



Comparative evaluation of effect of fixed prosthetic restorations on periodontal health.

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Abstract

Background: Adequate understanding of the relationship between periodontal tissues and restorative dentistry is required to ensure adequate form, function, esthetics, and comfort of the dentition. All dental restorations must be in harmony with surrounding tissue for establishing periodontal physiology and health. Hence, evaluating the site-specific parameters will be beneficial in providing evidence for the periodontal status. So, the aim of the study is to evaluate and compare the effect of fixed prosthetic restorations on periodontal health based on various periodontal parameters with the contralateral unrestored tooth.

Methods: A sample size of 200 teeth were examined and they were divided into two groups of 100 teeth each with fixed prosthesis and contralateral unrestored natural teeth. A preformed proforma was used for recording the different periodontal parameters like prosthetic margin, plaque score, bleeding score, probing pocket depth, clinical attachment loss, proximalbone loss. The mean values were calculated in each group and they were statistically analysed.

Results: The intergroup comparison result showed that apart from supragingival plaque accumulation, higher scores are present in all other periodontal parameters that were recorded in fixed prosthesis group. The intra group

comparison of different sub groups showed that the mean values of all the parameters were high in the subgingival crown margin group followed by equigingival and subgingival crown margin groups. Conclusions: Within the limitations of this study, it can be concluded that fixed prosthesis restorations with margins located subgingivally causes more periodontal destructions resulting in periodontal pocket formation, clinical attachment loss, gingival recession and proximal bone loss.

Keywords: Fixed prosthetic restorations, crown margins, supragingival, equigingival, subgingival, biologic width.

Introduction

Restorative dentistry and periodontics is dynamically related. Periodontal tissues form the foundation for proper function, esthetics, and comfort of the dentition. All prosthetic and restorative therapies generally require a healthy periodontium as a pre-requisite for successful outcome. The interactions between periodontal health at the restorative-gingival interface continues to represent one of the most difficult challenges for the restorative dentist. The proper margin location of a restoration relative to the alveolar bone may be one of the most important parameters in managing to ensure long-term gingival health^[1].

The key factors for achieving a healthy and biologically pleasing result are proper crown margin placement, gentle tissue management and fabrication of crowns. Supragingival, subgingival, and equigingival margin locations have been suggested for the placement of crown margins, each having its advantages and disadvantages^[2]. Supragingival margin placement is the location of choice for all restorative margins to avoid iatrogenic periodontal diseases. Although the research favours supragingival margins placement, most crown margins are placed subgingivally. The concept of

biologic width becomes important regarding the margin placement^[3]. It was thought, that restorative margins within the biologic width might lead to gingival inflammation, clinical attachment loss, and bone loss. This is perhaps due to the destructive inflammatory response to microbial plaque located deeply at restorative margins. Clinically, these changes are manifested as gingival inflammation, deepened periodontal pockets, gingival recessions and sometimes alveolar bone loss^[4].

In general, margins of any prosthesis are viewed as contributing factors for gingivitis and periodontal attachment loss by causing gingival inflammation owing to their retentive capacity for bacterial plaque. Thus, disruption of the balance between the beneficial microflora and perio-pathogens occur which is similar to that observed in chronic periodontitis. Our purpose is to reinstate good periodontal health, functional comfort, and satisfactory esthetic appearance. All dental prosthetic restorations should satisfy the established requirements for periodontal physiology and health, with regard to the surface, esthetic and functional characteristics. Thus, evaluating the site-specific parameters will be beneficial in providing evidence for the periodontal status. Hence, the purpose of the study is to evaluate the effects of different prosthetic margins on the periodontium based on various periodontal parameters and compared with the corresponding unrestored tooth on the contralateral side.

Materials and Method

The study was planned on patients (aged 18-60 years) with at least one fixed porcelain fused metal crown or bridge prosthesis, as well as those having a contralateral unrestored tooth. They were selected from the outpatient department of the Department of Periodontics, Kothiwal Dental College and Research Centre, Moradabad. The details were presented before the Ethical Committee on Human and Animal Studies, Kothiwal Dental College

and Research Centre, Moradabad, for approval, and after getting approved, the study was conducted. (KDCRC/IERB/12/2020/13)

Study subjects / sample

A sample size of 197 teeth was statistically required. For simplifying the study, 200 teeth were examined in 42 patients (aged 18-60 years) of which 22 patients were females (52.38%) and 20 patients were males (47.62%) with 100 restored teeth with crowns and 100 contralateral unrestored teeth. (Figure 1 and 2).

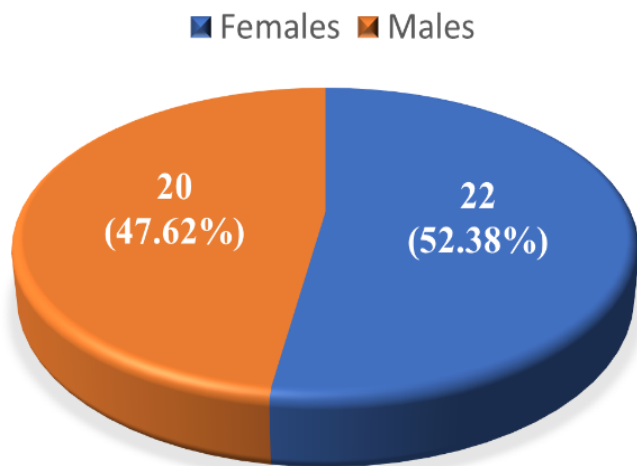


Figure 1: Gender distribution of total number of patients

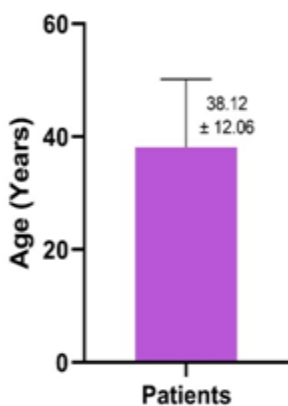


Figure 2: Mean age distribution of the patients

Inclusion criteria

1. Patients who gave informed written consent to conduct the study.

2. Patient having crowns or bridges with supra/ sub/ equi gingival margins for at least 6 months or more.
3. The contralateral tooth should be unrestored.
4. Teeth proximal to the crown should be healthy.

Exclusion criteria

1. Patients with deleterious or tobacco chewing habits.
2. Patients having super-eruption, cervical caries and cervical abrasion of the tooth/teeth of interest.
3. Third molars were not included.
4. Pregnant or lactating women.

Clinical Parameters

1. Margins of the restorations (supra/ equi/ sub gingival) with respect to gingival margin.
2. Plaque index (Turesky et al.,1962)^[5].
3. Bleeding index (Mühlemann and Son, 1971).^[6]
4. Periodontal pocket depth using UNC 15 periodontal probe (in mm).
5. Clinical attachment loss (in mm) using UNC 15 periodontal probe with respect to cemento-enamel junction.
6. Gingival recession (in mm).
7. Assessment of proximal bone loss by intra oral peri apical radiograph (using Radiovisiography).

2.5. Procedure At first patients were selected after satisfying the inclusion and exclusion criteria. Then teeth were selected and grouped under either test group A (teeth with fixed prosthesis) or controlled groups B (teeth without fixed prosthesis). Then clinical parameters were assessed in both the groups. In test group, first the gingival margins of the prosthetic crowns were assessed that whether they are supra/ equi/ sub gingival. (Figure 3)



Figure 3: Assessment of the crown margin at the test site. Then in both the groups with the help of an UNC 15 periodontal probe, periodontal pocket depth was assessed in millimetres (mm) from the crest of the marginal gingiva to the depth of the pocket at three sites on the facial aspect i.e., mesiofacial, mid facial and distofacial site and on the three sites on the lingual/ palatal aspect i.e., mesiofacial/lingual, midpalatal/lingual and distopalatal/lingual sites (Figure 4A and 4B)

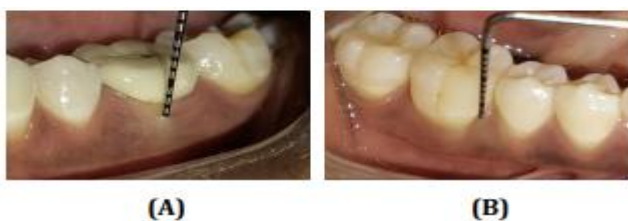


Figure 4: Recording of the probing pocket depth at the (A) test site and (B) control site

Similarly clinical attachment loss was also assessed at same sites on both the facial and palatal/lingual aspect of the concerned teeth from the cemento-enamel junction (CEJ) to the depth of the periodontal pocket (Figure 5A and 5B). If CEJ was not identifiable in the concerned tooth, then CEJ of the immediate adjacent tooth was recorded as the level of CEJ.



Figure 5: Recording of the clinical attachment loss at the (A) test site and (B) control site

After that, probing was done on the four sites of the concerned teeth i.e., mid buccal, mid palatal/ lingual, disto-papillary and mesio-papillary sites to check for bleeding on probing on these sites and colour and consistency of the gingiva was also assessed to draw the gingival bleeding score according to the Mühlemann and Son sulcus bleeding index [6] (Figure 6A and 6B).



Figure 6: Recording of the bleeding score at the (A) test site and (B) control site

Gingival recession was assessed from cemento-enamel junction (CEJ) to the crest of the marginal gingiva in millimetres (mm) only on the mid facial site of the facial aspect (Figure 7A and 7B).

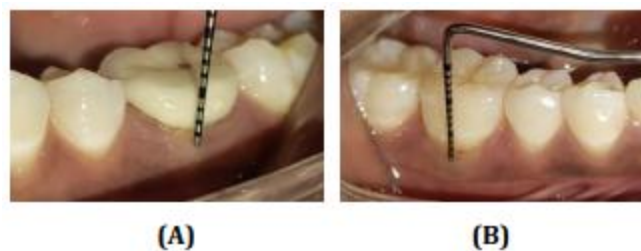


Figure 7: Recording of the gingival recession at the (A) test site and (B) control site

After that, plaque index was assessed using a plaque disclosing agent (Figure 8A and 8B). Disclosing solution was applied at the tip of a cotton swab stick and the tip was used to apply the disclosing agent onto the tooth surfaces, both facial and palatal/ lingual. After waiting for 30 seconds excess disclosing agent was suctioned out and plaque score was noted at both buccal and palatal/ lingual tooth surfaces according to the Turesky et al Modification of the Quigley Hein plaque indices [5].



Figure 8: Recording of the plaque index at the (A) test site and (B) control site

Lastly, radiographs were taken of the concerned teeth using photostimulable phosphor (PSP) x-ray plates by paralleling technique (Figure 9A and 9B), then developed in Vista scan x-ray developer which produced the result digitally on the computer screen (Figure 10A and 10B).

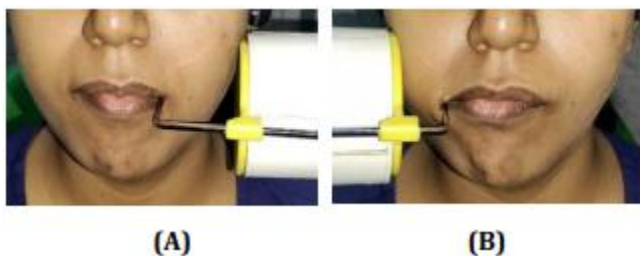


Figure 9: Paralleling technique used for taking IOPAR at the (A) test site and (B) control site

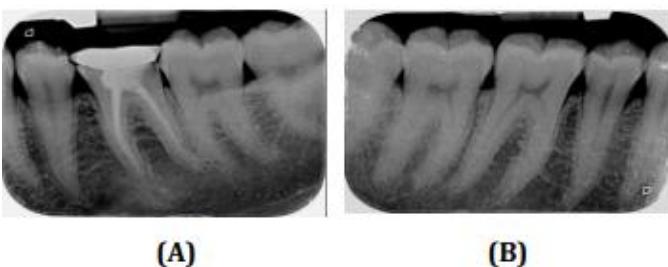


Figure 10: IOPA radiograph of the (A) test site and (B) control site

Here the type of proximal bone loss i.e., either horizontal or angular and amount of the bone loss was assessed. On the radiograph first a horizontal line was drawn digitally using the Vista scan software extending from the level of the bony crest on the healthy adjacent site to the site of our concern. Then another perpendicular line was drawn from that horizontal line to the depth of the bony defect

on the proximal sites which was recorded in millimetres (mm) to get the depth of the proximal defect.

2.6. Statistical analysis D'Agostino & Pearson test was performed to check the normality of the distribution of variables. Unpaired t test and Mann Whitney test was performed for normally and non-normally distributed variables, respectively. Chi squared test was performed for categorical data. Descriptive statistical data was represented by Mean and SD. P value less than 0.05 was considered as statistically significant. Statistical analysis was performed by using GraphPad Prism Software version 9.0e.

Results

(Table 1) depicts the inter group comparison of the different clinical parameters between the Group A and Group B. The comparative results between the two groups showed mean plaque score (MPS) to be more in the patients from Group B, whereas mean bleeding score (MBS), mean pocket depth (MPD) and mean gingival recession (MGR) were found increased in patients from Group A. Intergroup comparison of these parameters are statistically non-significant. But statistically significant difference were found in comparison of mean clinical attachment loss (MCAL) and mean proximal bone loss (MPBL) with higher values in group A. (Table 2) depicts the inter-group comparison of the percentage and type of proximal bone loss (TPBL) between Group A and Group B where both horizontal and angular type of proximal bone loss were more common in patients with Group A. The intra group comparison between the different groups with supragingival, equigingival and subgingival crowns revealed that the values of all the clinical parameters were higher in subjects with subgingival group followed by equigingival and supragingival groups.

The comparisons were non-significant except the comparison of mean proximal bone loss (MPBL)

between the supragingival - subgingival and supragingival equigingival crown group. Also, significant difference is found in the mean pocket depth between the equigingival and subgingival crown group.

Table 1: Inter-group comparison between Group A and Group B

Parameter	Group A	Group B	p value
MPS	1.424 ± 0.8023	1.609 ± 0.5860	0.2316
MBS	0.9646 ± 0.8156	0.7805 ± 0.8711	0.1220
MPD	2.189 ± 0.7015	1.988 ± 0.6077	0.1815
MCAL	2.272 ± 1.576	1.145 ± 1.626	0.0014*
MGR	0.7758 ± 0.8495	0.4908 ± 0.6777	0.1790
MPBL	2.324 ± 1.343	1.400 ± 0.8482	0.0013*

MPS- Mean plaque score; MBS- Mean bleeding score; MPD- Mean pocket Depth; MCAL-Mean clinical attachment loss; MGR- Mean gingival recession; MPBL- Mean proximal bone loss; * significant p value

Table 2: Comparison of type of bone loss between Group A and Group B

Type of proximal bone loss (TPBL)	Group A	Group B	p value
Angular	52.38%	45.24%	0.1716
Horizontal	45.24%	40.48%	
NA	2.38%	14.29%	

NA- Not applicable.

Discussion

A healthy coexistence between dental restorations and their surrounding periodontal structures is the goal of every dentist and the expectation of every patient. Over the years many concepts and techniques evolved and many were discarded or modified as they met with varying degrees of success or failure [7]. The key factors for achieving a healthy and biologically pleasing result are proper crown margin placement and gentle tissue management. Different locations of crown margins like supragingival, subgingival, and equigingival have been suggested for the placement of crown margins, each

having its advantages and disadvantages [8]. So, this study was conducted to assess the periodontal health of restored teeth with different margin locations compared to contralateral unrestored natural teeth. It has been documented in the literature that placement of fixed prosthetic restorations especially which has subgingival margins tends to accumulate good amount of plaque and becomes difficult to clean resulting in localised inflammation and periodontal destruction. In studies by Chan et al., 1986 [9] and Valderhaugh et al., 1993 [10], the plaque scores of the natural teeth recorded were higher than the contralateral teeth with fixed prosthesis. Glantz et al., 1969 [11] and Sorensen et al., 1989 [12] said factors like surface roughness of the crown influence the plaque retention capacity which can explain the higher mean plaque score in natural teeth as more micro roughness is present in the natural tooth surface than the metal ceramic crowns which were smoother and more polished. In the intragroup comparison of various crowned teeth, the supragingival crowned teeth showed less plaque score when compared to equigingival and subgingival crowned teeth which were non significant. This result is also in general agreement with studies by Silness et al., 1970 [13] and Orkin et al., 1987 [14]. The extension of the crown into the gingival pocket was thus not estimated otherwise, it is possible that significant differences could have been registered between the supragingival and the deepest subgingival crown margins. A study published in 1990 by Lang et al., 1990 [15], demonstrates how the absence of BOP represents a reliable indicator of periodontal stability. Intragroup comparison of the mean bleeding score revealed that the group A has higher mean value [0.9646 ± 0.8156] compared to group B [0.7805 ± 0.8711], though the difference was not statistically significant. Though plaque accumulation was seen less in the teeth with fixed

prosthesis, still the increased bleeding score is in accordance with the study done by Newcomb,1974 [16] and Kaqueler J et al., 1970 [17]. Newcomb 1974 [16] mentioned that the plaque bacteria are retained in the niche between the restoration and the tooth where they would not be measured by the plaque index. So, this explains that even though the plaque score is less in group A, still inflamed gingiva with greater bleeding score is seen in group A. Intergroup comparison of mean probing depth (MPD), mean clinical attachment loss (MCAL), Mean gingival recession (MGR), Mean proximal bone loss (MPBL), the values were found to be higher in the group A which is similar to the studies conducted by several authors like Al-Sinaidi et al., 2014 [18], Koke et al.,2003 [19] and Reddy et al., 2020 [20]. This observation might be considered due to increased plaque accumulation causing gingival inflammation. Socransky et al., 1984 [21] concluded that attachment loss begins as an inflammatory change in the connective tissue wall of the gingival sulcus in response to bacterial challenge and lead to further periodontal destruction. In the intragroup comparison, higher values of all the clinical parametres were found in the subgingival crown group followed by equigingival and supragingival crown patient groups. This results were similar to the findings by Müller,1986 [22] , Moretti et al.,2011 [23], Ahmad et al., 2018 [24] etc. The reason could be as described by Newcomb,1974 [16] and Silness,1970 [25] that, the subgingival crowns tend to accumulate more amount of plaque at the tooth-prosthesis interface as it becomes difficult to clean the area. According to Moretti et al [23] , sometimes the subgingival crown margin placement not only aggravates the inflammation but also violates the biologic width of the gingiva due to which greater attachment loss were seen in the subgingival crowned teeth. According to Aishwarya M et al., 2015 [26] , when

biologic width is violated, bone loss and gingival recession occur as the body attempts to recreate room between the alveolar bone and the margin to allow space for tissue reattachment. These explains the higher scores depicting more periodontal destructions in the subgingival group. 5. CONCLUSIONS So, within the limitations, this study evaluated the effect of fixed prosthetic restorations on the periodontal health which can be considered for planning a fixed prosthesis. One factor that directly influences the periodontal health status is the location of the prosthesis margin. Supragingival plaque accumulation appears to be higher in the natural teeth compared to the crowned teeth. But, the crown with sub gingival margins showed higher plaque accumulation than the supra and equigingival margins. Other factors like gingival biotype, teeth brushing habits of the patients etc. may affect the periodontal health following the placement of fixed prosthesis restorations, though these parameters were not assessed in this study. Longitudinal studies are required for assessing the long-term effect of fixed prosthetic restorations on periodontal health.

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