeth and the occlusal surfaces of the lower molar teeth is believed by the literature to be the cause of most cavities. External erosion has an impact on the labial surfaces of incisors and upper posterior teeth. After 6 months of consistent vomiting, visible signs of erosion make the clinical picture of this process distinct [25].

Limitations

This meta-analysis estimated summary measure of associations between EDs and dental caries using DMFT and plague indexes. However, this review had some limitations. The most prevalent adverse effects of eating disorders include dental caries and erosion; however, other complications, such as gingivitis and periodontal disease, may also arise. In this study, we focused solely on dental caries and plaque to conduct a meta-analysis of a specific outcome. This could serve as a foundation for future research.

Conclusion

Findings indicated that EDs was associated with dental caries and tooth decay. Tis meta-analysis showed that the DMFT index in higher among people with EDs in comparison with healthy people. Oral health issues are more prevalent among patients with EDs, which should be taken into account during patient evaluations and in the clinical and therapeutic decision-making processes by dentists and psychiatrists.

Declarations

Ethics approval and consent to participate

This review was approved by "Central Ethics Committee of the Islamic Azad University, Tabriz Branch" (number: IR.IAU.TABRIZ.REC.1403.043). The study protocol was approved in Department of periodontics, School of Dentistry, Tabriz University of Medical Sciences, after critical reviews and addressed revisions to number 403.218.

Consent for publication

Not applicable.

Consent to participate

Not applicable. The current study is a review.

Availability of data and materials

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no conflict of interests.

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Authors' contributions

HA, DI, and AKh developed the original idea and contributed to the protocol development, reviewed the first draft of the manuscript, and interpreted and revised the results. DI, AKh, AF, SMM, contributed to the protocol development, records screening, data extraction, conducted, searched, analyzed, and provided the first draft of the manuscript. All authors reviewed and approved the final draft of the manuscript.

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Clinical trial number: Not applicable.

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Appendix 1:

((((((((((((((((((((Eating Disorders[Title/Abstract]) OR (Feeding[Title/Abstract])) OR (Appetite Disorder[Title/Abstract])) OR (Anorexia Nervosa[Title/Abstract])) OR (Food Intake Disorder[Title/Abstract])) OR (Bulimia Nervosa[Title/Abstract])) OR (Food Addiction[Title/Abstract])) OR (Night Eating Syndrome[Title/Abstract])) OR (Orthorexia Nervosa[Title/Abstract])) OR (Pica[Title/Abstract])) OR (Rumination Syndrome[Title/Abstract])) AND (Periodontal Diseases[Title/Abstract])) OR (Periodontitis[Title/Abstract])) OR (Parodontosis[Title/Abstract])) OR (Pyorrhea Alveolaris[Title/Abstract])) OR (Gingival Diseases[Title/Abstract])) OR (Periodontal Abscess[Title/Abstract])) OR (Tooth Mobility[Title/Abstract])) OR (Gingivitis[Title/Abstract])) OR (Gingival*[Title/Abstract])) OR (Oral Health[Title/Abstract])

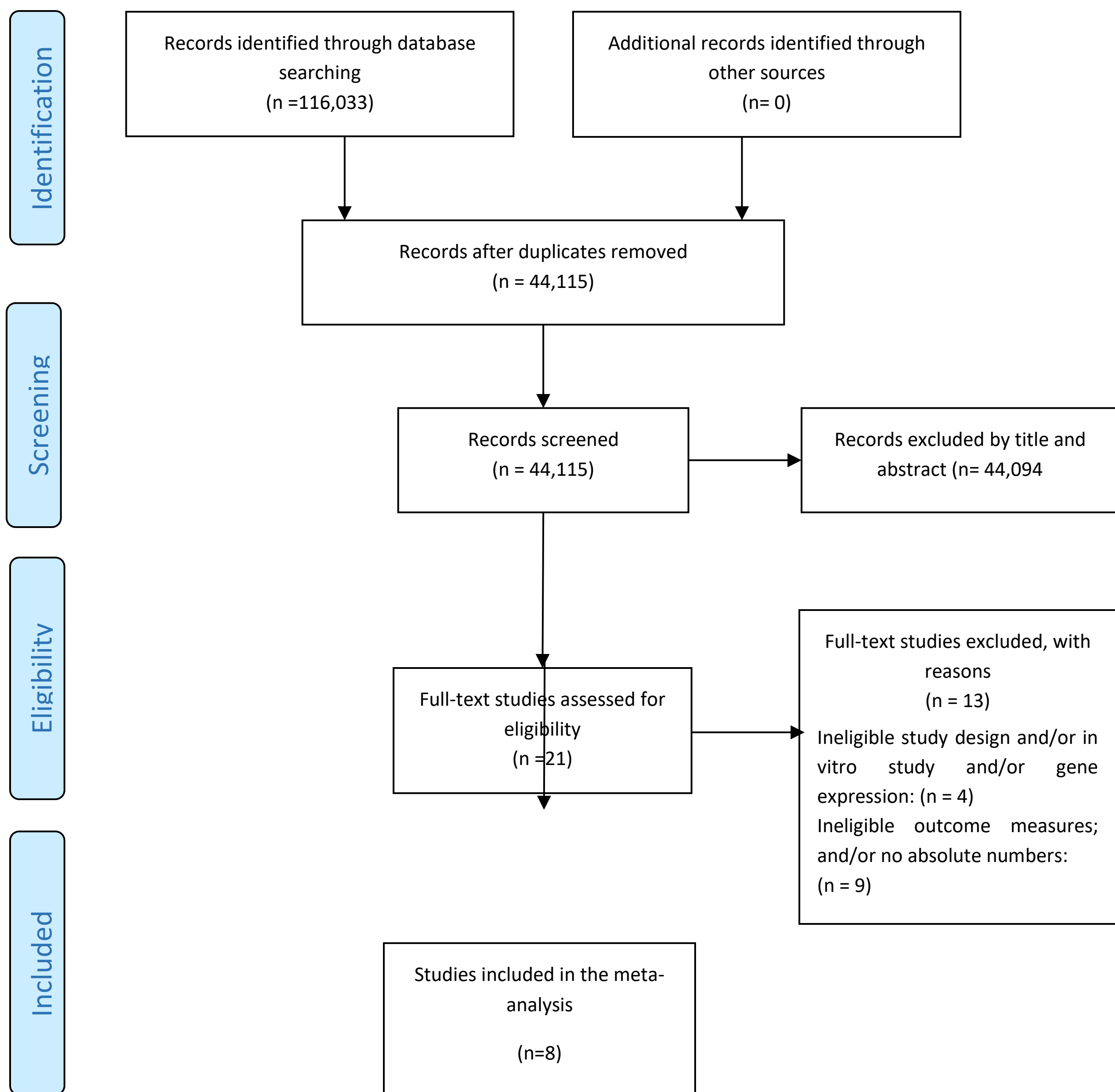

Figure 1) PRISMA flowchart

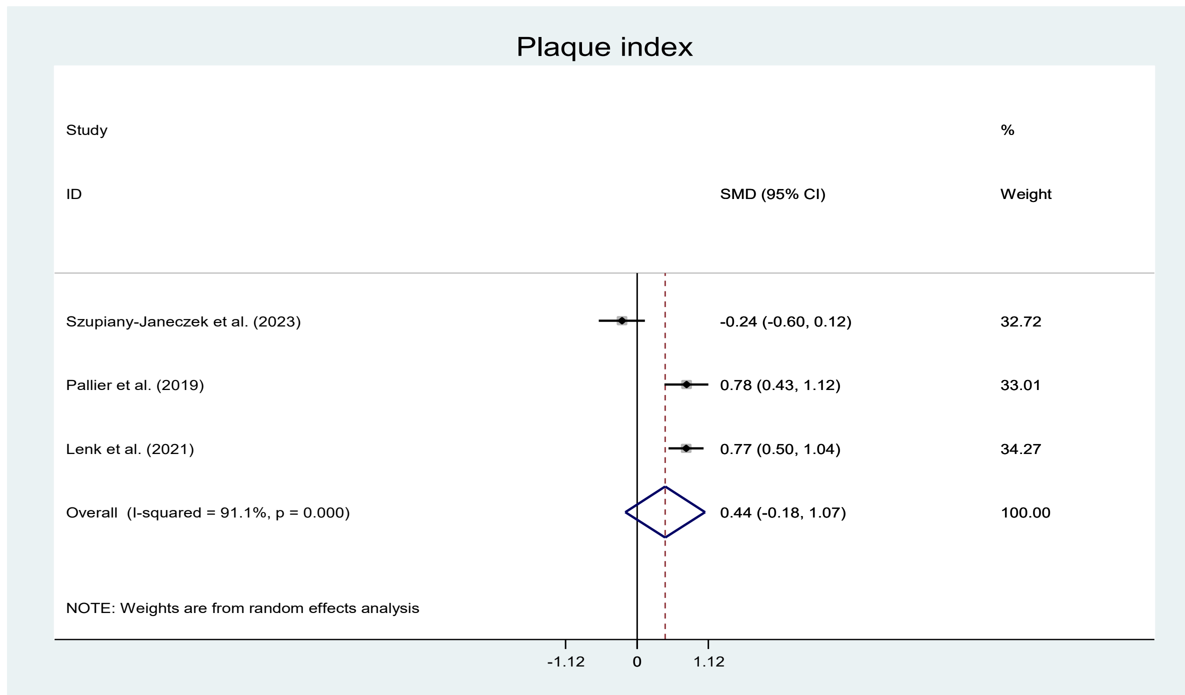

Figure 2) Forest plot of dental plague size among people with and without EDs compared

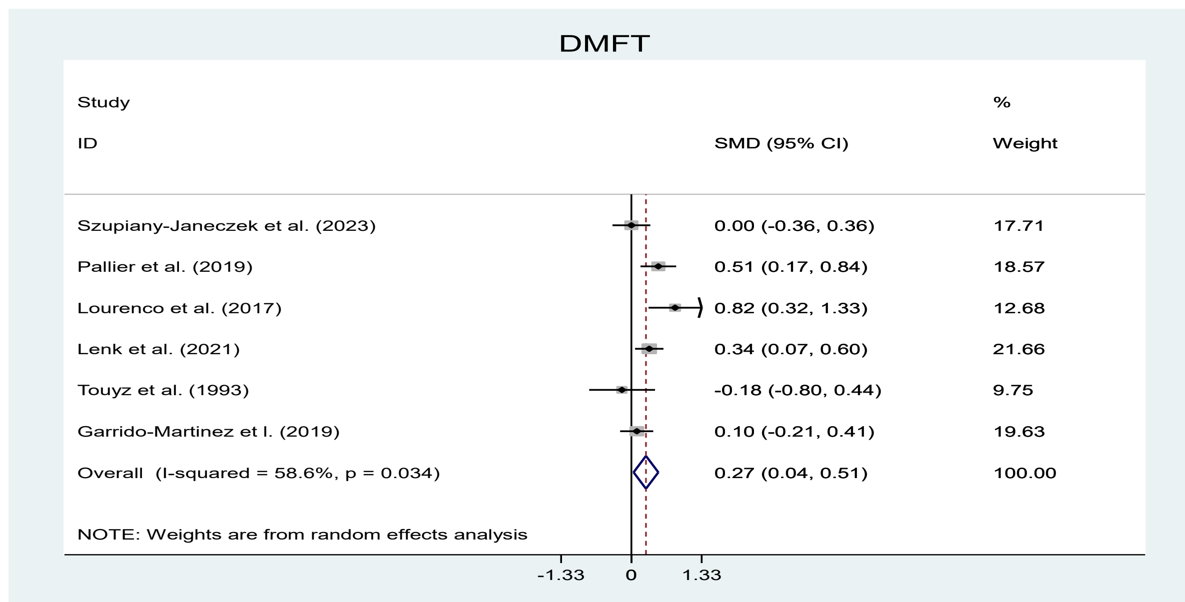

Figure 3) Forest plot comparison of DMFT scale in people with and without EDs

DMFT: decayed missing filled teeth

Table 1) The characteristics of the baseline for the studies included

Authors	Year	Country	Study design	Study groups	Sample size (n=844)	Sex (female %)	Age	Measurements	Main findings	Quality
Szupiany-Janeczek et al.[24]	2023	Poland	Case-control	60 Eds (Bulimia and Anorexia nervosa); 60 controls	120	75 %	31.6	DMF	The level of oral hygiene in patients with EDs was sufficient or bad	Low risk
Pallier et al.[26]	2019	France	matched case-control	70 Eds; 70 matched controls	140	100 %	31.1	DMFT, periodontal, and dental problems	More frequent periodontal and dental problems such as gingival recession, plaque index, and bleeding were observed in patients with EDs	Low risk
Lesar et al.[27]	2022	Croatia	Case-control	50 female ED patients: AN (n=27;54%), BN (n=6; 12%) and EDNOS (n=17; 34%)	50	100 % female	14 (range 10-18)	oral problems	There was a correlation between EDs and oral manifestations	Moderate risk

Shaughnessy et al.[10]	2008	USA	Cross-sectional	adolescents and young women with anorexia nervosa (AN)	23	100 % female	18.5 (2.9)	DMFT, Gingival Index System, Oral Hygiene Index	The proportion of gingival recession and the mean score of DMFT were 43% and 8.6, respectively.	Moderate risk
Lourenco et al.[28]	2017	Portugal	Case-control	Fifty-five women outpatients with AN or BN, and healthy women controls	66	100 % female	25.7 (7.8)	clinical oral examination	Patients with EDs suffered a higher incidence of oral-related complications and an inferior oral health status compared to controls	Low risk
Lenk et al.[29]	2021	Germany.	Case-control	111 patients with periodontitis, and 110 patients without periodontitis	221	59 % female	≥ 40 years	periodontitis and psychopathologic	Dental anxiety showed the greatest association with periodontitis	Low risk
Touyz et al.[19]	1993	Australia.	Case-control	15 AN, 15 BN, and 15 controls	45	100 % female	20.5	DMFT, Community Periodontal Index of Treatment Needs	Patients with EDs with acidic saliva are susceptible to gingivitis and gingival recession compared to control subjects	Low risk
Martinez et al.[23]	2019	Spain	Case-control	59 EDs and 120 controls	179	100 % female	27.6	DMFT, Periodontal Index, and oral health	Dental erosion and soft tissue lesions significant features among EDs	Low risk

DMFT (decayed missing filled Teeth index); EDs (eating disorders); NR (not-reporte)