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# Investigating the severity of dentin hypersentivity among patients aged 18-35 years with gastro- esophageal reflux disease (GERD) - A cross sectional study

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***Abstract*---**Aim: This study aims to evaluate the severity of dentin hypersensitivity among patients of aged 18-35 years with Gastro-esophageal reflux disease. Materials and Method: A descriptive cross-sectional study was conducted to evaluate the dentine hypersensitivity severity GERD patients. A total number of 734 patients were recruited

from medical-gastro clinic and are equally divided into two groups GERD and non-GERD based on the GERD questionnaire using simple random sampling method. The dentin hypersensitivity was recorded using Schiff sensitivity score and their salivary pH level was recorded using pH strip. The severity of dentin hypersensitivity was recorded using cumulative hypersensitivity index. The collected data was analyzed and tabulated using unpaired t test and one way ANOVA. P value <0.05 was considered to be statistically significant. Results: The salivary pH level and dentin hypersensitivity was found to be statistically significant among GERD and non-GERD patients (P<0.01). Conclusion: The dentine hypersensitivity was found to be higher among GERD patients compared to non-GERD. This study concluded that GERD patients had a higher chance of developing dentin hypersensitivity compared to non-GERD patients.

***Keywords*---**Gastro-esophageal reflux disease, Dentin hypersensitivity, Salivary pH, Oral health, Prevalence. .

## Introduction

Oral health is the reflection of general health. A dental professional plays a pivotal role in the early detection of many systemic diseases by examining the oral cavity. One such systemic disease is Gastro-esophageal reflux disease (GERD) can be diagnosed by assessing oral health [1]. Gastro-esophageal reflux disease is the most prevalent common disease of the lower esophageal sphincter (LES) in recent times [2]. GERD affects the quality of life and health of people due to problems associated with the disease by the retrograde movement of the acid into the esophagus [3]. Gastro-esophageal reflux disease (GERD) is defined as the involuntary muscle relaxing of the upper esophageal sphincter, which causes the reflux of acid to move upward from the stomach through the esophagus into the oral cavity, which might lead to many troublesome symptoms and complications [4].

Gastro-esophageal reflux disease (GERD) is the most prevalent chronic disease that exists globally with consequently greater burden on the Healthcare system. Traditionally, Gastro-esophageal reflux disease has been considered a disease of middle-aged and older people. Since risk factors for Gastro-esophageal reflux disease affects a growing number of the adult population, concerns have been raised that increasingly younger people may develop Gastro-esophageal reflux disease [5]. In general, Gastro-esophageal reflux disease (GERD) was considered to be the most prevalent disease in Western countries compared to Asian countries. But in contrast, the recent studies reported that the prevalence of Gastro-esophageal reflux disease (GERD) in India was found to be higher than western countries which might be due to the modification of lifestyle and diet [6].
Gastro-esophageal reflux disease was most common among pregnant women with a prevalence of 45.5%. GERD increases the severity of vomiting and nausea among pregnant women and have a negative impact on their quality of life. The GERD was found to be most common during the first trimester of pregnancy and this condition disappears soon after delivery [7, 8, 9]. The Gastro-esophageal

reflux disease causes the permanent demineralization of enamel surface of the teeth, which ultimately leads to dental caries and dental erosion. Other manifestation includes dysgeusia, burning sensation, halitosis, water brash acidic taste and erythema of uvula and palatal mucosa. Dental erosion is the most common oral manifestation in GERD which affects all the enamel surfaces of the teeth and leads to dentin hypersensitivity [10, 11].

Dentin hypersensitivity is a condition characterized by rapid onset of short sharp pain derived from the exposed dentinal tubules due to thermal, chemical, evaporative, tactile or osmotic stimuli, it disappears once the stimulus was removed which cannot be ascribed to any form of disease or defect [12]. The dentin hypersensitivity initiates and progresses by the characteristics of teeth and periodontium with the atmosphere of the oral cavity and external influences. The dentin hypersensitivity leads to many physical and psychological problems to the patient. Moreover, GERD can have a negative impact on the quality of a person's life, especially with regard to dietary selection, maintaining optimal dental hygiene, and beauty aspects [13, 14]. The Cumulative Hypersensitivity Index (CHI) was validated by Olley et al., 2013 to indicate dentin hypersensitivity severity per subject which may help to investigate the prevalence, aetiology and management of this condition. Olley et al., used the existing diagnostic criteria of Schiff index by combining the results from the teeth into an overall subject sextant score [12].

The dentin hypersensitivity affects the health and quality of life of people in general. This makes the accurate diagnosis and measurement of the severity of DH very important for appropriate corresponding management. In previous studies, only the association between dental erosion and Gastro-esophageal Reflux disease (GERD) was found [1, 3, 4] but none of the studies have focused on dentin hypersensitivity and its relation with Gastro-esophageal reflux disease. Hence this present aims to evaluate the severity of dentin hypersensitivity among patients of aged 18-35 years with Gastro-esophageal Reflux Disease (GERD).

**Materials and Method**

A cross-sectional study was conducted to determine the severity of dentin hypersensitivity among Gastro-esophageal reflux disease patients of age group 18-35 years. The study was conducted for a period of nine months from September 2020- May 2021. The approval of this study was obtained from the institutional review board of SRM Dental College, Ramapuram, Chennai and ethical clearance was obtained with ethical approval number SRMDC/IRB/2019/MDS/No.703. The sample size was calculated using G*power, study done by Dosumu et al in the year 2019 by setting the alpha error was 0.05 and the power (1- β err prob) - 0.99 and the final sample size obtained was 734.

The patients who visited the medical gastro-clinic of SRM medical college were randomly selected based on simple random sampling method using table of random numbers (every $5^{th}$ number of patients visited medical gastro clinic). The nature and purpose of the study were explained to them and consent forms were given to obtain permission for taking part in the study. The inclusion criteria of this study are only dentate individuals of aged 18-35yrs old were included;

Patients with both GERD and non- GERD are included; Only the non-carious teeth were examined for hypersensitivity; the subjects with atleast 20 number of teeth were included and only subjects who were given written consent form were included in the study. The exclusion criteria includes subjects on any type of NSAIDS, painkiller drugs or had used topical analgesic in the preceding 24hrs; subjects undergoing for periodontal or orthodontic treatment; tooth with restored, fractured, abfraction, abrasion and attrited are not included; teeth used for fixed partial denture or removable partial denture prosthesis, sensitivity due to caries were not considered; patients with systemic diseases other than GERD were not included; third molars and partially erupted teeth were not included in the study.

The study and control groups were selected based on the six item Gastro-esophageal reflux disease questionnaire. The maximum score obtained was 18. The patient with total score >8 was considered to be positive with GERD and the patient with scores <8 were GERD negative patient. Based on the scores the patients were divided into 2 groups- Gastro-esophageal reflux disease patients and non-Gastro-esophageal reflux disease patients. A total number of 734 samples were obtained and are divided equally from two groups- 367 GERD patients and 367 non-GERD patients. A self-administered 11 item questionnaire consists of demographic data, brushing techniques, oral hygiene habits, dentin hypersensitivity duration and factors induced dentin hypersensitivity were recorded. The salivary pH level was estimated from all patients of both groups using pH strip at least 2 hours after their breakfast and all the subjects were instructed not to eat, brush or use mouth rinses during the 2 hours. A pH indicator strip (Merck, Germany) was placed in each participant's mouth (buccal sulcus) and allowed ten seconds for any color change to occur. Salivary pH level was then determined by matching the strips with the color code chart available in the commercial kit. The obtained values were then recorded. The dentin hypersensitivity was recorded using Schiff sensitivity score. The severity of dentin hypersensitivity was evaluated from both groups using cumulative hypersensitivity index (CHI). The cumulative hypersensitivity index was calculated for all the samples by summation of highest Schiff sensitivity score from all the six sextants of the teeth. Then the percentage of the cumulative hypersensitivity index (CHI) scores was calculated. The collected was tabulated and analyzed using unpaired t test and one-way ANOVA. To analyze the data SPSS (IBM SPSS Statistics for Windows, Version 26.0, Armonk, NY: IBM Corp. Released 2019) was used. P-value <0.05 was considered to be statistically significant.

**Results**

Table-1
Association and descriptive statistics of dentin hypersensitivity questionnaire among the gerd and non-gerd patients

| QUESTIONAIRRE | OPTIONS | GERD | NON-GERD | P-VALUE |
|---|---|---|---|---|
| | | Percentage (%) | Percentage (%) | |
| Please indicate how many times you brush your teeth? | 1 time/day | 83.7 | 84.5 | >0.05 |
| | 2 times/day | 16.3 | 15.5 | |
| | Few days a week | 0 | 0 | |

| | | | | |
|---|---|---|---|---|
| | I do not brush my teeth | 0 | 0 | |
| What type of tooth brush bristles do you use? | Extra-soft | 0.5 | 0 | 0.023* |
| | Soft | 17.2 | 42.0 | |
| | Medium | 82.3 | 58.0 | |
| | Hard | 0 | 0 | |
| What oral care products do you use? | Tooth paste | 95.4 | 93.7 | >0.05 |
| | Tooth paste and mouth wash | 4.6 | 6.3 | |
| | Tooth paste and dental floss | 0 | 0 | |
| | I do not use oral care products | 0 | 0 | |
| How often do you use other oral care products (mouth wash or dental floss)? | 1 time/day | 3.5 | 4.9 | >0.05 |
| | 2 times/day | 0 | 1.4 | |
| | Few days a week | .8 | 0 | |
| | Never | 95.6 | 93.7 | |
| How often do you visit a dentist during a year? | 1 time/year | 12.8 | 68.4 | >0.05 |
| | 2 times/year | 0 | 0 | |
| | Few times a year | 1.1 | 0 | |
| | Never | 86.1 | 31.6 | |
| Regarding dental status, what are your complaints? | Sensitive teeth | 41.7 | 20.7 | 0.014* |
| | Caries | 0 | 18.0 | |
| | Dental erosion | 58.3 | 42.8 | |
| | Bleeding while brushing | 0 | 18.5 | |
| What is the duration of dentin hypersensitivity? | Continuous | 28.3 | 0 | 0.032* |
| | Intermittent | 54.2 | 29.7 | |
| | Rare | 17.4 | 70.3 | |
| Do you underwent any professional treatment for dentin hypersensitivity? | Yes | 2.7 | 0 | 0.048* |
| | No | 97.3 | 100.0 | |
| Do you use desensitizing tooth paste? | Yes | 56.4 | 36.2 | 0.038* |
| | No | 43.6 | 63.8 | |
| Type of brushing movements? | Circular | 35.7 | 58.9 | 0.031* |
| | Horizontal | 54.8 | 34.9 | |
| | Vertical | 6.5 | 0 | |

| | | | | |
|---|---|---|---|---|
| | Variable | 3.0 | 6.3 | |
| Any factor that initiated sensitivity? | Cold/hot drinks | 72.5 | 76.3 | >0.05 |
| | Cold/hot food | 0 | 0 | |
| | Sour stimuli | 17.2 | 4.6 | |
| | Tooth brushing | 0 | 0 | |
| | Sweet food | 10.4 | 19.1 | |

Table 1 depicts the percentage-wise distribution of questionnaire regarding oral hygiene, type of brush, frequency of brushing, dentine hypersensitivity and factor initiates hypersensitivity among GERD and non- GERD patients. Out of 367 GERD patients, majority of the patients used medium tooth brush (82.3%), 12.8% of them visited dentist once a year, 83.7 % of patients brush their teeth once daily, 41.7% of patients had sensitive teeth, 58.3% of GERD patients had complaints of dental erosion, 2.7% had underwent professional treatment of hypersensitivity, 56.4% of GERD patients used desensitizing toothpaste and cold/hot drinks (72.5%) were the most common factor initiates hypersensitivity among GERD patients. Out of 367 non- GERD patients, majority of the patients used medium tooth brush (58%), 68.4% of them visits dentist once a year, 84.5% of patients brush their teeth once daily, 20.7% of patients had sensitive teeth, 42.8% of GERD patients had complaints of dental erosion, 36.2% of GERD patients used desensitizing toothpaste and cold/hot drinks (76.3%) were the most common factor which initiates hypersensitivity among GERD patients.
There was a statistically significant relation was found between type of tooth brush (P=.023), complaints of dental health (P=0.014), duration of dentine hypersensitivity (P=0.032), professional treatment for dentin hypersensitivity (P=0.048), use of desensitizing tooth paste (P=0.038) and brushing movements (P=0.031) among GERD and non-GERD patients.

Table 2
Mean difference of surfaces of schiff score index was calculated among the gerd and non-gerd patients using one way anova

| Variables | Sum of Squares | Df | Mean Square | F | P-VALUE |
|---|---|---|---|---|---|
| Between Groups | 225.007 | 1 | 225.007 | 86.457 | <0.001* |
| Within Groups | 1907.654 | 733 | 2.603 | | |
| Total | 2132.661 | 734 | | | |

Table 2 depicts that there was a statistically significant difference was found in surfaces of Schiff score among GERD and non-GERD patients (P<0.001).

Table 3
Mean difference of cumulative hypersentivity index and salivary ph level was calculated among the gerd and non-gerd patients using unpaired t test

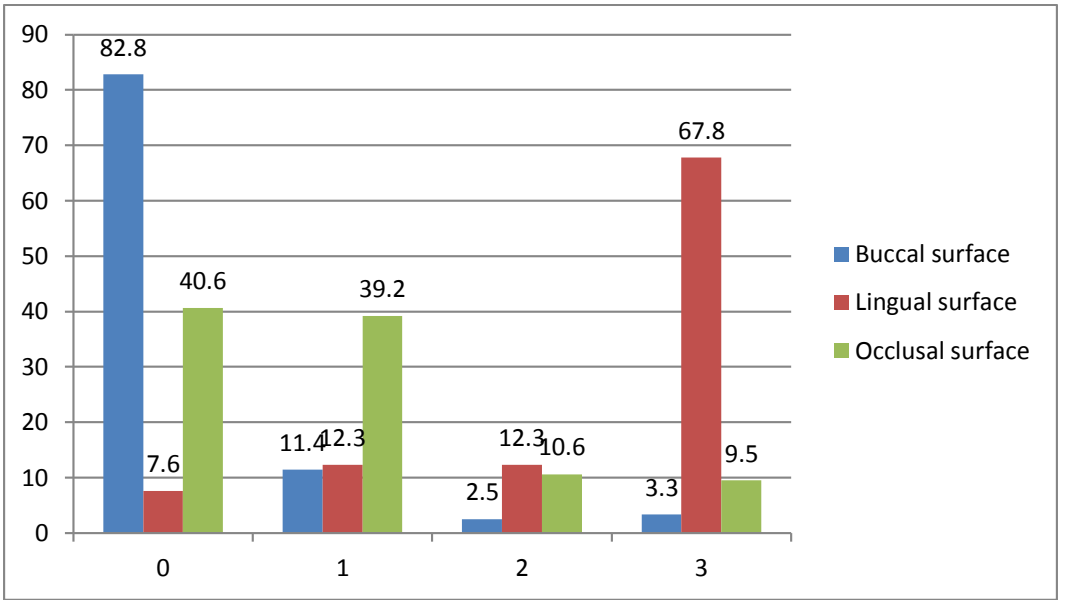
| Variables | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | T | df | P value |
|---|---|---|---|---|---|---|---|---|
| | | | | Lower | Upper | | | |
| Cumulative hypersensitivity index | 1.11172 | 2.25094 | .11750 | .88066 | 1.34277 | 9.462 | 366 | <0.01* |
| pH of saliva | 1.02752 | .86019 | .04490 | .93922 | 1.11582 | 22.884 | 366 | <0.01* |

Table 3 depicts that there was a statistically significant difference was found in cumulative hypersensitivity index (CHI) (P<0.01) and salivary pH (P<0.01) level among GERD and non-GERD patients (P<0.01).

Table 4
Gender difference on prevalence of cumulative hypersensitivity index (chi) among the gerd and non-gerd patients

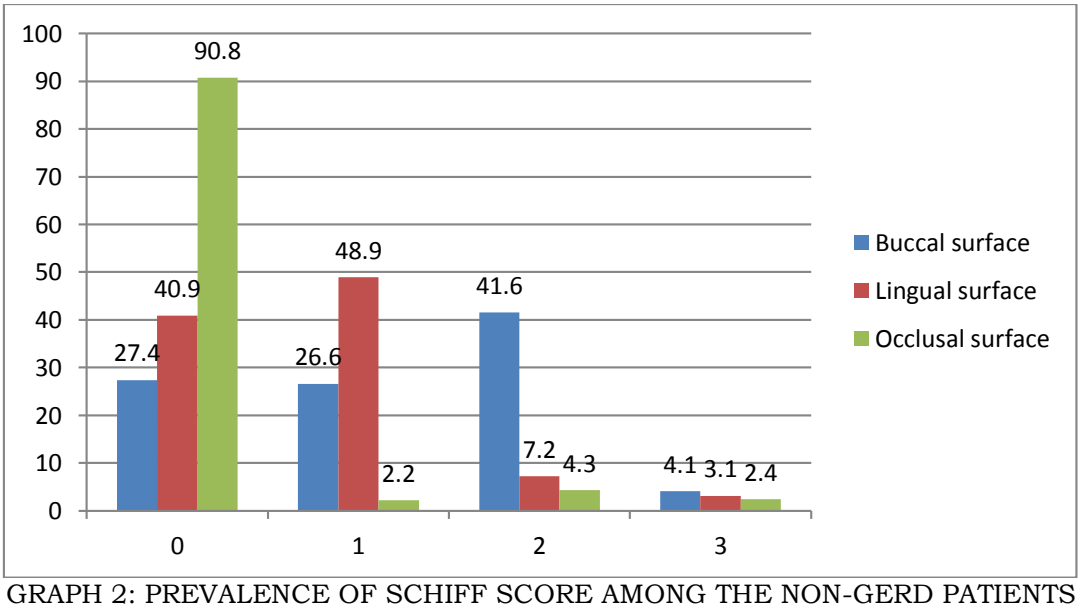
| GROUPS | GENDER (%) | CUMULATIVE HYPERSENSITIVITY INDEX | | | | | P-VALUE |
|---|---|---|---|---|---|---|---|
| | | Score 0 | Score 1 | Score 2 | Score 3 | Score >3 | |
| GERD | FEMALES<br>MALES | 8.3%<br>0 | 4.3%<br>4.4% | 7.4%<br>4.4% | 27%<br>38.7% | 53%<br>52.6% | 0.068 |
| NON-GERD | FEMALES<br>MALES | 12.9%<br>8.4% | 39.9%<br>12.1% | 10.1%<br>38.9% | 27.5%<br>27.4% | 9.6%<br>13.2% | 0.034 |

Table 4 shows that there was a statistically significant relationship was found in hypersensitivity with respect to gender among non-GERD patients (P=0.034).



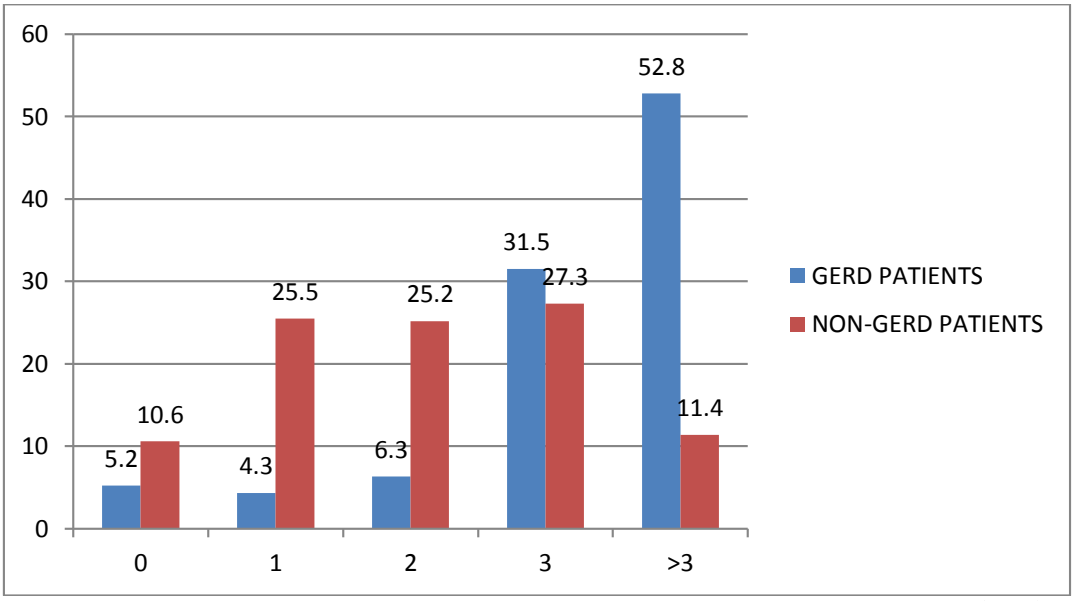

GRAPH 1: PREVALENCE OF SCHIFF SCORE AMONG THE GERD PATIENTS

Graph 1 depicts the prevalence of Schiff score among GERD patients. The Schiff score 0 was most common in buccal surface (82.8%) and occlusal surface (40.6%) whereas the Schiff score 3 was more common in the lingual surface (67.8%) of GERD patients.




GRAPH 2: PREVALENCE OF SCHIFF SCORE AMONG THE NON-GERD PATIENTS

Graph 2 depicts the prevalence of Schiff score among non-GERD patients. The Schiff score 2 was most common in buccal surface (41.6%), the Schiff score 1 was most common in lingual surface (48.9%) whereas the Schiff score 0 was more common in occlusal surface (90.8%) of non-GERD patients.




GRAPH 3: PREVALENCE OF CUMULATIVE HYPERSENSITIVITY INDEX (CHI) AMONG THE GERD AND NON-GERD PATIENTS

Graph 3 depicts the prevalence of CHI among GERD and non-GERD patients. Most of the GERD patients (52.8%) had a percentage of CHI score >3 whereas most of the non-GERD patients (27.3%) had a percentage of CHI score 3.

**Discussion**

The oral health plays a very pivotal role in determining many systemic diseases one such disease is Gastro-oesophageal reflux disease (GERD). The gastro-oesophageal reflux disease affects the oral health in many ways, but most common problem is dental erosion which occurs due to reflux of the acid from the stomach into the oral cavity. In general, the most common symptom of dental erosion is dentine hypersensitivity. The dentine hypersensitivity is one of the most prevalent and common problem in the oral cavity which ultimately affects the quality of life of people [2].

Another important factor for the cause of dental problems is the salivary pH level. Many oral health related problems such as dental caries, dental erosion, dentine hypersensitivity occurs due to alteration and imbalance in maintaining the adequate salivary pH level. The disruption in the level of salivary pH is the most common factor in gastro-oesophageal reflux disease which affects the oral health of people [2,15]. The association between dental erosion and Gastro-oesophageal reflux disease had been documented in numerous studies [16, 17]. None of the studies evaluated the association of dentinal hypersensitivity and Gastro-esophageal reflux disease. This current study was conducted to analyze the severity of dentine hypersensitivity among Gastro-oesophageal reflux disease patients by comparing non- Gastro-oesophageal reflux disease patients using the Schiff sensitivity score and the cumulative score of each subject was recorded by the cumulative hypersensitivity index.

Olley et al in the year 2013 had validated the cumulative hypersensitivity index, to assess the severity of dentin hypersensitivity among people in south-east England and concluded that the cumulative hypersensitivity index was a very effective and accurate tool in determining the severity of dentine hypersensitivity. According to this study the cumulative hypersensitivity index was found to be statistically significant with Schiff sensitivity score (P<0.001) [12]. In the current study, the cumulative hypersensitivity index (CHI) (P<0.01) and Schiff sensitivity score (P<0.001) was found to be statistically significant among GERD and non-GERD patients. The lingual surface Schiff scores was found to be highest in GERD patients; whereas in non-GERD patients the Schiff score was found to be highest in the buccal surface. This might be due to the fact that in GERD patients the acid reflux occurs from the stomach into the mouth so the lingual surface are more exposed causes dental erosion and dentin hypersensitivity. The reason behind the highest buccal Schiff score among non-GERD patients might be due to frequent exposure of acidic beverages and improper brushing techniques.

Another study conducted by Dosumu et al in the year 2019 had evaluated the severity of dentine hypersensitivity among Nigerians using cumulative hypersensitivity index and this study concluded that the cumulative hypersensitivity index was found to be statistically significant with gender, gingival recession and brushing techniques (P=0.05) [14]. This was in line with the present study the dentin hypersensitivity was found to be statistically significant with gender among non-GERD patients (p=0.034).

In the current study, the severity of dentine hypersensitivity was assessed among Gastro-esophageal reflux disease and non- Gastro-esophageal reflux disease patients. There was a statistically significant relation was found between type of tooth brush (P=.023), complaints of dental health (P=0.014), duration of dentine hypersensitivity (P=0.032), professional treatment for dentin hypersensitivity (P=0.048), use of desensitizing tooth paste (P=0.038) and brushing movements (P=0.031) among GERD and non-GERD patients.

Saliva plays a very crucial role in early diagnosis of various diseases especially GERD. Salivary pH is one of the most common presumptive factor for the diagnosis of Gastro-esophageal reflux disease. The study conducted by Caruso et al in the year 2016 had the association of salivary pH and Gastro-esophageal reflux disease patients by comparing with the control group (non-GERD) patients and concluded the salivary pH level was found to be statistically significant with Gastro-esophageal reflux disease and non-Gastro-esophageal reflux disease patients (P<0.05) [18].

The study conducted by Costa et al in the year 2005 was also found that salivary pH level was correlated with GERD patients [19]. This was in line with the present study, the salivary pH level of GERD and non-GERD patients were found to be statistically significant (P<0.01). This current study results was similar to the study conducted by Eckley and Costa in the year 2006 had found that the salivary pH level was statistically significant with before and after treated patients of Gastro-esophageal reflux disease [2]. This was due to reflux of acidic contents of the stomach into the oral cavity among GERD patients might alters the pH level of saliva.

The study conducted by Alavi et al in the year 2014 [3]; Reddy et al 2016 [11] and Ramachandran et al in 2017 [20] had concluded that the patients with GERD had higher prevalence of dental erosion compared to others which ultimately leads to dentine hypersensitivity. This was in line with the present study that the severity of dentin hypersensitivity was more common in Gastro-esophageal reflux disease patients than the non-Gastro-esophageal reflux disease patients.

Overall analysis of this study reveals that the prevalence of dentine hypersensitivity was highest in GERD patients than the non-GERD patients. The salivary pH level was highest among non-GERD patients compared to GERD patients. The salivary pH level range from 8-8.9 was most common in non-GERD patients whereas the salivary pH level range from 7-7.9 was most common in GERD patients.

**Limitations**

The primary limitation of this study is that only persons belonging to the age group between 18-35 years were recruited. Since the study is age specific the data might not hold consistent with general population. There might be a risk of social acceptability bias due to over reporting from the respondents. Further, the equal sampling of Males and Females were not the priority which might pave way for gender bias. Additionally, other factors like socio-economic factors, lifestyle habits were not accounted in the study which might enhance the chance of confounding bias.

**Conclusion**

The gastro-esophageal reflux disease (GERD) is one of the most common rapidly increasing disease that exists all over the world. This study concludes that patients with GERD had a strong correlation with dentine hypersensitivity. The early diagnosis and prompt treatment of GERD might improve the condition. Periodic regular dental checkups are mandatory since dentists are the first health care professionals to diagnose many systemic disease. Regular dental checkup might help the patients to identify the disease at an earliest stage and also helps to improve the patient's quality of life.

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