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**Review article**

# Dental Implants: Prevalence, Association with Periodontal Diseases and Awareness of Oral Hygiene among Dental Implant Patients in Saudi Arabia: A Cross-Sectional Study

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## Abstract

Periodontal disease is a broad spectrum that involves different entities and severity levels of the disease. Dental implants, just like normal teeth, can be affected by periodontal disease. This descriptive questionnaire-based study provides a brief shot on the most prevalent periodontal diseases associated with dental implants, associated risk factors, and levels of understanding and awareness about oral hygiene in the Saudi population. Results concluded that 10.5% of population have dental implants. 28.5% the sample confirmed that they have some sort of periodontal disease. Most prevalent symptoms among patients with dental implants are in order: periodontal pockets, redness and blood spitting after tooth brushing, and finally gingival recession. Most associated co-morbidities are cardiovascular disease and diabetes mellitus. Regarding oral hygiene, through assessing two oral health concepts: twice daily tooth brushing, and balanced diet, it is found that more than half of the sample (51.3%) apply these two concepts in their life, while the rest of the sample misses one or both of these two concepts. Focus should be directed toward raising the public awareness about periodontal disease and its symptoms, especially in cases of dental implants, and raising understanding and awareness about different oral health concepts.

***Keywords:*** ***periodontal disease, dental implant, periodontitis, peri-implant mucositis, peri-implantitis, oral hygiene.***

## Introduction

As known, loss of teeth is unavoidable with aging due to many diseases, most commonly caused by bacteria attached. These bacterial or peri-odontal diseases can be evident in any age even in young age groups. So, it is very important to keep those bacterial diseases away from periodontal tissues. Unfortunately, signs and symptoms of gum diseases are not well appreciated by the patient or the doctor unless they are advanced and associated with teeth loss.

One of the most important things to do to prevent bacterial attachment to the teeth is to maintain good oral hygiene, as nearly

all people who do not maintain good daily oral hygiene will develop gingivitis. If left untreated, this bacterial gum infection can progress from gingivitis to periodontitis, which results in bone loss around the teeth. As the bone tissue is lost, the gum tissues detach from the teeth and form little pockets that provide an even better environment for bacteria - where brush and floss can't reach. Even after implants, one can acquire this same disease just like how natural teeth acquired it. Peri-implant diseases are inflammatory processes affecting the soft and hard gum tissues surrounding dental implants. Just as natural tooth, bacteria can grow on the base of the implant, under the gum line. With time, the bacteria irritate the gum tissue, producing different levels of inflammatory reactions, damaging the tissue and if not diagnosed early, it will destroy the bony tissue under the implant.

## Literature review

Starting with the prevalence of dental implants and how common are they in different groups with different ages and socioeconomic status. There is no published study of Prevalence in Saudi Arabia. However, in a study conducted in the US, assessing how common are dental implants over a 17 years timespan, it concluded that there has been a huge increase in the prevalence of dental implants, from 0.7% in 1999 to 2000 to 5.7% in 2015 to 2016. Two main factors are believed to contribute to this increase (high socioeconomic status and high school education) [1]. From here, one can say dental implants became a treatment of choice for many Peri-odontal disease.

Just like the natural teeth, the same destructive mechanism can destroy dental implants which are bacterial overgrowth. There are two major groups of the common dental implant's disease: 1- peri-implant mucositis, defined as gum inflammation affecting only the soft tissue that surrounds the dental implants, with no signs of bone loss. Generally, peri-implant mucositis is considered a precursor to peri-implantitis. For this, it is important to know how to treat this condition [2]. The mechanism behind this is biofilm accumulation which interrupts the oral microbiological imbalance at the implant-mucosa interface. Evidence suggests that peri-implant mucositis may be successfully treated and is reversible if diagnosed early.

The second group is peri-implantitis, which is characterized by gum inflammation involving the soft tissue and the bony support as well. Peri-implantitis is usually treated surgically [2]. There are two types of dental implants. Each type has its different risk for one type of peri implants diseases. The endosteal type is the safest, but if infection occurs, it is likely to affect the bony support as it is anchored to the bone itself. The other type is periosteal implants which are infected more frequently but as it does not reach the bone. The infection is likely to occur in the gum.

Different factors are involved in peri-odontal disease process, from a seminar in the Lancet that stated that periodontal diseases affect more than 90% of the population worldwide. Gingivitis, the mildest type of periodontal disease, is induced by the bacterial biofilm (dental plaque) that attached to the teeth adjacent to the gingiva (gums). However, gingivitis does spare the underlying supporting structures of the teeth and it is reversible if treated not associated with teeth loss. More advanced form is Periodontitis results in loss of connective tissue and bone support and is a major cause of tooth loss in different age groups. Many factors play role in predisposing to odontal disease besides pathogenic microorganisms in the biofilm, genetic and environmental factors, particularly tobacco smoking, contribute to the prevalence of peri-odontal diseases. Systematic disorders like Genetic syndromes, dermatological, haematological, granulomatous, immunosuppressive, and neoplastic disorders can cause peri-odontal symptoms and be evident through oral manifestations [3]. A study conducted in the Riyadh city at KSA to measure the awareness of oral hygiene among teachers, it was a questionnaire on Four hundred and seventy teachers, male 236 (50.2%) and female 234 (48.8%) responded with a response rate of 85.5%. It concluded that almost 86% of male and 90% of female teachers believe that dental caries is due to the wrong oral brushing Technic, while sugar and soda drinks were thought to be the main factor by 90% of male and 98% of female teachers. 75%of male and 72% of female teachers considered irregular tooth brushing a major contributor of gums disease with 32% of male and 39% of female teachers do not feel the relationship between microbes and peri-odontal diseases. Tooth brushing was the preferred method of cleaning to 45% male and 49% female teachers due to perceived effect of better cleaning, while the rest are using Miswak sticking to the Sunnah. In comparison between genders it was an obvious difference as 33% of female teachers brushed 3 times a day as while 19% only of male teachers brush 3 times a day. Females seem to do regular dental visits more than males in percentages of 32% females and 28% males. The advice was to do measure to increase the public awareness about dental hygiene and it is relation with peri-odontal diseases and teeth loss as well [4].

## Aim

To determine the association of dental implants with periodontal diseases.

## Objectives

- To determine the prevalence of dental implants.
- To determine the most common diseases caused by dental implants.
- The rate of increased periodontal disease compared to the type of dental implants.
- To determine the causes of periodontal disease.
- To measure the extent of understanding the importance and awareness of oral hygiene.

## Methodology

**Study design**
This is an analytical cross-sectional study.

**Study Setting and period**
This is an analytical cross-sectional study conducted in kingdom of Saudi Arabia (from the general population IP and OP), from March 01/ 2020 till July 15/ 2020.

**Study population and sampling**
General population (IP and OP)

**Study participants and sampling method**
Participants were conducted study be carrying the questionnaire during the period of data collection from 01/03/2020 till 15/06/2020.

**Inclusion criteria:** General population and who is doing dental implants.

**Exclusion criteria:** others.

**Sampling size:** 500

### Measurements

**Explanatory variables**

1. Sociodemographic characteristics: age, and sex
2. Periodontal disease: Association with Dental implants, Risk factors, Causes, Symptoms, Types of implants, Duration, Associated diseases and Awareness of oral hygiene.

**Data management and analysis**

Data was entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 17. Descriptive statistics was displayed as frequencies and percentages for categorical variables. Measures of central tendencies (the median), and measures and dispersion (minimum – maximum) were used to summarize continuous variables, as the continuous variables not normally distributed. Univariate analysis was performed to investigate the association between the exposure factors (age, and sex, periodontal disease: Association with Dental implants, Risk factors,Causes, Symptoms, Duration, Associated diseases and Awareness of oral hygiene)

This was performed using Chi-squared test and Mann-Whitney test. Multivariate analysis to investigate factors independently was performed using binary logistic regression. P value was set at a significance level of < 0.05.

## Results

**Basic and Epidemiological Data**

As shown in table (1), sample size is 1025 cases, with no missing cases in any of the results. Distribution according to age group is as follows: less than 12 years: 3 cases (0.3 %), 12 – 18 years: 97 cases (9.5 %), 19 – 25 years: 181 cases (17.7 %), 26 – 32 years: 292 cases (28.5 %), 33 – 44 years: 174 cases (17%), and more than 44 years: 278 (27.1 %). 291 cases (28.4 %) are males, while 734 cases (71.6 %) are females. Of 1025 cases, 780 (76.1 %) are non-smokers, 199 (19.4 %) are smokers, and 46 (4.5 %) are ex-smokers. As for comorbidities, most cases (909 (88.7 %)) have no comorbidities. However, 78 cases (7.6 %) have diabetes mellitus, 36 cases (3.5 %) have cardiovascular diseases, and 2 cases (0.2 %) have HIV/AIDS. Among participants, 108 (10.54%) had dental implants, while the rest of them didn't have.

**Tables 1: Characteristics of respondents**

| **Sample** | **1025 cases** | |
|---|---|---|
| Age groups | < 12 years | 3 (0.3 %) |
| | 12 – 18 years | 97 (9.5 %) |
| | 19 – 25 years | 181 (17.7 %) |
| | 26 – 32 years | 292 (28.5 %) |
| | 33 – 44 years | 174 (17%) |
| | > 44 years | 278 (27.1 %) |
| Gender | Male | 291 (28.4 %) |
| | Female | 734 (71.6 %) |
| Smoking | Non-smoker | 780 (76.1 %) |
| | Smoker | 199 (19.4 %) |
| | Ex-smoker | 46 (4.5 %) |
| Comorbidities | No comorbidities | 909 (88.7 %) |
| | Diabetes mellitus | 78 (7.6 %) |
| | Cardiovascular diseases | 36 (3.5 %) |
| | HIV / AIDS | 2 (0.2 %) |
| Dental implant | Yes | 108 (10.5 %) |
| | No | 917 (89.5 %) |

**Periodontal diseases**

According to the respondents, 292 (28.5 %) of them claimed having periodontal diseases, 507 cases (49.5 %), however, denied having periodontal diseases, while an answer of "Maybe" was reported in 226 cases (22 %).

As shown in table 2: among all respondents, bleeding was the most reported symptom of periodontal disease with 574 cases (56 %), followed by blood spitting after tooth brushing with 359 cases (35 %), halitosis, bad breath, or persistent metallic taste with 205 cases (20 %), recurrent gum swelling with 140 cases (13.7 %), gingival recession with 78 cases (7.6 %), and finally: deep pockets between teeth and gum with 76 cases (7.4 %).

However, as shown in table 3, among respondents confirming to have periodontal disease, having deep pockets between teeth and gum comes as the most prevalent symptom, followed by redness and Blood spitting after tooth brushing, then gingival recession.

**Table 2: gum disease symptoms among all respondents**

| | |
|---|---|
| Bleeding | 574 (56 %) |
| Recurrent gum swelling | 140 (13.7 %) |
| Blood spitting after tooth brushing | 359 (35 %) |
| Halitosis, bad breath, or persistent metallic taste | 205 (20 %) |
| Gingival recession | 78 (7.6 %) |
| Deep pockets between teeth and gum | 76 (7.4 %) |

**Table 3: Prevalent symptoms among respondents having periodontal disease**

| Symptom | Mean |
|---|---|
| Deep pockets between teeth and gum | 1.01 |
| Redness and Blood spitting after tooth brushing | 0.99 |
| Gingival recession | 0.96 |

**Association of periodontal with age group, smoking, and comorbidities**

Among respondents having periodontal diseases, it was most prevalent among the age group of 33 – 40 years with a mean value of 0.78, compared to other age groups, with exception of childhood age group (less than 12 years) because of its small sample (just 3 cases).

Smoking comes first in association with periodontal diseases, with a mean value of 0.76, compared to other choices in smoking status choices.

As for comorbidities, cardiovascular diseases rank first in association with periodontal diseases, with a mean value of 1.01, compared to diabetes mellitus (0.74) and HIV / AIDS (0.50). See table 4.

**Table 4: Association between periodontal diseases and different comorbidities**

| Comorbidities | Mean |
|---|---|
| Cardiovascular diseases | 1.01 |
| Diabetes mellitus | 0.74 |
| HIV / AIDS | 0.50 |

**Understanding and awareness of oral hygiene**

As shown in figures 1, 2, 3, half the respondents think it is important to clean their teeth, brush thoroughly twice a day and floss daily. However, a large percentage are not aware of the importance of eating a balanced diet. On the other hand, half the respondents believe that the concept of dental health is related to all options, including eating a balanced diet and using dental products that contain fluoride, including toothpaste.

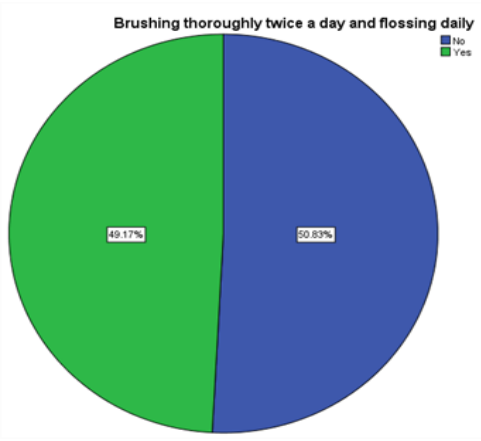


**Figure -1**

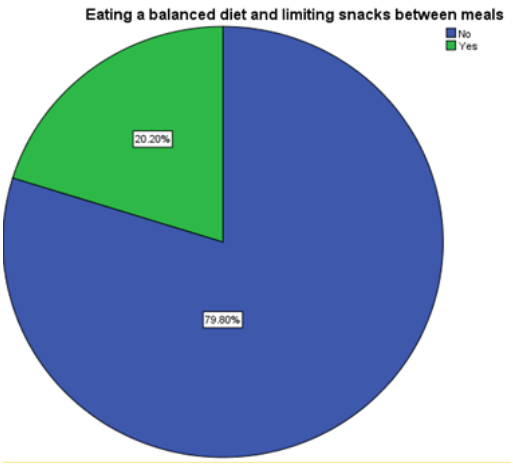


**Figure - 2**

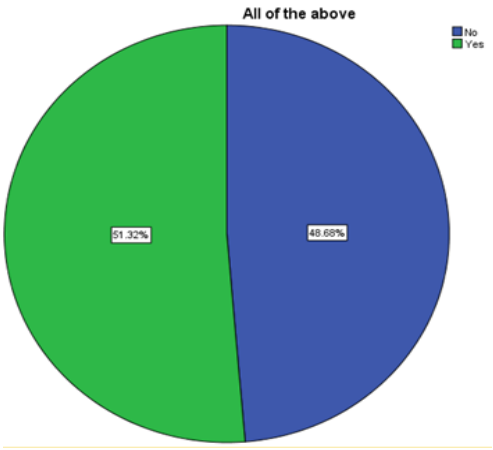


**Figure - 3**

## Discussion

We present the results of a cross-sectional study based on an e-questionnaire distributed among a sample of Saudi population. With a 500 cases, we found that prevalence of dental implants reached 10% of the sample. Most common symptoms among dental implant patients are deep pockets between the gum and the implants, redness and blood spitting after brushing, and gingival recession, respectively. We found that several comorbidities are associated with periodontal disease, among which are:

cardiovascular and diabetes mellitus. Among the 500-case sample, awareness and understanding of importance of oral hygiene hardly exceeded half the sample.

There are limited evidence concerning prevalence of dental implants in Saudi Arabia or the Middle East, and to our knowledge, this is the first such study to be conducted in the Saudi Arabia. However, in a cohort study conducted in the US, the prevalence of dental implants has increased from 0.7% in 1999 to 5.7% in 2016. The study also predicted that the prevalence could be as equal as 12% in 2021, and 23% in 2026 [1]. This finding correlates with our result in this result which was about 10.5%.

About prevalence of periodontal disease, CDC stated that 47.2 % of adults older than 30 years have some form of periodontal disease [5]. This somewhat can match with our result, with the difference of the design of the questionnaire in our study. Offering a "maybe" choice affected, and probably prevented, knowing the exact percentage. From another angle, this research question is highly subjective, and depends on the background knowledge of the participants.

Available evidence classifies periodontal disease associated with dental implants into two stages: 1- peri-implant mucositis, and peri-implantitis. Peri-implant mucosistis is a common finding in dental implant patients, and includes signs and symptoms like redness, bleeding, and periodontal pockets [6]. This finding correlates with our result with common symptomatology of peri-implant disease being redness and bleeding, pocket formation, and gingival recession. Yet, Peri-implantitis is a more severe form of periodontal disease in dental implant patients, affecting soft and hard tissues around the dental implant. This form was not included in our study.

According to recent study on peri-implant mucosistis, risk factors associated with peri-implant disease were mainly smoking, radiation therapy, and poorly-controlled diabetes as major risk factors [6]. This study of ours points to the association of various risk factors like DM, cardiovascular disease and HIV.

Awareness of oral hygiene is measured in this study by two main concepts: balanced meal and limiting snacks between meals, and regular tooth brushing twice daily. Nearly half of participants sticks to these two concepts. When compared to other studies, oral hygiene includes different ways and techniques for dental preventive measures such as flossing [7], oral irrigation [8], and others. However, this study still highlights the most important concepts of oral hygiene.

## Conclusion

Dental implants are prevalent in about 10% of Saudi population. Main symptoms of peri-implant disease are periodontal pockets, redness and bleeding, and gingival recession. Association is found between cardiovascular disease, DM, and HIV. Two main concepts of oral hygiene, being regular twice-daily tooth brushing, and balanced diet, are found in nearly half the participants.

## Data availability

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

## Conflicts of interest

None

## Funding

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