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Effects of Gastroesophageal Reflux Disease on Periodontium: A Systematic Review

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Abstract

Background: The periodontium comprises the periodontal and gingival components, which serve as an attachment mechanism to uphold the integrity of the entire dental and surrounding bone structure.

Gastroesophageal reflux is the most common digestive issue which occurs when gastric acid is discharged repeatedly in the esophagus.

Aim: To probe into a possible connection between Gastroesophageal reflux disease and its role in the development of periodontal diseases.

Methods: A systematic examination of the controlled tests was carried out.278 papers have been extracted from electronic and manual searches, and 4 studies have been included in the systematic review.The studies

analyzed in the review took into account both interference and possible associations.. In addition, a literature review was performed using Pubmed, PMC, Science direct, and Wiley using keywords "periodontium", and "gastroesophageal reflux disease". According to PRISMA guidelines, the mesh terms were altered in each search engine.

Results: In this study, we used the chi-square test, univariate and multivariate models, descriptive statistics to analyze the relation between gastroesophageal reflux disease and periodontium, which shows a higher susceptibility to periodontitis in patients with reflux disease than in those without the disease.

Conclusion: The relation between GERD and periodontium was established in this review. The

probable reason for the development of periodontal problems because of GERD is the altered salivary function. Low pH,low salivary buffering capacity are the additional influences.

Keywords: Controlled trials, Gastroesophageal reflux disease, Periodontium.

Introduction

The periodontium is composed of four distinct components, which include cementum, periodontal ligament (PDL), alveolar bone, and gingiva, all of which are connective tissues. Its main functions are supporting the tooth, protecting it against oral microflora, and attaching the tooth to the underlying bone[1]. The healthy periodontal complex provides tooth attachment, distributes forces equally, nourishes and invests teeth via neurovascular elements, it is also a source for stem and progenitor cells for dentoalveolar repair, and protects deeper periodontal tissues from microbes.[2]. The absence of histological evidence of periodontal inflammation and anatomical change to the periodontium is defined as the "pristine" form of periodontal health. However, it can not be seen in most adults.Hence,the term "clinically healthy" should be used to refer to the tissue that demonstrates an absence or of very low level clinical indicators of inflammation, such as bleeding on probing and inflammatory markers in gingival fluid[3].

Periodontitis is an inflammatory disease followed by an infection in which the composition of the biofilm plays an important role. Dental plaque accumulated at the gingival margin initiates an inflammatory response that causes microbial alterations that eventually lead to drastic changes in the periodontium in susceptible individuals. Chronic irritation and inflammation of the gingiva will also lead to periodontitis, which results in irreversible attachment loss and bone loss.In advanced

conditions, can tooth loss be noted in adults[4].Periodontitis is associated with biofilm abnormalities and is characterized by the progressive destruction of periodontal tissue that can lead to tooth loss.Although it can result in inflammation and bleeding, periodontitis is often described as a silent condition...This also has link with many systemic conditions, like severe pregnancy outcomes, cardiac diseases, respiratory diseases, cancers, systemic lupus erythematosus, rheumatoid arthritis, diabetes mellitus (DM), and chronic renal diseases. Periodontal therapy has the potential to enhance not just periodontal measures but also the quality of life pertaining to oral health[5].

Various domains of dentistry have recently incorporated machine learning and deep learning techniques. This technology is very helpful in reaching an appropriate diagnosis, interpreting images and also making relevant treatment planning[6]. Artificial intelligence in dentistry is used to evaluate various articles which will give added information for appropriate treatment planning[7].

Gastroesophageal reflux, short for GERD, is a very common digestive disorder.GERD, as defined by Montreal, is a condition that presents worrying symptoms and complications due to reflux of gastric contents in the esophagus.Risk factors for GERD include older age, a higher body mass index (BMI), smoking, anxiety or depression, and reduced physical activity. Eating habits such as consumption of acidic foods, and the size and timing of meals, with respect to sleep can also contribute to GERD[8].

Typical symptoms of GERD include regurgitation, heartburn and dysphagia(symptom for uncomplicated GERD).Chest pain is another symptom that is often associated with GERD, but a cardiac cause must be considered and ruled out first.Other symptoms include indigestion, bloating, nausea, sore throat, and upper

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abdominal pain.Certain patients may have extraesophageal symptoms like asthma, pharyngitis, laryngitis, sinusitis, chronic cough, dental erosions, idiopathic pulmonary fibrosis, and recurrent otitis media. Below are some of the factors that contribute to GERD; 1.Transient Lower Esophageal Sphincter

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2.Hiatus hernia

Relaxation(TLERS)

3. Pressure in low lower esophageal sphincter

4.Occurrence of acid pockets due to poor mixing of acid and chyme in the proximal stomach

5.Obesity

6.Delayed gastric emptying

7.Increased gastroesophageal junction distensibility[9] Certain studies described the possible connection between periodontitis and reflux disease. Dzhamaldinova et al. conducted the pioneer study regarding risk of periodontal disease and its association with GERD.A morbific association was found between reflux disease and periodontitis that was characterized by combination, but not monotherapy. Song et al. reported a significantly elevated risk of chronic periodontal disease in patients with GERD and carried out a small population clinical study which considered this as an independent risk factor. Recently, Lee et al. carried out a small clinical study on obstetrical cases and has demonstrated that GERD is strongly correlated with the risk of periodontitis during pregnancy and premature birth associated with systemic inflammation. The studies were designed as controlled or cross-sectional studies, and were conducted on comparatively limited samples. To address these limitations, this study is performed to find the possible connection between GERD and its role in development of periodontal diseases[10]. The study of changes in salivary function makes sense in the context of reflux. Saliva is composed

of protective factors which include epidermal growth factor, mucus, and bicarbonate, which are altered by Laryngophageal reflux(LPR).LPR is associated with decreased salivary epidermal growth factor and may delay the healing of mucosal lesions[11]. Under normal circumstances, salivary and swallowing functions play a role in preventing oral problems due to acid reflux through their neutralizing and cleansing effects. OHI-S values were also notably more in patients with reflux disease compared to both control groups. Gingivitis can be found in patients with severe GERD patients. The reasonable explanation for this is impaired salivary function[12]. After tooth erosion, uneven tooth surfaces become susceptible to friction and wear, leading to occlusal wear and tooth loss.In addition, patients with GERD often have abnormal esophageal motility, which closely associated with delayed acid is clearance.Normally, under physiological conditions, gastric reflux is induced by swallowing, which induces peristaltic return to the stomach, or by stimulation of the esophageal mucosa, which induces secondary peristaltic clearance. However, in patients with GERD, this process hindered, resulting is often in delayed acid removal.Additionally, studies have reported oral health indices to be superior in healthy individuals than in GERD patients[13].Proton pump inhibitors (PPIs), usually prescribed to treat the acid-related gastrointestinal disorders, can also cause periodontal disease.PPIs regulate osteoclast function, decrease gastric acid secretion, and are associated with establishing a diverse gastrointestinal more microbiota.Periodontitis is identified by host-initiated inflammation associated with microbes, resulting in loss of periodontal attachment.Patients using PPI had fewer teeth with increased probing depth than those without,

supporting the hypothesis of an association between PPI and periodontitis[14].

Materials And Methods

Search strategy: In this study, we extracted data from various electronic databases like Pubmed, Wiley, NIH, and ScienceDirect for this systematic review from 2003 to 2022.

Following Prisma's guidelines, each search engine's mesh terms were changed when there were too many or too few results.

Inclusion criteria

- Controlled trails and pilot studies from 2003 to the present.
- It included full-text articles available in the search engines mentioned in the search strategy.
- Studies demonstrating the risk of periodontitis in patients suffering from GERD.
- Relation between gastroesophageal reflux and chronic periodontal disease.
- Dental and periodontal damage to patients suffering from gastroesophageal reflux disease.

Exclusion criteria

- Studies which show other non-periodontal problems caused by GERD.
- Animal studies.
- Patients diagnosed with any systemic diseases.

Results

A total of 278 articles were initially obtained. On further screening based on inclusion and exclusion criteria as detailed in Fig.1, 42 studies were excluded, and no studies were added manually. Thus, 252 studies were assessed for eligibility, in which 4 studies were included in qualitative analysis.



Fig. 1: Flowchart shows the total number of studies identified, screened, evaluated, eligibility checked, excluded, and included in the systematic review.

Table 1: Shows the features of the studies that are chosen through systematic review. The following characteristics were studied; Name of the author, year of the study, sample number including their details such as gender and the interventions involved in the study. All the included studies were conducted strictly on the patients with periodontal problems and GERD. The study group consisted of people with GERD and periodontitis, while the control group consisted of people who were relatively healthy.

Author Name Year Duration Interventions Sample Size 2022 Study group- persons with GERD Xin Li[10] 20,125 12 years Control group- persons without GERD 2013 560 Jun Young Song[15] 2 years Study group- patients with chronic periodontitis Control grouppatients without chronic periodontitis 253 J.V. Munoz[16] 2003 2 years Study group- patients with GERD Control group- healthy persons Ramanarayana 2020 40 2 years Study group- patients with chronic periodontitis Boyapati[17] and GERD Control group- patients who were systematically healthy but diagnosed with chronic periodontitis

Table 2: Shows the effective measures and outcome data of periodontal problems in correspondence to GERD.

Table	h .	Information		The	Descrites	Dat	a a set a d T		Ter also de d	Ctudian
Table	2:	Information	1 On	Ine	Results	Ke	portea I	n i ne	Included	Studies.

Author Name	Year	Effect Measures	Results
Xin Li10]	2022	Chi-squared test was used for age group, sex, and comorbidity; Two- tailed t-test was performed for mean age. To measure cumulative incidence rate of periodontitis in both groups. MKa plan- Meier model was used to analyze inter group differences. MCox univariate and multivariate proportional models were performed. M The statistical analyses were carried out using SAS softwarer.	This study indicates that patients with GERD may have a higher risk of periodontitis than patients who do not have it. GERD may be the etiology of idiopathic periodontitis. When GERD and periodontitis coexist, the overall health suffers.
Jun Young Song [15]	2013	Chi-square test and Student's t-test being employed to examine univariate associations between chronic periodontitis and variables. A	In this study, there is a strong the correlation between the coexistence of GERD and chronic periodontitis patients. The most rational explanation of GERD as a predisposing factor is

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		multivariate review was conducted to	poor salivary function.
		determine independent risk factors. All	
		tests were carried out in SPSS.	
	2002		
J.V. Munoz[16]	2003	To verify the normality of the	The relation between presence of dental
		distribution of quantitative variables,	erosions, pathological periodontal indexes and
		the Kolmogorov-Smirnov test was	GERD were observed. No statistical association
		employed. Statistical differences were	was found between dental erosion and plaque
		compared using x^2 -test, Fisher test in	index. Finally, from a logistic regression model,
		the case of qualitative parameters and	dental erosion was an independent variable that
		Student t-test for quantitative	influenced the diagnosis of GERD.
		parameters.If quantitative parameters	
		was not normally distributed, the	
		Mann-Whitney U test was utilized.	
		Pearson test for correlation between	
		quantitative parameters was analyzed.	
		All analysis was conducted using	
		SPSS.	
Ramanarayana	2020	Descriptive statistics such as mean and	There is a strong relationship between
Boyapati[17]		standard deviation for continuous	periodontal problems and GERD, which may
		variables and frequencies and	also lead to gastric cancer. Eliminating H. pylori
		percentages for categorized variables	from plaque and oral cavity plays an important
		were identified. T test was performed	role in eliminating gastrointestinal problems
		for comparisons between groups and a	associated with H. pylori.
		Pearson correlation test was performed	
		to assess the correlation between	
		different parametersAll analysis was	
		conducted using SPSS.	

Table 3: Shows the bias analyzes of the included studies which are labeled as low risk of bias, high risk of bias, or unclear risk of bias

 Table 3: Assessment of Bias Included in Studies

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Author name	Random sequence	Allocation	Blinding of	Incomplete	Selective	
	generation	concealment	outcome	outcome data	reporting	
Xin Li[10]	+	?	?	-	?	C C

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Jun Young Song[15]	+	-	?	?	?
J.V. Munoz[16]	?	-	?	-	?
Ramanarayana Boyapati[17]	?	?	?	+	-

Discussion

This systematic review established all sets of results regarding the correlation between GERD and periodontal problems. All the 4 studies were taken into consideration which can give probable relation between them.Various factors are considered in the study like age,sex, and other comorbidities.

Xin Li et al [10] conducted a study examining the incidence of periodontitis in both GERD and non-GERD patients. The risk of developing periodontitis was significantly greater in the GERD group in comparison to the non-GERD group.Furthermore, the percentage of individuals in the high-risk group for periodontal disease was significantly higher among those with GERD, as compared to those without GERD, across all age groups, genders, and comorbidities. GERD patients have an elevated proportionate risk of developing periodontal disease. Both diseases have a more complex pathogenesis, involving multiple cell mechanisms. These conditions are primarily distinguished by systemic inflammation that weakens the protective connective tissue barrier against various pathogens, including bacteria and harmful agents. They share similar pathological processes based on inflammation, including inflammatory cytokines like interleukins 6, 8 and 9, altered activity of protease/antiprotease receptors, leukocytes and oxidative stress. Poor salivary function is the most relevant reason for GERD as an etiology for periodontitis to develop.

Jung-Yong Song et al.[15] The researchers incorporated additional variables that were known to have a significant association with chronic periodontitis in their study. They discovered that the prevalence of GERD was considerably higher in individuals with chronic periodontitis. Moreover, the study demonstrated that GERD is an independent risk factor for chronic periodontitis, regardless of established risk factors for the condition, such as dental caries, smoking, and previous drug use. It has been. The most reasonable explanation that GERD predisposes to chronic periodontitis would be an inadequate salivary function. Forms a protective diffusion barrier against thermal, chemical, and microbial damage. Saliva functions as a natural antacid, which safeguards against symptomatic gastroesophageal reflux by providing insufficient acid neutralization. In a physiological context, an increased amount of gastroesophageal reflux is compensated by producing more saliva. However, salivary volume in GERD patients does not depend on regurgitation. Individuals with GERD may experience a weakened esophageal salivary reflex, which can result in reduced saliva production, even in the presence of substantial reflux. However, the specific mechanism behind this phenomenon has not been fully explained.

J.V. Munoz et al[16] from his study detected extraesophageal lesions related to GERD is important on account of the severity of these lesions. Most of these extraesophageal lesions are located near the upper

esophageal sphincter due to the passage of stomach acid through this area. Therefore, structures such as pharynx ,larynx, lungs, and the oral cavity, including teeth, could be potentially damaged by the action of acid reflux. Many patients with extraesophageal manifestations of GERD do not present with the typical symptoms of the disease, such as heartburn and acid reflux.

Ramanarayana Boyapati et al [17] conducted a study that found decreased salivary flow in GERD patients as a cause of dry mouth. All patients with his GERD treated in this study presented with symptoms typical of his GERD: reflux symptoms, dry mouth, and atypical symptomatic tooth erosion. Decreased salivation can induce gingivitis in GERD patients and acts as an exacerbating factor. Gastric contents such as pH 1-1.5 acids, bile salts, pepsin, and trypsin can affect the esophagus and oral cavity of GERD patients. Gebara and colleagues reported that periodontal disease has a high prevalence of Helicobacter pylori (43%) in the dental plaque of affected individuals. The bacterium was found in salivary, supragingival and subgingival plaques, suggesting that these sites may be considered reservoirs for H. pylori in patients carrying urea sis [14]. Elimination of Helicobacter pylori from plaque and oral cavity should play a distinct and important role in the complete management of gastrointestinal disorders associated with H pylori.

Conclusion

All the articles taken for the systematic review have shown the probable relation between GERD and periodontal diseases. These studies show that GERD affects the oral cavity causing various diseases such as periodontitis, gingivitis, dental erosions and tooth loss etc. Among these periodontal diseases are quite common. GERD causes backwash of stomach acid into the esophagus and oral cavity which can cause constant

irritation of these structures. In general, saliva present in the oral cavity acts as a buffer and neutralizes acids. However, salivary function is impaired in patients with reflux disease. In particular, factors such as low pH and low salivary secretion greatly affect the development of oral diseases in periodontal tissues.

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