

Reflex Gastroesophageal Disorders and Functional Dyspepsia: Potential Confounding Variables for the Progression of Chronic Periodontitis: A Clinical Study

Abstract

Aim: To probe into the possible connection between gastroesophageal reflux disorders (GERDs) and functionally occurring dyspepsia as a factor raising the risk of chronic periodontitis.

Materials and Methods: A cross-sectional study was carried out on 40 patients with chronic periodontitis with age group between 40–60 years. The test group included 20 people diagnosed with gastroesophageal reflux disease (GERD), according to the Montreal Definition and Classification agreement, and chronic periodontitis. Symptomatic diagnoses were done to confirm functional dyspepsia. The control group comprised 20 systematically healthy people suffering from chronic periodontitis. Indices measured included flow-rate of saliva, repetitive saliva swallowing test for swallowing function, papillary marginal attachment index of gingiva, oral hygiene index-simplified and decayed, missing, filled teeth index. Data was analyzed using SPSS version 22 (IBM Inc. Chicago, USA). Descriptive statistics, such as mean and standard deviation (SD) for continuous variables and frequency and percentage for categorical variables were determined. T test was performed for intergroup comparison and Pearson correlation test was done for evaluating correlation between various parameters. $P \leq 0.05$ considered as significant. **Results:** Statistically significant differences were observed between the test and control groups with regard to all the clinical parameters of interest. Pearson's correlation test revealed a strong negative correlation between salivary flow rate and OHI-S and DMFT scores. The RSST swallow function values demonstrated a moderate negative correlation with OHI-S scores, while OHI-I scores and DMFT scores were observed to be strongly correlated in a positive direction. A statistically significant difference was present in the probing depth and CAL levels between both the groups with higher levels in test group. **Conclusion:** GERD was linked to incremental incidences of chronic periodontitis and was established as an independent risk-raising factor.

Keywords: Chronic periodontitis, functional dyspepsia, gastroesophageal reflux, risk factor

Introduction

Periodontitis is an inflammatory oral disease that causes swelling in the tissues around the teeth. It also causes raised inflammatory biomarkers, resulting in tooth loss, disarrayed esthetics, impaired oral-functioning and poor quality of life caused by compromised oral health.^[1]

In addition to being resistant to antibiotics, bacterial biofilms are usually linked to a variety of chronic infections compared to nonattached bacteria.^[2] Bacteria like *Helicobacter pylori* are found in large numbers in periodontal pockets and can result in gastroesophagitis and gastric conditions that could be precancerous.^[3] Increased growth of free radicals, apoptotic

or necrotic cell destruction, and augmented proliferation of cells are considered procancerous. Periodontal pathogens can cause inflamed conditions stimulated by incidence of cell initiation, hinderance to normal cell growth, and proneness to carcinogenic conditions.^[4]

Montreal Definition and Classification Agreement defined gastroesophageal reflux disease (GERD) as “a condition characterized by reflex of the contents in stomach causing symptomatic problems and/or complications.”^[5]

Extraneousophageal discomforts arising from GERD are associated with respiratory, esophageal, and digestive systems including laryngeal (reflux laryngitis, hoarseness,

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Access this article online

Website:
www.ijpvmjournal.net/www.ijpvm.net

DOI:
10.4103/ijpvm.IJPVM_141_19

Quick Response Code:



How to cite this article: Boyapati R, Vudathaneni VK, Nadella SB, Bollepalli AC, Marella Y, Adurty C. Reflex gastroesophageal disorders and functional dyspepsia: Potential confounding variables for the progression of chronic periodontitis: A clinical study. *Int J Prev Med* 2020;11:138.

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chronic cough in some cases, vocal cord ulcers and granulomas), pharyngeal (mucositis), respiratory (asthma, bronchitis, chronic cough, and aspiration pneumonia), sinus (sinusitis), middle ear (otitis media), and oral conditions (tooth erosion, sour taste, and mucositis).^[6] Chronic periodontitis may be caused by GERD since it can induce poor oral conditions through poor salivary function or microbial colonization.^[7]

Studies have shown that inflammatory chronic periodontitis is associated with pathological gastroesophageal reflux. Patients suffering from inflammatory periodontitis and GERD can be managed with treatments isolated for chronic inflammatory periodontitis.^[8,9]

GERD patients are often predisposed for chronic periodontitis; this may be due to poor salivary function. The salivary coats on internal anatomical surfaces along with mucin-rich secretions provide a diffusion barrier that protects against chemical, mechanical, thermal, and microbial damages. Saliva is the endogenous antiacidic agent protecting the organs against symptomatic gastroesophageal reflux, and reduced secretion of saliva can prove inefficient in neutralizing the acids being formed.^[10] The exposure of esophageal mucosal to gastroesophageal reflux reduces the pH and triggers esophageal mechani/chemoreceptors, resulting in activated afferent fibers. Parasympathetic (nerve VII or IX) fibers stimulate active secretion of water and electrolytes including buffers in the glands producing saliva. Saliva secretion depends on the volume of gastroesophageal refluxate, whereas the quantity of saliva in GERD patients is independent of the volume of refluxate. Therefore, GERD patients usually have affected esophagosilivary reflex caused by hyposalivation, even in the case of high volume of refluxate. This reduced salivation in GERD patients causes their internal oral surfaces to be prone to acidic as well as proteolytic contents in the epidigestive system, ultimately resulting in chronic periodontitis.^[11]

Hyposalivation could be linked to intraoral proliferation of bacteria in people affected with GERD. Different types of antimicrobial proteins (AMPs) in human saliva and gingival fluid protect the epithelial cells from various invasive microbes and ensure oral homeostasis of pathogenic and commensal bacteria.^[12] One such AMP is chemokine ligand 28 (CCL28) that is effective in destroying anaerobic pathogens, such as *Porphyromonas gingivalis* and *Aggregatibacter Actinomycetemcomitans*, responsible for periodontal problems. Reduced salivary secretion also reduces the volume of CCL28, leading to weak oral self-defense.^[13] Thus, in GERD patients, hyposalivation should have a strong linkage to the cause of chronic periodontitis, allowing the spread of intraoral bacteria. This being the background, the present study is aimed at investigating the possible linkage between GERD and functional dyspepsia while analyzing risk factors in chronic periodontitis patients.

Materials and Methods

Ethical consideration and study design

This cross-sectional observational study has been approved by the Ethical Committee of Mamata Dental College and Hospital, Khammam, Telangana, India. The participants who have volunteered were enlightened with detailed information on the purpose of the proposed research, and their written/signed consent were obtained. Institutional ethical committee approved the present study on December 5, 2016.

Study population and inclusion criteria

The control group consisted of 20 individuals who are systemically healthy, but diagnosed with chronic periodontitis. Test group, similarly, contained twenty individuals suffering from GERD and functional dyspepsia. Both the groups included those patients who were referred to the outpatient department of periodontics, Mamata Dental College and Hospital, Khammam during the period from December 2016 to January 2018.

Exclusion criteria

Patients diagnosed with gingivitis, acute periodontitis, and other systemic diseases like acquired immunodeficiency syndrome, diabetes mellitus, carrying or lactating, smokers and those who were under treatment for orthodontics or even submitted to periodontal therapy in the previous six months of the study have been excluded.

Case definitions

The catalyzing factors to GERD include gaining weight, intake of fatty and nonfibrous foods, caffeine-containing gaseous drinks, and use of alcohol, tobacco, and drugs. Drugs that alleviate sphincter pressure at esophagus are antihistamines, anticholinergics, antidepressants classified as tricyclic, CBB, progesterone, and nitrate-based applications. The most common symptom for GERD is heartburn along with regurgitation of acidic contents upward to mouth along the esophagus. Other symptoms include epigastric pain, chest pain, hoarseness, throat irritation, and sometime cough.^[5]

The symptoms like postprandial fullness, feeling of early satiation, epigastric problems including burning, if diagnosed, could be attributed to functional dyspepsia, but without any structural evidence of the disease.^[14] No additional tests were performed

Chronic periodontitis' diagnosis is corroborated with clinical findings of inflammation on gingiva, clinical attachment loss ≥ 2 mm interdentially and ≥ 3 mm buccally, and the size of probing pocket depths >3 mm at ≥ 2 teeth per quadrant.^[15]

Salivary flow volume (Milliliter/minute)

Saxon test was conducted twice for every participant where the average quantity of saliva excretion was considered as

the salivary flow. For this test, the participants were made to bite and clamp-down upon a folded, weighed gauze piece for two minutes, after which the gauze inserted and the lab dish that contained the rest of intra-oral saliva were weighed. Standard conditions were maintained while collecting saliva for each volunteer.^[12]

Swallowing function (Number of swallows/second)

The Repetitive Saliva Swallowing Test (RSST) was used to evaluate the swallowing function so as to understand the saliva-swallowing potential. The frequency of swallowing for a 30 × period and “time-to-onset of the first swallowing” were clinically recorded. RSST was carried out keeping the conditions for each and every participant same as that of the volume of salivary flow.^[12]

Oral examinations for teeth - dental caries

Various indexes were used in the present study, such as dental caries, remaining tooth count, decayed tooth count (D), missing teeth (M), filled (treated, F) teeth, total number of DMF (decayed, missing and filled), and DMF indexes. Calculation of DMF index was done on the basis of “total number of decayed, treated, and missing teeth/residual teeth × 100 (%)”.^[16]

Oral examinations for soft tissue gingivitis

The severity of gingivitis was assessed and studied to establish its link to GERD with respect to optical findings. Papillary, marginal, and attached (PMA- Massler M, 1967) indices^[17] were used for the evaluation of gingiva inflammation. The simplified oral hygiene index (OHI-S- Greene JC & Vermillion JR, 1964) was used for oral hygiene.^[18] The tests identified PMA index scores as 0: zero inflammation, and 1: for inflammation of papillary, marginal, and attached gingiva to all teeth.

OHI-S outcomes included two subset of debris scores and calculus scores, each having proneness range of scores from zero to three.

Statistical analysis

Data were analyzed using SPSS version 22 (IBM Inc. Chicago, USA). Descriptive statistics, such as mean and standard deviation (SD) for continuous variables and frequency and percentage for categorical variables were

determined. The data were found to be normally distributed. Tests performed were descriptive for scale data. T test was performed for intergroup comparison and Pearson correlation test was conducted for evaluating correlation between various parameters.

Results

This study was carried out on 40 patients with chronic periodontitis with age group range 40–60 years. The test group included 20 patients, 18 male and 2 female, were diagnosed with gastroesophageal reflux disease (GERD) and chronic periodontitis. The control group comprised of 20 systematically healthy people (17 male, 3 female) suffering from chronic periodontitis.

Intergroup comparison of various parameters like salivary flow rate, RSST, PMA, OHI S and DMFT(%). The mean salivary flow rates in test and control groups were 4.90 ± 0.66 and 6.45 ± 0.06 , respectively. The mean RSST values were 0.21 ± 0.02 and 0.23 ± 0.04 in test and control groups, respectively. In addition, PMA scores of the test and control groups were 4.07 ± 0.57 and 3.77 ± 0.73 , respectively. The OHI S scores of both the groups were 3.26 ± 0.55 and 2.19 ± 0.58 , respectively. The DMFT(%) of the test group and control group were 57.44 ± 11.73 and 49.22 ± 9.38 , respectively. Inferences drawn from the above results revealed a statistically significant difference between swallow function as evaluated by RSST and also in DMFT (%), where $P < 0.05$. Highly statistically significant differences with a $P < 0.001$ were seen between the two groups with respect to salivary flow rate, PMA, and OHI S [Table 1].

Pearson correlation between various clinical parameters. It can be inferred that salivary flow rate has r value (0.641) with OHI S Score, which indicates a statistically significant moderate negative correlation with OHI S. In other words, if the OHI S score increases, there is a decrease in salivary flow rate. It was also observed that DMFT has r value (0.598) with OHI S, which indicates a statistically significant moderate positive correlation with OHI S. In other words, if OHI S increases, there is a definite increase in DMFT [Table 2].

Comparison between probing depth and CAL. The mean probing depth and CAL in the test group were 6.52 ± 1.35 and 3.62 ± 0.74 , respectively. In comparison, the mean

Table 1: Intergroup comparison of various parameters like salivary flow rate, RSST, PMA Index, OHI-S Index and DMFT index [independent t-test]

Parameter	n	Test		Control		Mean Difference	P
		Mean	Std. Deviation	Mean	Std. Deviation		
Salivary flow rate	20	4.90	0.66	6.45	0.66	-1.5550	<0.001**
RSST	20	0.21	0.02	0.23	0.04	-.02300	0.026*
PMA Index	20	4.07	0.57	3.26	0.55	0.8100	<0.001**
OHI-S	20	3.77	0.73	2.19	0.58	1.5750	<0.001**
DMFT (%)	20	57.44	11.73	49.22	9.38	8.21500	0.019*

*Significant ($P < 0.05$), **Highly significant ($P < 0.001$)

Table 2: Correlation between various parameters like salivary flow rate, RSST swallow function test, PMA index, OHI-S index, DMFT index, PD, and CAL (Pearson Correlation)

Parameter	Statistics	Correlations						
		Salivary Flow Rate	RSST swallow function test	PMA Index	OHI-S	DMFT (%)	PD	CAL
Salivary flow rate	Pearson correlation	1	0.311	-0.269	-0.641**	-0.801**	-0.502**	-0.487**
	P		0.051	0.094	0.000	0.000	0.001	0.001
	n	40	40	40	40	40	40	40
RSST swallow function test	Pearson correlation	0.311	1	-0.399*	-0.530**	-0.203	-0.547**	-0.628**
	P	0.051		0.011	0.000	0.210	0.000	0.000
	n	40	40	40	40	40	40	40
PMA index	Pearson correlation	-0.269	-0.399*	1	0.629**	0.305	0.548**	0.486**
	P	0.094	0.011		0.000	0.056	0.000	0.001
	n	40	40	40	40	40	40	40
OHI-S	Pearson correlation	-0.641**	-0.530**	0.629**	1	0.598**	0.784**	0.789**
	P	0.000	0.000	0.000		0.000	0.000	0.000
	n	40	40	40	40	40	40	40
DMFT(%)	Pearson correlation	-0.801**	-0.203	0.305	0.598**	1	0.660**	0.541**
	P	0.000	0.210	0.056	0.000		0.000	0.000
	n	40	40	40	40	40	40	40
PD	Pearson correlation	-0.502**	-0.547**	0.548**	0.784**	0.660**	1	0.747**
	P	0.001	0.000	0.000	0.000	0.000		0.000
	n	40	40	40	40	40	40	40
CAL	Pearson correlation	-0.487**	-0.628**	0.486**	0.789**	0.541**	0.747**	1
	P	0.001	0.000	0.001	0.000	0.000	0.000	
	n	40	40	40	40	40	40	40

**Correlation is significant at the 0.01 level (2-tailed). *.Correlation is significant at the 0.05 level (2-tailed)

Table 3: Comparison of PD and CAL in the both Test group and Control group

Parameter	Group	n	Mean	Std. Deviation	Std. Error Mean	Mean Difference	P
PD	Test	20	6.525	1.3521	0.3023	2.575	<0.001**
	Control	20	3.950	0.7592	0.1698		
CAL	Test	20	3.625	0.7412	0.1657	1.75	<0.001**
	Control	20	1.875	0.5350	0.1196		

**-Highly Significant (P<0.001)

probing depth and CAL in control group were 3.95 ± 0.75 and 1.87 ± 0.83 , respectively. A statistically significant difference was observed in probing depth and CAL levels between both groups with higher levels in the test group [Table 3].

Discussion

This study attempts to establish reduced salivary flow volume in GERD patients as the cause for oral dryness. All patients with GERD covered in this study showed symptoms of typical reflux. This draws verifiable correlations between reflux of acid as a symptom of typical GERD and dryness in the oral cavity and atypically symptomatic dental erosions. Reduced salivary flow can induce gingivitis in GERD patients, and thus, it acts as an aggravating factor. In GERD patients, swallowing function was observed to have been substantially reduced.^[11]

Gastric contents like acid, bile-salt, pepsin, as well as trypsin with a pH value of 1–1.5 may impact the

esophagus and oral cavity in GERD patients. This can lead to numerous typical dental erosions including lesions, reflecting extraesophageal problems to soft tissues in the oral cavity with failure in suitably adapting themselves affected by the oral buffer mechanism.^[13]

Similar to periodontal disease, dental caries is one of the major oral disorders. Therefore, the risks of dental caries were also evaluated. The DMF indices were significantly higher in GERD patients than in systemically healthy controls. Certain oral bacteria, especially major pathogens of periodontal diseases, may play a more direct role through local inflammatory responses and carcinogenic transformations.

In major pathogens of periodontics, certain types of bacteria can directly influence the localized inflammatory sensitiveness and reactions and may result in carcinogenic occurrences. An example typical in periodontitis is *A. actinomycetemcomitans*, a Gram

negative bacteria growing in oral cavities of almost more than one-third of the total population, besides *A. actinomycetemcomitans* when separated from many similar lesions in different parts of human body, regarded as a systemic pathogen.^[19] Increased production of carcinogenic nitrosamines is another plausible mechanism which may explain the observed relationships between periodontal diseases and gastric cancer. This relationship could be promoted by tobacco use and certain dietary factors, wherein endogenous nitrosamines were formed by nitrate-reducing bacteria.^[20] In spite of being cleared from gastric mucosa, triple or quadruple therapies fail to defend *H. pylori* infection on the dental plaque. This raises the possibilities that dental plaque could potentially be a source of reinfections in gastric-mucosa.^[21,22]

Oral cavity functions like a vault of Pylori and often as a pathway of transmission. According to Gebara *et al.*, periodontics manifest high incidences (43%) of *H. pylori* in the dental plaque of patients.^[23] Similarly, Umeda *et al.* established that 41.2% of people diagnosed with periodontics had *H. pylori* in their stomach and duodenum, in a depth more than 4 mm.^[24] Dye *et al.* conducted a survey of 4,504 periodontitis patients with a pocket depth of 5 mm or even more to conclude that those pockets were impacted with odds of *H. pylori* seropositivity.^[25] Annand *et al.*, Chitsazi *et al.* and Kamat *et al.* also reported that periodontal diseases and *H. pylori* infection were not much related.^[26] Interestingly, frequently occurring chronic gastritis or GERD may aggravate to atrophic gastritis, intestinal metaplasia, dysplasia, and sometimes into a gastric adenocarcinoma.^[27,28]

Shakerei and team studied 309 GERD patients and observed a strong relationship between tooth loss and low DMFT score, leading to the risk of gastric cancer. Moreover, a visible linkage was observed only in respect to gastric cardia cancer, for those who used to brush teeth less than daily brushing. Removal of *H. pylori* from plaques and oral cavity should play a clear and significant role in the comprehensive management of *H. pylori*-associated GI problems.^[29] Eradication of *H. pylori* from dental plaques and oral cavity should be an important part of the comprehensive management of *H. pylori*-associated GI diseases.^[30,31]

Thus, spreading of awareness about oral health and hygiene should be a part of community health programs so as to reduce possible outbreak of systemic health concerns.^[32]

The limitations of the study include its small sample size that limited the power to assess associations between GERD and chronic periodontitis. The cross-sectional study precludes any definitive statement regarding a causal association. The possibility of potential selection bias cannot be overruled completely, even though the participants were unaware of their health status at the time of recruitment of oral health examinations.

Conclusion

Though chronic periodontitis is associated with deterioration of health status and subsequently increased cost for medical care among the elderly, the association between GERD and chronic periodontitis has less often been reported. The observation made in the present study that GERD is an independent risk factor for chronic periodontitis gives us a heads-up on the need to inform gastroenterologists about considering the incidence of chronic periodontitis while providing care for subjects with GERD. Furthermore, subjects with unexplained chronic periodontitis must be evaluated for the presence of GERD. It is suggested that large epidemiological studies should be conducted to confirm the association between GERD and chronic periodontitis.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Received: 22 Apr 19 **Accepted:** 08 Aug 19

Published: 03 Sep 20

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