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PREVALENCE OF DENTAL EROSION AMONG PATIENTS WITH GASTROESOPHAGEAL REFLUX DISEASE

Original Research

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ABSTRACT

Background: Dental erosion, the progressive loss of tooth structure due to non-bacterial acid exposure, has been increasingly associated with gastroesophageal reflux disease (GERD). GERD, characterized by chronic gastric acid regurgitation, can lead to oral acid exposure, thereby contributing to dental erosion. The extent of this association remains underexplored in the local context.

Objective: To assess the prevalence and severity of dental erosion in patients diagnosed with GERD using a validated clinical index.

Methods: This cross-sectional study was conducted over eight months in Lahore, Pakistan, involving 196 participants equally divided into GERD and control groups. Dental erosion was assessed using the Basic Erosive Wear Examination (BEWE) index by calibrated examiners. Data on age, gender, body mass index (BMI), and PPI use were collected. Statistical analysis was performed using SPSS version 26, with significance set at $p < 0.05$.

Results: The prevalence of dental erosion was significantly higher in the GERD group (77.6%) compared to controls (28.6%) ($p < 0.001$). The GERD group showed a mean BEWE score of 9.4 ± 2.1, indicating high severity, while the control group averaged 3.2 ± 1.7. High-risk BEWE classification (≥9) was observed in 66.3% of GERD patients versus only 10.2% of controls. Differences in anterior and posterior erosion scores were also statistically significant between groups.

Conclusion: GERD is strongly associated with increased prevalence and severity of dental erosion. These findings highlight the importance of interdisciplinary collaboration for early detection and prevention of erosion-related oral complications in GERD patients.

Keywords: Body Mass Index, Dental Erosion, Gastroesophageal Reflux, Oral Health, Prevalence, Proton Pump Inhibitors, Risk Assessment.

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INTRODUCTION

Dental erosion, a progressive and irreversible loss of dental hard tissue by chemical processes not involving bacterial action, has emerged as a significant oral health concern in recent decades. Its multifactorial etiology includes both extrinsic acids, such as those from dietary sources, and intrinsic acids, notably those resulting from gastroesophageal reflux disease (GERD) (1). GERD, a chronic condition characterized by the backward flow of gastric contents into the esophagus, is increasingly recognized for its impact beyond the esophagus, particularly in the oral cavity where its acidic nature can directly erode dental enamel (2). Despite extensive gastrointestinal literature on GERD, its dental implications remain underrecognized, necessitating deeper investigation into its role as a causative factor in dental erosion. GERD affects a substantial proportion of the global population, with estimates suggesting a prevalence of 10–20% in the Western world. Reflux episodes can reach the oral cavity, introducing gastric acid with a pH as low as 1.5, well below the critical threshold of 5.5 required to initiate enamel dissolution (3,4). This repeated exposure to acid, particularly when compounded by other factors like reduced salivary flow, inadequate buffering capacity, and poor oral hygiene, accelerates the process of dental erosion. Clinical observations and emerging studies have suggested a positive correlation between GERD and dental erosion, with GERD patients exhibiting a higher prevalence and greater severity of erosive lesions compared to healthy individuals (5-7).

Multiple cross-sectional and observational studies support the notion that GERD is a significant risk factor for dental erosion. For example, a hospital-based study conducted in India reported that 95.6% of GERD patients demonstrated signs of dental erosion, a figure significantly higher than that of controls (8). Similarly, a study found that the prevalence of dental erosion among GERD patients (22.6%) far exceeded that among suspected or healthy individuals (9). Another investigation in Mexico revealed that nearly 79% of GERD patients had some degree of dental erosion, with a direct correlation noted between the severity of reflux and the extent of erosion (10). While the relationship between GERD and dental erosion appears well-supported, variations in diagnostic criteria, erosion indices, and reflux assessment methods introduce heterogeneity in findings across studies. Nevertheless, several comprehensive reviews and meta-analyses have attempted to consolidate this data. A meta-analysis concluded that the prevalence of dental erosion in GERD patients is approximately 51.5%, significantly higher than the 21.3% seen in non-GERD controls, with GERD patients five times more likely to develop erosion (11). Beyond epidemiology, the clinical manifestation of GERD-related dental erosion often presents with characteristic lesion patterns, predominantly affecting the palatal surfaces of maxillary anterior teeth. This localization supports the hypothesis of direct acid contact during reflux episodes. The severity of erosions may be further influenced by the frequency and duration of acid exposure, salivary composition, dietary habits, and concurrent systemic conditions. For instance, studies have reported that patients with both GERD and comorbidities like asthma or diabetes are at increased risk, possibly due to polypharmacy or altered salivary profiles (12,13).

Although dentists are often the first to observe early signs of erosion, GERD as a contributing factor may go undiagnosed unless carefully investigated. This underscores the importance of multidisciplinary collaboration, where dental professionals play a pivotal role in early detection and referral for gastrointestinal evaluation. Furthermore, the establishment of dental erosion as an extraesophageal manifestation of GERD reinforces the necessity of its inclusion in diagnostic and management protocols (14). Despite a growing body of evidence, gaps remain in understanding the precise pathophysiological mechanisms linking GERD to dental erosion and in standardizing diagnostic and preventive strategies. Cultural, dietary, and genetic factors also appear to modulate this relationship, suggesting the need for region-specific studies to tailor interventions effectively (15). Given these considerations, this study seeks to systematically evaluate the prevalence and severity of dental erosion in individuals diagnosed with GERD. By focusing on a cross-sectional population, it aims to shed light on the extent of this often-overlooked manifestation, ultimately supporting more holistic care approaches for patients living with GERD. The objective is therefore to assess the prevalence and severity of dental erosion in GERD patients, identifying possible patterns and risk factors that could inform preventive dental and medical strategies.

METHODS

This cross-sectional study was conducted over a period of eight months in Lahore, Pakistan, at the outpatient departments of gastroenterology and dental units of two tertiary care hospitals. The research was designed to assess the prevalence and severity of dental

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erosion in adult patients clinically diagnosed with gastroesophageal reflux disease (GERD). The study population comprised patients referred for endoscopy or previously diagnosed with GERD by gastroenterologists, as well as age- and sex-matched controls who had no symptoms or clinical history suggestive of GERD. A calculated sample size of 196 participants was determined using a 95% confidence interval, 5% margin of error, and an estimated prevalence of dental erosion in GERD patients of 50%, based on prior literature, to ensure adequate statistical power. A 1:1 ratio of GERD patients to healthy controls was maintained, resulting in 98 participants in each group. Participants aged between 18 and 60 years were included if they had a confirmed diagnosis of GERD, verified by either endoscopy or clinical criteria based on the Montreal definition of GERD. Individuals with a history of frequent vomiting due to non-GERD conditions (e.g., eating disorders or pregnancy), history of radiation therapy, or ongoing use of medications known to impact salivary flow or oral pH (e.g., anticholinergics, cytotoxic drugs) were excluded (5). Additionally, patients with structural dental abnormalities unrelated to erosion (e.g., amelogenesis imperfecta) were also excluded to avoid confounding the dental assessment. After obtaining informed consent, each participant underwent a thorough dental examination conducted by two calibrated dental professionals blinded to the participants' GERD status. Dental erosion was evaluated using the Basic Erosive Wear Examination (BEWE) index, a validated and widely accepted scoring system for assessing the severity and extent of erosive tooth wear. Each sextant of the dentition was scored from 0 to 3 based on the severity of erosion, and cumulative BEWE scores were used to classify participants into risk groups: low (BEWE 0–2), medium (3–8), and high risk (≥9). Calibration of examiners was performed prior to the study to ensure consistency and minimize inter-observer variability, with a Cohen's kappa value of 0.87 indicating strong agreement.

Data on potential confounding variables such as dietary habits (including frequency of acidic beverage and citrus intake), oral hygiene practices, systemic comorbidities (e.g., diabetes), and salivary flow status were collected via a structured questionnaire administered during face-to-face interviews. Additional information regarding GERD severity, duration of symptoms, and use of proton pump inhibitors (PPIs) was obtained through patient records and clinical interviews. To ensure data integrity and consistency, all collected information was entered into a secured digital database with double-entry validation. Statistical analysis was performed using IBM SPSS Statistics version 26. The primary outcome variables were the prevalence and severity of dental erosion, measured via BEWE index scores. Data distribution was assessed for normality using the Shapiro-Wilk test and visual inspection of histograms and Q-Q plots. As the data were normally distributed, parametric tests were applied. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. The prevalence of dental erosion in GERD and control groups was compared using the Chi-square test. Independent sample t-tests were applied to compare mean BEWE scores between groups. Multivariate linear regression analysis was employed to adjust for potential confounding variables, including age, gender, dietary acidity exposure, and oral hygiene status, in assessing the association between GERD and dental erosion severity. A p-value of less than 0.05 was considered statistically significant. Ethical approval for this study was obtained from the Institutional Review Board (IRB) of relevant institute. All participants provided written informed consent prior to their inclusion in the study. The study was conducted in accordance with the ethical standards of the Declaration of Helsinki and adhered to all relevant national guidelines for research involving human subjects. This detailed methodological approach aimed to provide accurate, reproducible findings on the relationship between GERD and dental erosion. The integration of validated clinical indices, controlled assessment of confounding variables, and robust statistical analysis collectively ensured that the study findings could reliably contribute to the growing body of evidence linking gastrointestinal disorders with oral health outcomes.

RESULTS

The study included 196 participants, evenly divided into a GERD group and a control group. The mean age of participants in the GERD group was 42.3 ± 10.7 years, closely matching the control group at 41.8 ± 9.9 years. The gender distribution was comparable, with 47 males and 51 females in the GERD group, and 45 males and 53 females in the control group. The body mass index (BMI) was slightly higher in the GERD group (26.5 ± 3.4 kg/m²) than in the control group (25.9 ± 3.2 kg/m²). Notably, the use of proton pump inhibitors (PPIs) was reported by 89.8% of GERD patients, compared to just 5.1% in the control population. Dental erosion was significantly more prevalent in the GERD group, affecting 76 participants (77.6%), compared to 28 participants (28.6%) in the control group. The difference in prevalence between the groups was statistically significant ($p < 0.001$). This finding underscores a markedly higher occurrence of erosion among those with clinically diagnosed GERD. Analysis of BEWE scores revealed substantial differences in the severity of dental erosion. The GERD group exhibited a higher mean total BEWE score of 9.4 ± 2.1, while the control group averaged 3.2 ± 1.7. Anterior teeth in GERD patients had a mean score of 3.8 ± 1.0 compared to 1.2 ± 0.6 in controls, and posterior teeth scored 5.6 ± 1.3 in GERD versus 2.0 ± 0.9 in the control group. These differences were statistically significant across all regions assessed ($p < 0.001$). Risk

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categorization based on BEWE total scores further differentiated the two groups. Among GERD patients, 66.3% (n=65) were classified into the high-risk category (BEWE ≥9), while only 10.2% (n=10) of control subjects fell into the same category. Conversely, the majority of controls (38.8%) were in the low-risk range (BEWE 0–2), compared to only 4.1% (n=4) of GERD patients. The medium-risk category (BEWE 3–8) included 29 GERD participants (29.6%) and 50 controls (51.0%). These results, as visualized in the bar charts, indicate a strong and consistent pattern of elevated dental erosion prevalence and severity in individuals with GERD. The quantitative differences in BEWE scores and risk classifications provide compelling evidence for a meaningful association between gastroesophageal reflux disease and the development of erosive dental lesions.

Table 1: Demographics

Variable	GERD Group (n=98)	Control Group (n=98)
Age (years)	42.3 ± 10.7	41.8 ± 9.9
Gender		
Male	47	45
Female	51	53
BMI (kg/m²)	26.5 ± 3.4	25.9 ± 3.2
PPI Use (%)	88 (89.8%)	5 (5.1%)

Table 2: Prevalence of Dental Erosion

Dental Erosion	GERD Group (n=98)	Control Group (n=98)
Present	76	28
Absent	22	70

Table 3: Mean BEWE Scores

BEWE Score (Mean ± SD)	GERD Group	Control Group
Total Score	9.4 ± 2.1	3.2 ± 1.7
Anterior Teeth	3.8 ± 1.0	1.2 ± 0.6
Posterior Teeth	5.6 ± 1.3	2.0 ± 0.9

Table 4: BEWE Risk Categories

Risk Level	GERD Group (n=98)	Control Group (n=98)
Low (0–2)	4	38
Medium (3–8)	29	50
High (≥9)	65	10

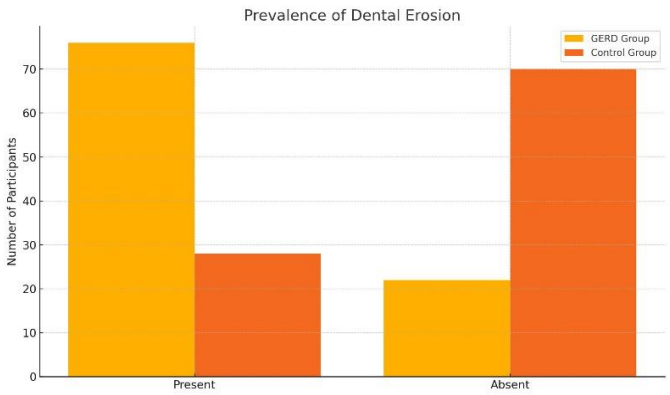


Figure 2 Prevalence of Dental Erosion

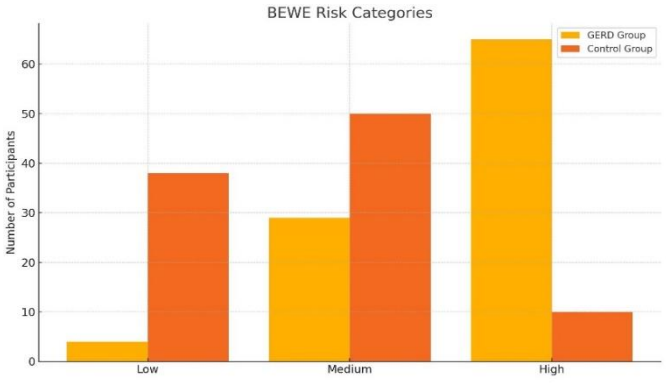


Figure 2 BEWE Risk Categories

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DISCUSSION

The present study demonstrated a significantly higher prevalence and severity of dental erosion in patients with gastroesophageal reflux disease (GERD) compared to healthy controls, corroborating findings from a growing body of international literature. Using the Basic Erosive Wear Examination (BEWE) index, the current analysis revealed that more than three-quarters of GERD patients exhibited erosion, and over two-thirds fell into the high-risk category for erosive wear. These outcomes reinforce GERD's role as a key intrinsic factor contributing to non-carious dental tissue loss. Recent global studies provide consistent support for these observations. A large-scale meta-analysis reported a pooled dental erosion prevalence of 51.5% among GERD patients compared to 21.3% in controls, and found a fivefold increase in the odds of erosion in GERD populations (13). Similarly, a local hospital-based study in Pakistan identified dental erosion in 34% of GERD patients, emphasizing the condition's clinical relevance in South Asian settings (14). This study's findings of 77.6% prevalence are higher, likely reflecting the inclusion of confirmed GERD cases with consistent symptomatology and high PPI use, which might be indicative of more advanced disease stages. The strong association between GERD and erosion severity aligns with reports of elevated salivary pepsin concentrations in GERD patients and subsequent acid-mediated demineralization of enamel surfaces (15). The predilection for erosion on palatal surfaces of maxillary anterior teeth, noted in this and prior studies, reflects the direct exposure of these areas to gastric contents during nocturnal reflux events (16). While this study effectively isolated GERD as a risk factor by matching controls on age and sex and excluding participants with other known intrinsic or extrinsic erosive contributors, the complex etiology of dental erosion warrants careful consideration. Factors such as dietary habits, frequency of acidic food and beverage intake, and salivary pH and buffering capacity were not quantitatively assessed in this study. Other literature confirms these as important mediators; frequent consumption of acidic drinks, particularly carbonated beverages and fruit juices, has been shown to amplify the effects of reflux-related acid exposure (17).

The strengths of this research lie in its prospective, controlled design, examiner blinding, and use of a validated scoring tool for dental erosion assessment. The study also reflects a relatively large and clinically well-characterized sample, increasing its internal validity and generalizability within similar healthcare settings. However, certain limitations must be acknowledged. The cross-sectional design precludes causal inference, and recall bias may have affected self-reported data on dietary and oral hygiene practices. Salivary biomarkers, such as pH, flow rate, and buffering capacity, were not measured, despite being established intermediaries in the erosion process (18,19). Moreover, this study did not stratify erosion severity according to GERD subtype (non-erosive reflux disease vs. erosive esophagitis), which could have provided additional insights. Evidence suggests that patients with more severe esophageal involvement exhibit more pronounced oral findings (20). Future research could explore longitudinal changes in dental erosion post-GERD treatment, particularly in response to pharmacological acid suppression and dietary interventions. In light of these findings, multidisciplinary collaboration between dental and medical professionals becomes imperative. Early recognition of dental erosion by dentists should prompt timely gastroenterological referral, as DE may be the earliest or sole sign of undiagnosed GERD (21). Furthermore, educational outreach targeting primary care providers can enhance GERD screening in dental settings and improve patient outcomes. In conclusion, this study reinforces the significant burden of dental erosion among GERD patients and affirms the need for integrated preventive strategies. As GERD continues to rise globally, particularly in developing nations, oral health professionals are positioned to play a critical role in early disease detection and holistic care.

CONCLUSION

This study confirmed a significantly higher prevalence and severity of dental erosion among patients with gastroesophageal reflux disease, emphasizing GERD as a key intrinsic risk factor for enamel loss. The findings underscore the need for routine dental screening in GERD patients and advocate for integrated care approaches between gastroenterologists and dental professionals to enable early detection, prevention, and management of erosion-related complications.

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AUTHOR CONTRIBUTION

Author	Contribution
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Ramsha Zuberi	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Fakeha Zahid	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Sidra Ghayas	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Atia Jamal	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Namra Naseem	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Maria Aftab Quadri	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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