



Research Article

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Determining the Correlation between Oral Hygiene and Periodontal Conditions around Different Types of Restorations Using Radio-graphic Evaluation

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ABSTRACT

Objective: In the healthcare setting, periodontal disease is among common dental disease resulting in tooth loss. Given its increased prevalence, the study determines the correlation between oral hygiene and periodontal conditions using radiographic data. Methods: A cross-sectional study design was used and radio-graphic data of 1000 patients (aged 16 years or above) from King Abdul Aziz University Faculty of Dentistry (KAUFD) was assessed. The patients were divided into four groups based on their type of restoration; such as amalgam (77), composite (65), a crown (44), and temporary (11). Data was collected through questionnaire-based approach, which was analyzed statistically using SPSS. Results: Majority of the patients had fair oral hygiene (53.8%). The correlation analysis of oral hygiene with the restoration surface (p-value 0.571) and control tooth surface (p-value 0.476) was insignificant. Similar results were obtained for case tooth (crown restoration) (p-value, .356) and control tooth (p-value, .925). However, there was significant effect of oral hygiene on restored tooth bone loss (p-value, 0.004) and control tooth bone loss (p-value, 0.003). Conclusion: The study presents instigating initiatives to reinforce oral hygiene and educate general masses about periodontal conditions and its prevention.

Key words: Dental Implant, Oral Hygiene, Periodontal Conditions, Radio-graphic Data, Types of Restorations.

INTRODUCTION

The presence of periodontal diseases is considered as a significant cause affecting the oral hygiene negatively [1]. Various studies have highlighted that periodontal diseases are a predominant causal factor contributing to tooth loss and are associated with a myriad of systemic diseases [1-3]. Due to tooth loss, a significant reduction in a patient's quality of life may be noted [4]. The prevalence of periodontal diseases is increasingly observed among diabetic patients [5], in addition to those suffering from various forms of cancer [6]; Therefore, the prevalence of such periodontal diseases is significantly higher and needs to be addressed appropriately to

decrease its rate of incidence. Moreover, the prevalence of periodontal breakdown has particularly been noted in the patients with class two dental restorations [7, 8].

The naturally occurring oral biofilm bacteria is a primary causal factor leading to incidence of periodontal diseases [9]. Moreover, these bacteria play an important role in initiating an inflammatory cascade response that eventually results in periodontal disease pathogenesis [8, 10, 11]. For instance, the use of oral gels was strongly recommended to combat periodontal diseases by maintaining appropriate oral hygiene [8]. Furthermore, the emulation of correct oral hygiene practices was associated with plaque control leading to amelioration of periodontal diseases [10].

Plaque-retentive areas are created through restoration with defective margins, which might result in bone loss, inflammation, and periodontal destruction [12]. The proliferation of anaerobic bacteria associated with chronic periodontitis results when the subgingival microflora is altered. There is an increased risk of tooth loss among the prosthetically rehabilitated patients as compared to those, who have not undergone ant prosthetic treatment. This clearly suggests that the use of restorations might result in a significant risk factor for periodontal disease [12]. It is possible to evaluate the evolution of periodontal area after placement of restoration because of uncertain results or unable to attain optimum adjustments [13]. Thereby, to provide protection to the remaining teeth and provide prosthodontic restoration longevity, maintaining adequate oral health is crucial.

The radiographical techniques in the form of cone-beam computed tomography (CBCT) are used to detect periodontal conditions [14]. Additionally, the applicability of digital intra-oral radiography was discussed to assess periodontal defects by conducting evaluations at the interdental bone level [15]. However, there is lack of studies assessing correlation between oral hygiene and periodontal conditions using radiography. There is a need to evaluate the correlation between oral hygiene and periodontal conditions for different types of restorations. Therefore, this cross-sectional study was aimed to bridge this gap by incorporating the use of radiography to analyze the relationship between oral hygiene and the presence of periodontal conditions. Through this, the association between these two factors may definitively be concluded.

THEORETICAL BACKGROUND

Different types of restorations have been recognized to prevent the deterioration of teeth. Few of the previous studies have confirmed that dental prosthesis is more effective as compared to conventional dentures [16, 17]. Rajan and Ramamurthy [18] reflected interproximal restorations as the prime cause of periodontal disease. Moreover, periodontal conditions occur majorly in a fixed prosthesis, following artificial crowns and removable prosthesis, if proper care is not practiced. Nart et al. [19] and Juárez et al. [13] stated that periodontal destruction mostly occurs in defective margins of fixed prosthesis, which serve as plaque-retentive areas associated with bone loss, inflammation, and insertion.

A recent study of Liu [17] resonates that the periodontal prosthesis technique is preferred due to multiple pontic replacements for the fixed bridge which is used on compromised teeth, where the conventional dentures or other restorative techniques cannot be applied. Prosthesis restoration relies on good oral hygiene as well as maintenance; however, its success, in the long run, remains questionable. Prosthesis restoration is labelled as a breakthrough in the contemporary dentistry with an implant survival over a follow-up period of 10 to 15 years [20].

However, Zlatanovska et al. [21] reported that prosthetic appliances had been documented for the inadequate level of hygiene habits in the patients. Geiballa et al. [22] found that the patients who have undergone fixed prosthodontic restoration are able to sustain a satisfactory level of oral hygiene. The impact of poor oral hygiene implantation is said to lead to prosthetic therapy failure, which also occurs due to planning and technical errors. The placement of restorative margin should be done with great care in the labial region from one proximal area to the other one. Previous studies have shown that there is a significant association between the use of subgingival margins and occurrence of inflammatory periodontal reaction because of trouble in applying oral hygiene measures, defective tooth-restoration interface, disturbed biologic width, over-contouring of restoration, and increased pathogenicity of subgingival dental plaque [23]. Undesired tissue effects are likely to be caused after subgingival restorations, despite of controlled bacterial plaque. In comparison to the natural dentition, the restorations with subgingival margins are presented with increased plaque, inflammation, probing depths, and gingival index scores [24].

Attachment loss is likely to be accompanied with subgingival restorations; while, few of the studies have reported increased chances of bleeding after the placement of subgingival margin than the supragingival finishing lines [25]. A gingival restoration is displayed after restorations, when the subgingival margin is placed

with a thin gingival biotype after restoration [26, 27]. Therefore, subgingival margins are not likely to stay over time; although, they are highly preferred by the dental practitioners because of esthetic concerns.

At times it is not possible to avoid the intracrevicular restorative finishing lines; although, the supragingival margin placement is highly beneficial [28]. Therefore, it is important to establish a healthy periodontium because of stable gingival tissues that are less likely to be affected by future recession. Considering the junctional epithelium, it is important to perform subgingival placement of the restorations with great care because the healthy gingival sulcus is very shallow [23]. The harmful effects of placing restorations caused by minimal encroachment on subgingival tissues are minimized by placing the restoration not deeper than 0.5 – 0.7 mm into the gingival crevice.

MATERIAL AND METHODS

Study Design

A cross-sectional study design was employed to determine the correlation between oral hygiene and periodontal conditions using radiographic data. The rationale behind using this approach is that earlier researches have been conducted on the same discipline [29, 30] and it allows collected of unbiased data that can be easily represented [31].

Statistical Population and Inclusion Criteria

A questionnaire-based approach was used to investigate three calibrated and general dentists, who were responsible for the data collection. Patient demographic data, oral hygiene, and dental history were addressed by this questionnaire. For this study, 1000 patients, who were either of sixteen years or above, were screened for inclusion by the dentists at King Abdul Aziz University Faculty of Dentistry (KAUFD). The patients were screened based on the determined inclusion and exclusion criteria (as shown in Table 1).

Table 1: The Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
The patients who had undergone class two restorations; of mesio-occlusal (MO), distal-occlusal (DO) or mesio-occlusal-distal (MOD) restorations	The patients who had not undergone any type of restorations or restoration other than class two
The patients who had fixed prosthesis on the first or second permanent molars	The patients who had no fixed prosthesis on the first or second permanent molars
The patients who had fixed prosthesis at least six months ago	The patients who had fixed prosthesis less than six months ago

Consequently, based on the inclusion criteria, 73 patients were included, among which 51 were female; while, 22 were male (Figure 1).

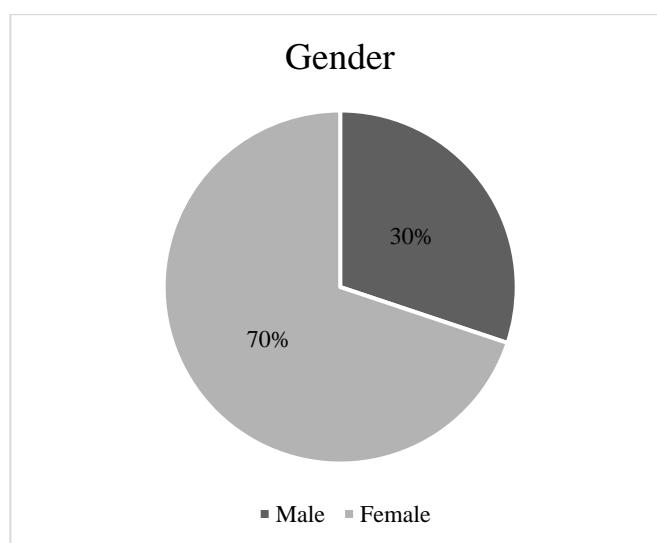


Figure 1: The Patients' Gender

Informed and written consent was obtained from all the participants to ascertain their willingness to be a part of this study. These patients were classified into four main groups of interest in accordance with the type of restoration, which was used (amalgam 77, composite 65, crown 44, and temporary 11) (Figure 2).

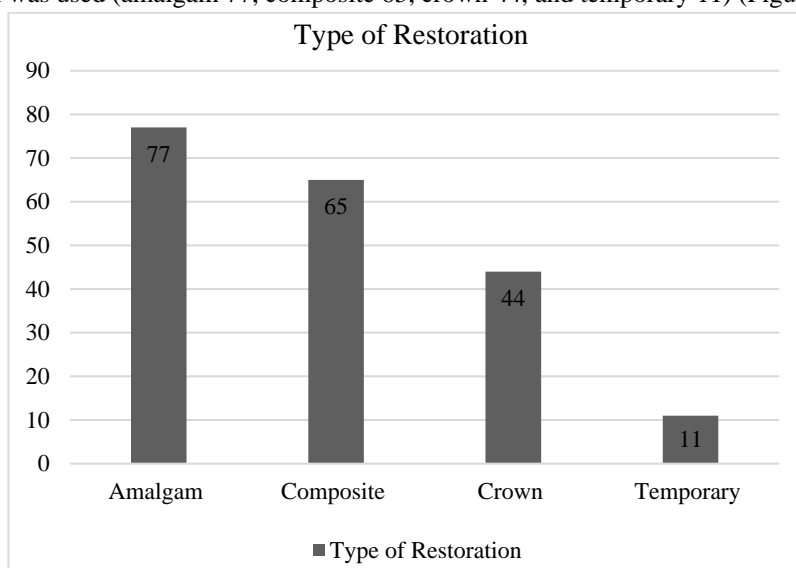


Figure 2: The type of restoration

Furthermore, comparisons were conducted between the patients presented with south tooth surfaces and restoration in the same tooth. Additionally, comparisons were held between the restored tooth and a control tooth on the other side of the arch among the patients with no sound surface on the restored tooth.

Calibration Process

All the examiners had attended a review seminar prior to conducting the clinical assessments. In the seminar, a complete discussion was conducted regarding trial objectives, research parameters, methodologies, and schedule. Furthermore, all these examiners were qualified personnel from Cardio-Pulmonary Resuscitation and Ethics of Human Subjects Research.

Following this, a clinical examination and radiographic evaluation were used to ascertain the degree of periodontal health in these patients. In this regard, the first general dentist carried out the calibration process by conducting the periodontal examination. Additionally, the second dentist performed the radiographic evaluation. Calibration was carried out to suitably quantify the intra-examiner reliability of measuring the periodontal hard and soft tissue parameters. It was done in accordance with the pre-set guidelines for both periodontal and radiographic examiners. The calibration of the examiners was carried out at KAUFU by an experienced periodontist and radiologist. In this regard, the periodontal examiner was calibrated to evaluate the degree of periodontal diseases using a manual probe (UNC-12).

Radiographic Evaluation

The calibration subjects were in the form of patients who fell within a range of periodontal conditions (types I, II, and III). Furthermore, the radiographic examiner was calibrated to effectively utilize the radiographic tools of 4R software for reading the bone loss from the radiograph. The use of bitewing radiographs (BW) was incorporated to conduct the radiographic evaluation by acquiring linear measurements from the cement-enamel junction to the alveolar bone crest. It was based on a previous study that had incorporated a similar approach [32]. Following this, the acquired data was statistically analyzed through inferential statistics in the form of correlation and two-tailed paired t-tests using SPSS.

RESULTS AND DISCUSSION

The results of the patients’ oral hygiene are presented in Table (2). The responses of the participants reveal that majority of the patients possessed an adequate level of oral hygiene (53.8%), while some had poor hygiene (37.1) and only a few had good oral hygiene (9.1%) (Table 2).

Table 2: The Patients’ Characteristics

Variable	Frequency (N)	Percent (%)
Oral Hygiene		

	Poor	73	37.1
	Fair	106	53.8
	Good	18	9.1

Table 3 shows comparison between the patients presented with south tooth surfaces and restoration in the tooth (Table 3). The correlation analysis presents an insignificant correlation between the oral hygiene and restoration surface (p-value, 0.571). Similar results were achieved for the control surface (p-value, .476). There is significant impact of restoration over the other as revealed by the achieved p-value such as .000.

Table 3: Correlation among Oral Hygiene, Restoration Surface and Control Surface

Variables		Oral Hygiene	Restoration Surface	Control Surface
Oral Hygiene	Pearson Correlation	1	.041	-.051
	Sig. (2-tailed)		.571	.476
Restoration Surface	Pearson Correlation	.041	1	-.279**
	Sig. (2-tailed)	.571		.000
Control Surface	Pearson Correlation	-.051	-.279**	1
	Sig. (2-tailed)	.476	.000	

Table 4 presents the correlation between the tooth case, which has undergone filling and crown along with surface restoration with the control tooth case that just has surface restoration. There is an insignificant correlation between oral hygiene and case tooth (crown restoration), which reveals an adverse effect of the restoration (p-value, 0.356). This is similar for the control tooth, which shows an insignificant correlation in terms of oral hygiene (p-value, 0.925).

Table 4: Correlation between Oral Hygiene, Case tooth, and Control Tooth

Variables		Oral Hygiene	Case Tooth # (Has Filling, Crown) + Surface	Control (sound) tooth # + surface
Oral Hygiene	Pearson Correlation	1	.066	.007
	Sig. (2-tailed)		.356	.925
Case Tooth # (Has Filling, Crown) + Surface	Pearson Correlation	.066	1	.817**
	Sig. (2-tailed)	.356		.000
Control (sound) tooth # + surface	Pearson Correlation	.007	.817**	1
	Sig. (2-tailed)	.925	.000	

Concerning the use of radiography, the bone loss of the tooth for the two tooth cases, i.e., one restored tooth and other control tooth has been presented in Table 5. There is an insignificant correlation between oral hygiene, bone loss of a restored tooth (p-value .320) and the bone loss of control tooth (p-value, .378). These results reveal a detrimental effect of oral hygiene on the periodontal health of the patients.

Table 5: Correlation among Oral Hygiene, Bone Loss of Restored Tooth and Control Tooth

Variables		Oral Hygiene	bone loss of restored tooth	bone loss of control tooth
Oral Hygiene	Pearson Correlation	1	-.071	.063
	Sig. (2-tailed)		.320	.378
Bone Loss of Restored Tooth	Pearson Correlation	-.071	1	.444**
	Sig. (2-tailed)	.320		.000
Bone Loss of Control Tooth	Pearson Correlation	.063	.444**	1
	Sig. (2-tailed)	.378	.000	

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

Table 6 presents the paired t-test results of oral hygiene and bone loss of control tooth demonstrating a significant value based on the mean of the two-bone loss as well as the t-value direction (p-value 0.004). There was significant improvement among the patients, who had undergone tooth restoration.

Table 6: Paired T-Test Results of Oral Hygiene and Bone Loss of Restored Tooth

	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Oral Hygiene	1.7208	.62124	-2.880	196	0.004
Bone Loss of Restored Tooth	1.9726	1.01497			

Table 7 presents the t-test results for the oral hygiene and control tooth. The results reveal that there is a significant impact of oral hygiene on the occurrence of tooth periodontal disease (p-value, 0.003), which is better as compared to the restored tooth.

Table 7: Paired T-Test Results of Oral Hygiene and Bone Loss of Control Tooth

	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Oral Hygiene	1.7208	.62124	3.045	196	0.003
Bone Loss of Restored Tooth	1.4066	1.34798			

The study has demonstrated the correlation existing between the oral condition of the patients and the periodontal disease. The results showed that oral condition has a substantial impact on the oral health of the patients, which helps in overcoming the periodontist prospects. These findings are consistent with the study of Ding et al. [33], which revealed similar results among the Chinese patients. This might be because dental disease such as plaque can be controlled by maintaining oral hygiene, which is corroborated by Kabali and Mumghamba [34] in Tanzania and Kadam et al. [35] study in India.

The outcomes of the current study showed an increased correlation between the oral condition and periodontal health of the patient. This is in-line with the study of Ercoli and Caton [36], who demonstrated a clear association between patient compliance with the self-performed control for plaque and periodontal health following fixed dental prostheses. These results are also corroborated by Gulati et al. [37] showing promotion of prosthesis implant care because of increased preferences of the patients towards it. It also stresses that patients must be communicated the proper care procedures to be followed to maintain these restorations.

According to present study, oral hygiene was better for the control tooth as compared to the restored tooth because patients generally neglect the oral care habits initially used to practice before restoration. This is in-line with the research of Bhola and Malhotra [38]; however, it is found conflicting with the study of Prabhu et al. [39] as it showed improved oral health after teeth restoration. This can be due to the difference in the type of tooth restoration. The current study findings showed that restoration of the tooth had no impact on the oral hygiene of the patients. These results were conflicting with the previous study of Skudutyte-Rysstad et al. [40] might be due to the difference in the type of restoration.

Based on the findings, the study recommends the development of effective and good oral care habits, which can be reinforced by introducing various public health campaigns. It also recommends dental experts and dental hygienist for promoting education among the patients, motivating them to adopt oral care practices, and improving their behaviour to enhance their oral behaviour. The adaptation of these practices by dental nurses and assistants can also provide effective and useful results. Moreover, individually tailored oral health practices and instructions can be adopted to obtain an adequate level of oral hygiene.

The findings also recommend that interventions such as goal-setting, self-monitoring, and effective planning should be introduced to enhance oral hygiene practices among the patients for preventing occurrence and prevalence of periodontal conditions. Likewise, the prevention against these conditions can be strengthened by outlining the benefits of the oral health-related behavioral changes and the adverse effect of periodontitis. Accordingly, the study recommends that patients should have 24/7 access to dental care, following instructing them on efficient plaque removal techniques. Other more specific recommendation includes plaque removal by implant polishing or water irrigation (using Hydro Floss) for implant maintenance. However, it is emphasized that care must be taken considering the implant positioning as it can cause damage to the seal. Moreover, dental hygiene visits should be made to remove calculus and plaque, if present for the implanted teeth.

CONCLUSION

Examination of correlation of oral hygiene and the periodontal disease showed that there exists a substantial impact between the two. It showed the dental care of the patient influence oral health outcomes. It showed that with the use of fabricated restoration, the occurrence of the plaque is higher as compared to the untreated reference tooth. Using a quantitative study design, the study showed that there is a need to promote fundamental dental health and hygiene practices among the patients, which overcome the risk of developing any oral disease.

In composite restoration, the increased percentage of secondary caries and marginal defects relates to decreased radiopacity of resin. Moreover, this may increase the chance of detecting adjacent defects and caries in line of the restorations.

Oral health is likely to be reinforced through the promotion of hygiene activities such as regular brushing and bi-annually dental visits to reduce the risk of periodontitis. It is quiet challenging to assess and diagnose the periodontal conditions as various consequences of periodontal disease such as alveolar bone loss, attachment loss, and tooth loss are irreversible. Certain limitations of this study include restriction of recruiting patients from a single institute, which limits the generalizability of its findings. Similarly, the study has considered limited variables for determining the oral hygiene and periodontal conditions using radiography, where inclusion of more variables can provide more comprehensive findings. The study, therefore, directs the future research to adopt the qualitative research design, include population from more institutes and consider more variables which assist in expanding the study area.

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