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The Effect of Bulimic Patients' Oral Condition on Dental Ceramics

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Abstract

Bulimic patients are repeatedly exposed to gastric acid through self-induced vomiting, making them particularly susceptible to dental erosion and degradation of restorative materials. This review examines the effects of the acidic oral environment associated with bulimia nervosa on dental ceramics and summarizes restorative and preventive considerations. Recurrent exposure to gastric acid promotes irreversible loss of enamel and dentin, especially on the palatal surfaces of maxillary anterior teeth, leading to sensitivity, discoloration, altered esthetics, and increased risk of wear and fracture. Acidic conditions may also affect restorative ceramics by increasing surface roughness and micro-porosity, reducing hardness and fracture resistance, and altering translucency and color stability. Lithium disilicate and zirconia-reinforced lithium silicate ceramics demonstrate favorable mechanical and esthetic properties, although their surfaces remain susceptible to acid-induced degradation. Surface polishing and glazing may improve resistance to acidic challenges and help preserve the clinical performance of ceramic restorations. For minimally invasive cases, direct composite restorations can conserve remaining tooth structure, while indirect ceramic or composite restorations may be considered when erosion is extensive. Treatment planning should consider the severity and progression of erosion, the patient's acid exposure, remaining tooth structure, esthetic requirements, and long-term restorative prognosis. Preventive strategies, including patient education, fluoride or remineralizing agents, reduction of acid exposure, and collaboration with mental health professionals, are important components of comprehensive care. Appropriate material selection and surface management, combined with control of the underlying eating disorder, may improve restoration longevity and support oral health and patient well-being. Regular monitoring is recommended to detect recurrent erosion.

Keywords: Bulimic patient, oral environment

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1. Introduction

Bulimia nervosa (BN) is a serious psychiatric eating disorder characterized by recurrent episodes of binge eating followed by inappropriate compensatory behaviors aimed at preventing weight gain. These behaviors most commonly include self-induced vomiting, but may also involve excessive exercise, fasting, or misuse of laxatives and diuretics. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the diagnostic criteria for bulimia nervosa include: (1) repeated binge-eating episodes with a sense of lack of control, (2) recurrent compensatory behaviors, (3) occurrence of these behaviors at least once weekly for three months, and (4) self-evaluation excessively influenced by body shape and weight. Physically, repeated purging leads to systemic complications including electrolyte imbalances, particularly hypokalemia, gastrointestinal disturbances such as reflux and esophagitis, and enlargement of the salivary glands (sialadenosis). Mechanical trauma from induced vomiting may also result in calluses on the dorsum of the hand (Russell's sign). Psychologically, patients commonly experience anxiety, depression, low self-esteem, and a distorted body image. Together, these manifestations contribute to both systemic health risks and oral complications [1-4]. The oral cavity is significantly affected due to repeated exposure to gastric acid (pH ≈ 1–2) [1,2]. The diagnostic features described above are summarized in Figure 1.

Dental erosion is the most characteristic finding and is defined as the irreversible loss of dental hard tissues by chemical processes without bacterial involvement. It predominantly affects the palatal surfaces of maxillary anterior teeth and may extend to posterior occlusal surfaces in advanced cases. This results in enamel demineralization, dentin exposure, increased sensitivity, and compromised esthetics. Salivary flow and buffering capacity are often reduced, further increasing susceptibility to erosion. Soft tissue changes such as mucosal irritation, oropharyngeal lesions, and angular cheilitis may also occur. These conditions complicate restorative treatment by reducing bonding durability and increasing material wear, making the selection of acid-resistant restorative materials essential. Meta-analyses indicate that over 50% of bulimic patients suffer from dental erosion, with bulimics being more than ten times more likely to experience tooth erosion than healthy individuals. The severity of erosion correlates strongly with the duration and frequency of purging behaviors. The erosive lesions can extend from enamel to dentin, causing tooth sensitivity, discoloration, and increased risk of wear and fracture [1,2].

2. Oral Manifestations in Bulimic Patients

- Dental erosion: Irreversible loss of enamel and dentin, predominantly on palatal surfaces of maxillary anterior teeth.
- Sensitivity and esthetic compromise: Exposed dentin increases pain and discoloration.
- Soft tissue changes: Mucosal irritation, angular cheilitis, and oropharyngeal lesions.

Restorative challenges: Reduced bonding durability and increased wear of restorative materials due to acid exposure. In patients with bulimia, selecting appropriate dental materials for restorative treatment is crucial due to severe enamel erosion from gastric acid exposure. The literature suggests that minimally invasive adhesive restorations using direct composite resins are often preferred initially because they preserve the remaining tooth structure and meet the high esthetic demands of typically young patients. Composite resins provide good mechanical properties and excellent esthetics and allow conservative treatment of limited erosive damage [5,6]. For more extensive erosion, indirect restorations such as ceramic or composite veneers offer durable esthetic solutions [5-7,17]. zirconia-reinforced lithium silicate ceramics and lithium disilicate glass ceramics are favored for their strength, esthetics, and relative resistance to acid degradation, making them suitable for bulimic patients who require more long-lasting restorations [7,17]. Ultimately, treatment plans must balance esthetics, conservation of tooth structure, mechanical durability, and patient-specific factors, often combining direct and indirect approaches for optimal functional and aesthetic outcomes. Collaboration with mental health professionals and preventive strategies to manage acid exposure are also recommended to maximize restoration longevity. This multimodal approach is supported by evidence on gastric-acid effects and restorative surface behavior [7,17]. The principal oral manifestations are summarized in Figure 2 and Table 1.

Lithium disilicate ceramics represent a significant advancement in the evolution of dental restorative materials, known for combining exceptional esthetics with high mechanical properties. Introduced commercially in the late 1980s, lithium disilicate glass-ceramics initially gained attention due to their unique microstructure comprising finely distributed needle-shaped lithium disilicate crystals embedded within a glassy matrix. This microstructural arrangement imparts enhanced flexural strength, fracture toughness, and durability compared to earlier glass ceramics, such as leucite-reinforced porcelains [10-14]. At the microstructural level, lithium disilicate ceramics consist predominantly of interlocking rod- or needle-shaped lithium disilicate crystals embedded in a residual glassy matrix. These crystals typically range from approximately 1 to 5 micrometers in length and about 0.5 to 0.8 micrometers in width, depending on the specific formulation and manufacturing process. This characteristic microstructure is created through controlled crystallization of the parent glass during heat treatment, often induced by nucleating agents such as P2O5, which promote uniform crystal growth within the glass matrix. The crystalline phase can constitute around 60-70% of the material volume, with the remaining portion being the amorphous glassy phase

The optical superiority of lithium disilicate is attributable to its microstructure: small, uniformly distributed needle-like crystals within a glassy phase. This configuration minimizes internal scattering and maximizes translucency. Ion leaching and molecular-level changes (e.g., tetragonal-to-monoclinic phase transformations in zirconia counterparts) may produce microdefects that reduce translucency, which lithium disilicate structurally resists more effectively due to its glass ceramic nature [10,14]. Furthermore, exposure to oral erosive agents, including simulated gastric acid, has been shown to preferentially dissolve the glassy matrix component of lithium disilicate surfaces, exposing the crystalline network and increasing roughness and micro-porosity. This selective erosion alters the surface energy and may facilitate plaque retention and discoloration. Polished and glazed surfaces generally demonstrate improved resistance to acid-induced degradation compared to unglazed ones, underscoring the importance of surface treatment in protecting the microstructure and ensuring durable clinical outcomes, especially in patients with acidic oral environments such as bulimics [7,17].

3. Effects of Acidic Exposure on Dental Ceramics

Acidic exposure significantly influences the surface integrity, mechanical properties, and optical characteristics of dental ceramic materials. Several in vitro studies have investigated how exposure to various acidic agents—such as acetic acid, citric acid, gastric acid, and fruit juices—impacts ceramics commonly used in restorative dentistry, including lithium disilicate, zirconia-reinforced lithium silicate, and feldspathic porcelains [7,17-19]. The main oral erosive agents discussed in this section are illustrated in Figure 3.

A) Surface Roughness and Topography

Research consistently demonstrates that acidic environments increase the roughness of dental ceramics. A pivotal study revealed that immersion in 4% acetic acid at elevated temperatures notably increased surface roughness across multiple ceramic types, with some materials (e.g., Vitadur Alpha) exhibiting more pronounced roughening. The mechanisms involve selective leaching of alkali ions and degradation of the silicate glassy matrix, leading to surface layer dissolution and topographical changes visible under scanning electron microscopy. Even mildly acidic agents like fruit juices cause measurable roughening, albeit less than stronger acids

B) Mechanical Properties

Acidic exposure not only alters surface topography but also reduces ceramics' mechanical resilience. Studies on lithium silicate-based ceramics note significant decreases in hardness and fracture toughness in acidic conditions, especially at lower pH values (around 5.8 or lower). This degradation compromises the material's structural integrity, increasing susceptibility to crack propagation and failure during clinical function [40].

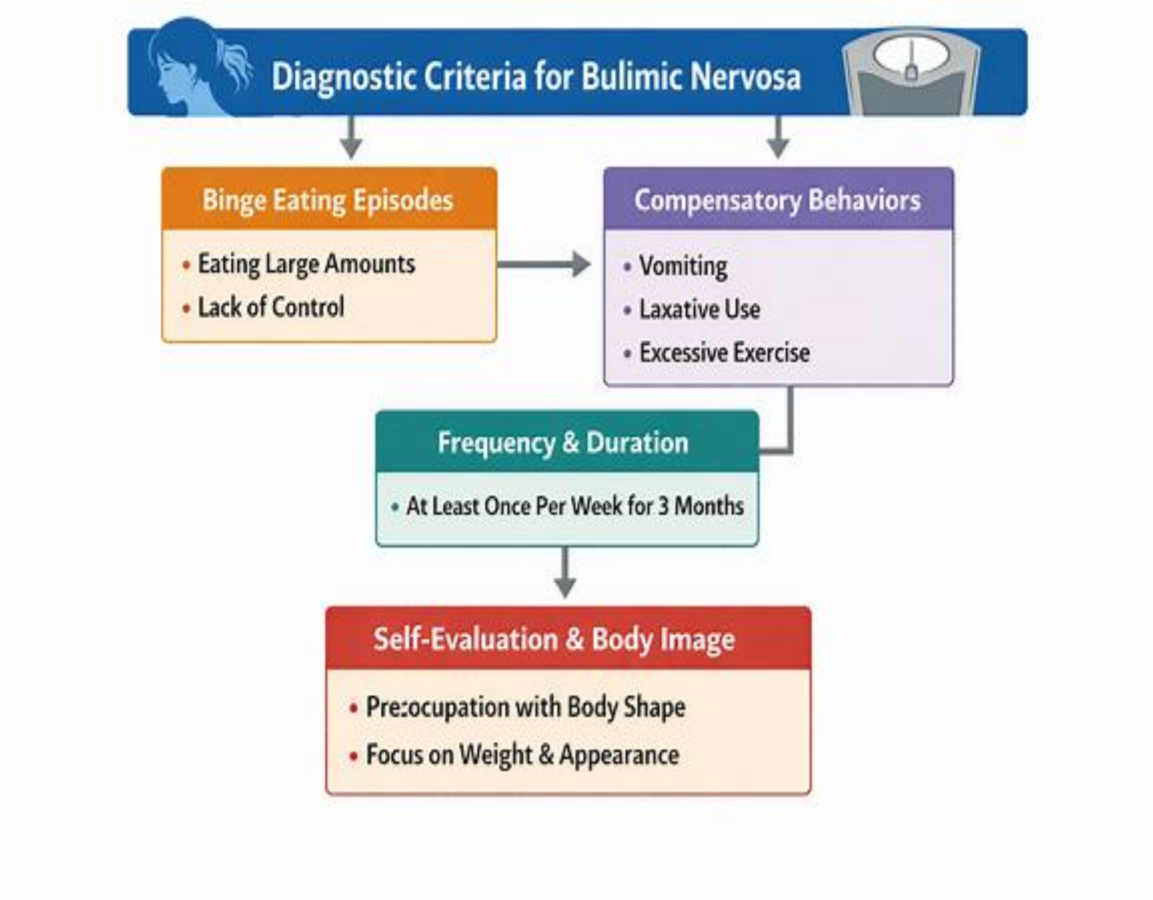

Figure 1: Diagnostic criteria for bulimic patient

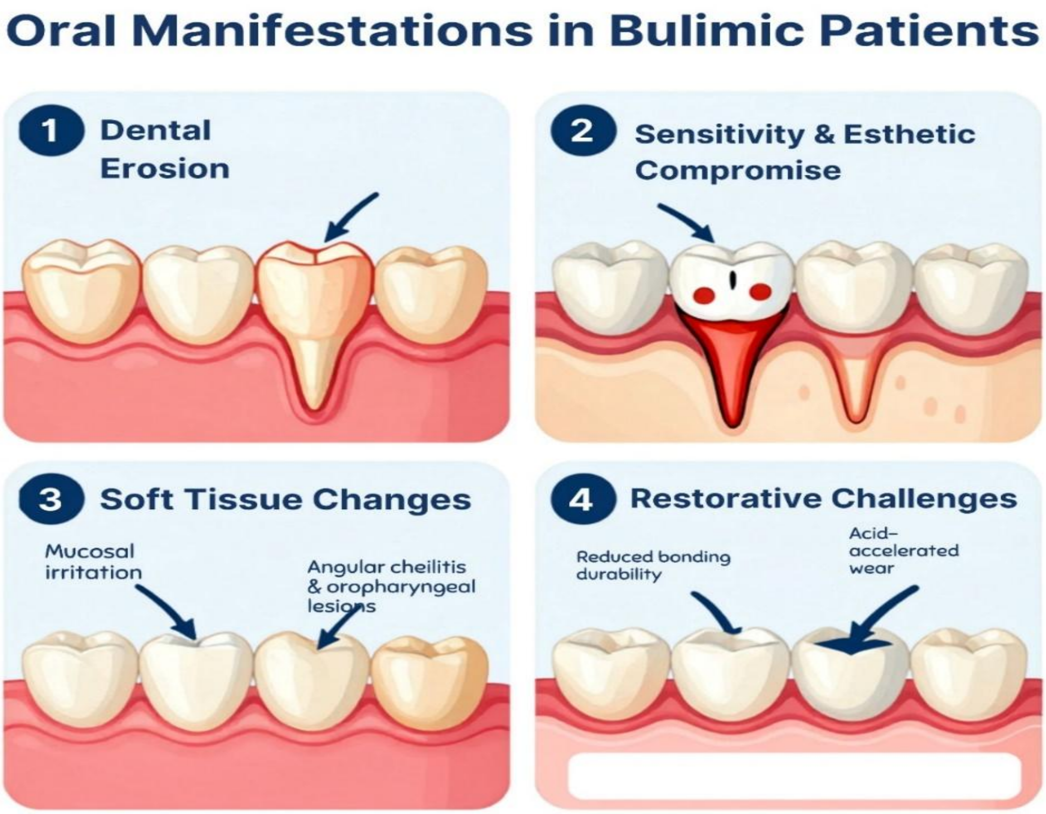

Figure 2: Oral Manifestations in Bulimic Patients

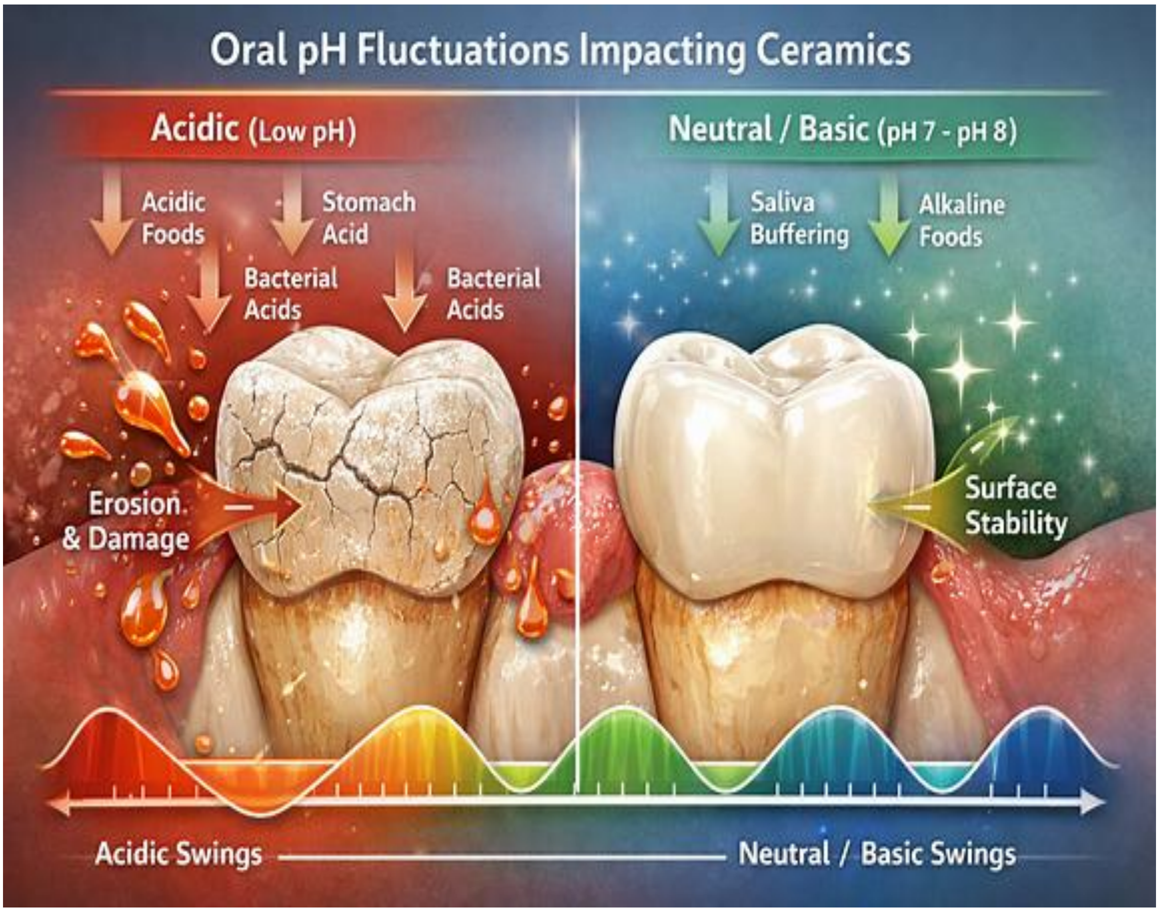

Figure 3: Exposure to oral erosive agents

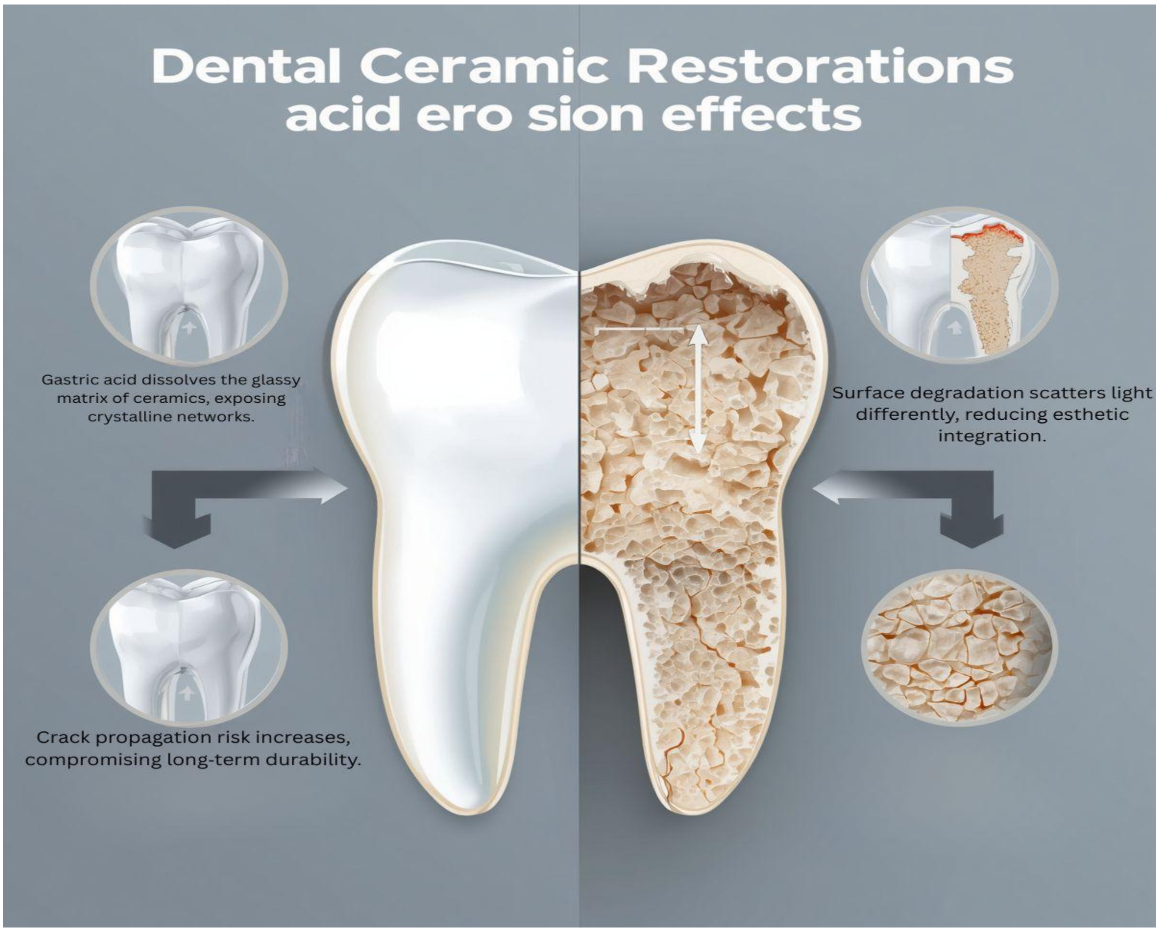

Figure 4: Effect of Erosion on dental ceramic

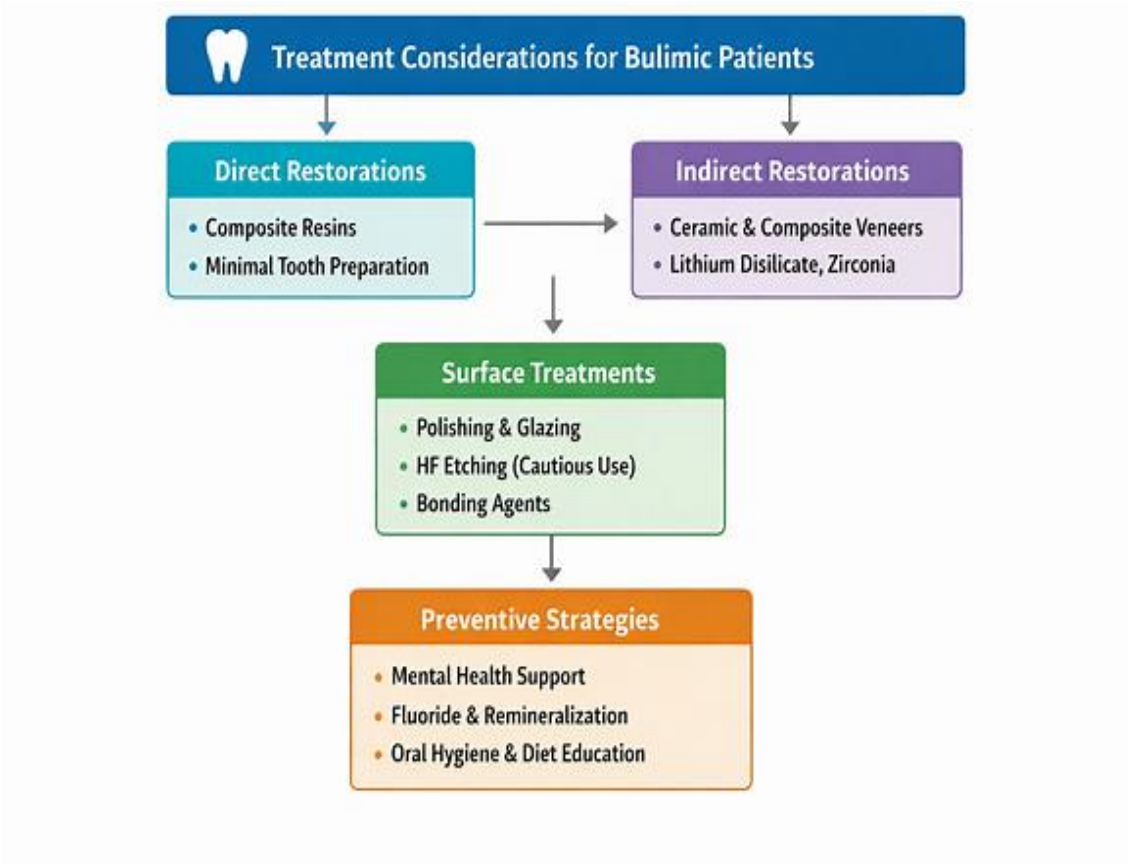

Figure 5: Treatment Considerations for Bulimic Patients

Table 1: Oral Manifestations in Bulimic Patients

Manifestation	Description
Dental erosion	Irreversible loss of enamel and dentin, mainly on palatal surfaces of maxillary anterior teeth
Sensitivity & esthetic issues	Exposed dentin → pain, discoloration, compromised esthetics
Soft tissue changes	Mucosal irritation, angular cheilitis, oropharyngeal lesions
Restorative challenges	Reduced bonding durability, increased wear of restorative materials due to acid exposure

Table 2: Treatment Considerations for Bulimic Patients

Aspect	Details
Direct restorations	Composite resins for minimally invasive cases; preserve tooth structure, good esthetics
Indirect restorations	Ceramic/composite veneers for extensive erosion; lithium disilicate and zirconia-reinforced ceramics preferred
Surface treatments	Polishing & glazing improve acid resistance; careful use of HF etching; silane coupling agents enhance bonding
Preventive strategies	Collaboration with mental health professionals; fluoride/remineralizing agents; patient education on hygiene & diet

C) Optical Properties and Color Stability

Acidic challenges affect the color and translucency of dental ceramics, which could compromise esthetic outcomes. While some ceramics maintain color stability under mild acidic exposure, stronger or prolonged acid contact can cause perceptible color changes and translucency loss over time. For example, gastric acid simulation studies show that translucency parameters decline gradually during extended acid immersion, often exceeding clinically acceptable thresholds after several years of simulated exposure. Other studies report that acidic degradation exposes roughened surfaces that scatter light differently, thus changing the optical appearance [18,21]. The oral environment's intrinsic pH fluctuations—from dietary acids, gastric reflux, or biofilm metabolism—pose continuous challenges to ceramic restorations. The evidence indicates that patients with high acidic exposures or erosion risk may experience faster deterioration of ceramic restorations in terms of surface quality, strength, and esthetics. Therefore, material selection and protective strategies in these patients are critical. Some newer ceramics like zirconia-reinforced lithium silicates show comparatively better resistance to acid-induced degradation, suggesting material composition profoundly impacts longevity.

4. Clinical Considerations Treatment considerations are summarized in Figure 5 and Table 2.

- ***Material Selection***
  - Direct composite resins for minimally invasive cases.
  - Lithium disilicate ceramics for esthetic anterior restorations.
  - Zirconia-reinforced ceramics for severe acid exposure cases.
- ***Surface Treatments***
  - Polishing and glazing improve acid resistance.
  - Hydrofluoric acid etching enhances bonding but risks microstructural damage if overused.
  - Silane coupling agents improve chemical adhesion to resin cements.
- ***Preventive Strategies***
  - Collaboration with mental health professionals.
  - Use of protective agents (fluoride, remineralizing solutions).
  - Patient education on hygiene and diet to minimize acid exposure.

5. Conclusion

Bulimic patients present a unique restorative challenge due to severe enamel erosion and acidic oral conditions. Dental ceramics, particularly lithium disilicate and zirconia-reinforced variants, offer promising esthetic and mechanical outcomes but remain vulnerable to acid-induced degradation. A multimodal approach—combining careful material selection, preventive strategies, and psychological support—is essential to ensure restoration longevity and patient well-being.

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