INTRODUCTION

The aim of any prosthodontic treatment plan is to restore the lost or missing tissue with prosthesis. This prosthesis should be compatible with existing hard and soft tissues and fulfill the functional and aesthetic requirements as well. It is important for the treating clinician to be knowledgeable about the interactions of these prosthodontic appliances with oral tissues and consequences of violating the integrity of these structures. Indirect restorations in the form of crowns and fixed partial dentures come in close proximity of the periodontal tissues. This interaction of margin of a fixed prosthesis with gingival tissue was classified by Gardner into three types, namely supra-gingival: if the margin terminated above the level of marginal gingival, juxta-gingival: if the margin lies at the level of marginal gingival and sub-gingival: if margin lies below the level of marginal gingival into the gingival sulcus. 1

The correct level of placement of margin of a fixed prosthesis has attracted a lot of debate. Reitemeier found increased plaque accumulation around sub-gingival margins of crowns and hence a poor gingival health. 2 Similar experiences have been reported by others. 3-10 In a literature review of 64 studies from 1953 to 2009, Kosifaki concluded that although supra-gingival placement of margins is most beneficial for the gingiva in long term, sub-gingival margins may be needed in areas of aesthetic concern. 11 De Baker reported that irrespective of margin configuration, it is the baseline periodontal health that determines the long term periodontal success of a fixed restoration. 12

There is virtually no consensus amongst the

OBJECTIVE: The objective of this study was to evaluate the association between crown margin and type of restorative material on the periodontal health of the restored teeth.

METHODOLOGY: This case control study was conducted on 100 patients (50 metal crowns, 50 porcelain fused to metal crowns) whose prosthesis were fabricated in the department of crown and bridge of Fatima Jinnah Dental College Hospital. Contra-lateral tooth of same patient served as control. Clinical evaluation was performed and periodontal indices including Bleeding index, Plaque index, and Pocket depth measurement were recorded on a proforma. CPI TN (Ash) “C” probe was used to record the readings. Data was analyzed with SPSS for windows using chi square test.

RESULTS: One hundred patients with either porcelain fused to metal crown (n=50) or metal crown (n=50) with unrestored and healthy contralateral dentition were included in the study. Teeth restored with supra-gingival margins scored better for bleeding index, plaque index and pocket depth as compared to teeth restored with sub-gingival margins (p value<0.01). The type of restorative material did not have an effect on recorded scores (p value>0.1).

CONCLUSION: Supragingival preparations for the crowns were better tolerated by the periodontium as compared to the subgingival preparations. There was no influence of type of restorative material on gingival health.

KEYWORDS: Crown margins, periodontal health, prosthodontic treatment.
researchers regarding the effects of type of restorative materials on gingival health. Al-Wahadni reported that ceramics attract more plaque irrespective of level of placement of crown margin. Similar findings were reported by Gemalmaz for all ceramic crowns with sub-gingival margins but contradicted Al-Wahadni in supragingival margin placement. Weishaupt et al. presented an interesting theory. According to their findings, particular alloy type may have a stabilizing effect on gingival health irrespective of level of margin placement. Contrary to the claim made by Weishaupt, Reitemeier did not find any effect of the type of alloy on gingival health.

In spite of overwhelming evidence, some clinicians still prefer sub-gingival margins. There is also a lack of local and national data on this topic. We hypothesize that there is no difference in periodontal status of teeth crowned with either porcelain fused to metal or metal crowns. It is the objective of current study to investigate the effect of the margins of fixed prosthesis and type of restorative material on the periodontal health of the fixed prosthesis fabricated in the department of crown and bridge, Fatima Jinnah Dental College Hospital.

**METHODOLOGY**

Current study was Case Control type conducted in the department of crown and bridge, Fatima Jinnah Dental College. Hundered patients with single unit full coverage crowns were selected by convenience sampling. The study population consisted fifty each of Metal and fifty of Porcelain fused to metal crowns. Patients between 20 years to 50 years of age of both sexes, having prosthesis on vital & non vital teeth, not less than six months old or more than two years old were included. Patients were excluded from the study if there was evidence of generalized periodontal problems, medical history which may affect the periodontal status such as Diabetes, Hepatitis,HIV, habit of eating pan, supari, smoking, patients on drugs which cause hyperplasia of gums such as Contraceptive pill, Cyclosporine A, Phenoobarbital & transplant patients because their immunity may be impaired. All prosthesis' were fabricated in the department of crown and bridge. Unrestored, healthy contralateral teeth in the same individual served as controls.

Patients were first briefed about the study. Their written consent was taken. Clinical evaluation were performed and periodontal indices recorded on a proforma. CPITN (Ash) “C” probe (fig. no. 1) was used to record the readings. Indices included Bleeding index, Plaque index, and Pocket depth measurement. The examination involved the use of a thin periodontal probe CPITN (Ash) “C” with a colored strip (running from 3.5 to 5.5) with a 0.5 mm ball at the tip. A single assessor who was a specialist with more than 5 years of experience assessed all the cases. During examination, the entire sulcus of the abutment and the control tooth was probed, and a reading was taken at six points. Readings were taken at the mesiobuccal, midbuccal, distobuccal, and corresponding lingual/palatal areas. The probe was inserted into the crevice until resistance was met, at which point reading was taken. Similarly readings were recorded for bleeding and plaque index (fig. no. 2) as well as for the level of placement of margins as been either supragingival or sub-gingival and the type of restorative material (metal or porcelain fused to metal). Data was compared using 'Chi Square' test with SPSS for windows version 11.

![Fig. no 1: CPITN Probe](image)

**RESULTS**

A total of 100 patients were included in the study, out of which 50 had all metal crowns and 50 had porcelain fused to metal crowns. The teeth that received the crowns were compared to the same teeth on the opposite side of the same arch (contra lateral) using them as a control. The comparison with the controls was done on the basis of bleeding index, plaque index, and pocket depth.

Among the 50 patients who received porcelain fused to metal crowns (n=35) 70% had supragingival preparations and the (n=15) 30% were sub gingival. Whereas out of 50 patients who received all metal crowns, (n=42) 84% had supragingival preparations and only (n=8) 16% had sub gingival preparations.
**BLEEDING ON PROBING:**

In porcelain fused to metal crowns with supragingival preparations significantly more (n=34, 97%, p value<0.01) patients had no bleeding on probing compared to those with subgingival preparations in which (n=4) 27% patients had bleeding on probing. Similar results were found in the case of metal crowns where (n=42) 100% (p value<0.01) patients with supragingival preparations had no bleeding on probing while (n=8) 25% patients with subgingival preparations had bleeding on probing. *P value<0.01

<table>
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<tr>
<th>Margins</th>
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<th>Metal Crowns</th>
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</tr>
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<tr>
<td>No Bleeding</td>
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<td>42</td>
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<tr>
<td>Sub-Gingival</td>
<td>N=15</td>
<td>N=8</td>
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<tr>
<td>Bleeding</td>
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<td>2</td>
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<tr>
<td>No Bleeding</td>
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*Table No 1. Bleeding Index Scores*

**PLAQUE INDEX:**

In porcelain fused to metal crowns with supragingival preparations (n=34) 97% patients had a plaque index score of 0, and (n=1) 3% had a plaque index score of 1. None of these had a plaque index score of 2 and 3. On the other hand, (n=11) 73% patients with subgingival preparations had a plaque index score of 0, (n=3) 20% had a score of 1, and (n=1) 7% had a score of 2. None of the patients had a score of 3. However, in all metal crowns with supragingival preparations (n=42) 100% patients had a plaque index score of 0, while in subgingival preparations (n=6) 75% had a score of 0, (n=1) 13% had a score of 1 and (n=1) 12% had a score of 2. *P value<0.01

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*Table No 2. Plaque Index Scores*

**POCKETPROBING DEPTH:**

In porcelain fused to metal crowns with supragingival preparations, when pocket depth was measured significantly more (n=34, 97%, p value<0.01) patients had pocket depth score of 0, and (n=1) 3% had a score 1. None of these had a score of 2. On the other hand, (n=11) 73% patients with subgingival preparations had a score of (n=3) 0, 20% had a score of 1, and (n=1) 7% had a score of 2. Whereas, in all metal crowns with supragingival preparations (n=42) 100% patients (p value<0.01) had a pocket depth score of 0, while in subgingival preparations (n=6) 75% had a score of 0, (n=1) 13% had a score of 1 and (n=1) 12% had a score of 2. *P value<0.01

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*Table No 3. Plaque Index Scores*

**TYPE OF RESTORATIVE MATERIAL:**

When the scores of both types of materials, i.e. porcelain fused metal and full metal crowns were compared for bleeding index, plaque index and periodontal depth, no statistically significant difference was found. (p value>0.1)

**DISCUSSION**

Level of the margin in relation to gingiva may be the most important biologic factor responsible for maintaining long term health of adjacent soft tissues. Supra gingival margin is the desired configuration if there are no contraindicating factors, e.g. short crown height, deep caries etc. The benefits of surpa-gingival margins are manifold. They produce less gingivitis than sub gingival margins. Impression taking is easier. It is also easy to assess the fit and to maintain them. According to Gemalmaz and Ergin, the reason for better periodontal health around supra-gingival margin is twofolds:’

1) Supragingival preparation/restoration are easy to clear.
2) They do not violate the biological width.
Marcum also observed a favorable periodontal response if the margins were located at the gingival crest, as compared to sub-gingival placement. Silness in a cross sectional study concluded that supragingival positioning of the crown margins seemed to be most favorable. Valderhaug did a 10 years follow-up to study the effects of different placement of crown margins on gingival health, loss of periodontal attachment and incidence of caries. He observed that in teeth where the crown margins were located supragingivally and in the control teeth, there was no change in the mean pocket depth during the 10 years observation. Similarly, he observed that supragingival preparations resulted in the least amount of loss of attachment followed by margins at the gingival crest and then subgingival crown margins. Same author reported similar findings in a 15 year clinical and radiographic follow-up study. Reitemeier in 2002 observed that the risk of bleeding at intra-sulcular posterior crown margins was approximately twice that at supragingival margins. All of these observations are in agreement with our study results. In the current study the sample size for supra gingival group (n=77) was far greater than sub gingival group (n=23) which is a limitation of our study. However, this probably highlights the currently prevailing mindset of the operators in our department which favors the supra- gingival placement.

Sub gingival margins of the fixed prosthesis are known to cause deleterious effects on gingiva. However, other factors also contribute to poor periodontal health around crowns, such as open and over-hanging margins, irregular surface texture and over-contoured morphology leading to improper emergence profile, all of which have been extensively documented. These various factors provide a stagnation area for plaque to collect. The micro-organisms inhibiting the plaque induce an inflammatory response which manifests itself as gingival inflammation. These ill effects of such margins have been well documented. Larato in his study observed an increase in pocket depth with subgingival crown margins. Stein and Glickmann in 1960, Kahn in 1965 and Cripps in 1968 were all of the opinion that crowned teeth extending subgingivally, however well constructed, were potential irritants to the tissues. Other investigators have also shared similar experiences.

Sub-gingival margins, although carrying a bad reputation, may be necessary in certain situations as long as they don't violate biological width. In situations where aesthetics is the over-riding factor and in teeth with less available occluso-gingival height of crown, as is the case in certain second and third molar situations, sub-gingival preparations may be unavoidable. Other situations where such margins are considered are deep caries, existing restorations, fractures and root sensitivity. Such preparations especially in esthetic zone may be difficult for patient to clean and may promote gingival inflammation on a long term basis and may even become unsightly thus defeating the primary purpose of aesthetics. In such situations, clinician should pay extra attention to other important aspects such as emergence profile, smoothness of surface and accurate adaptation of margin alongwith the proper oral hygiene maintenance by the patient.

In the context of sub-gingival margins, it may be reasonable to believe that the resistance of gingiva to impingement from restorative margins shows a linear relationship with the width of attached gingival. Such observations were made by Stetlar and Bissada who studied the long term effects of the placement of sub gingival restoration in zones of keratinized gingiva greater than and less than 2.0mm. They observed that in the presence of subgingival restorations, the degree of gingival inflammation is significantly greater in association with narrow ( <2.0mm ) zones of the keratinized gingiva than with those greater than 2.0mm. On the other hand, non restored teeth with either wide or narrow zones showed no significant difference. It may be noted that the above mentioned, well published results are not endorsed by some researchers. One study has reported that crown margins located at the gingival crest cause less inflammation than margins placed supragingivally or subgingivally. Another study by Richter and Ueno revealed no difference between subgingival and supragingival placement. Koth concluded from his study that gingival inflammation around sub-gingival margins can be controlled or minimized if the restorations are adequate and patient maintains his oral hygiene. Jones concluded much of the inflammatory response can be directly related to the standard of marginal fit of the crown rather than its level. Similar findings were reported by Kancyper. These views are not supported by our study. Researchers have also focused their attention on the effect of type of restorative material on gingival health. Reitemeier reported that type of alloy did not affect the level of plaque accumulation and gingival health was similar around any alloy. Christensen in a comparison of zirconium to metal fused to porcelain crowns also made similar conclusions. Kancyper also noted similar findings. The results of our study are in agreement with above mentioned studies. Our
sample was equally matched for the porcelain fused to metal and all metal crowns and presented an equal chance to both types of materials for a good comparison. It may however be noted that these observations are contradicted by some researchers. Al-Wahadni reported that all ceramic restorations attract more plaque irrespective of level of placement.19 Gemalmaz in a clinical trial of IPS Empress crowns also agreed with Al-Wahadni19. Weishaupt et. al. concluded in their study that galvano-ceramic crowns may accumulate less plaque as compared to metal ceramic crowns. They attributed certain stabilizing effect of this particular material for a favorable gingival response.55 We used relatively simple and easy to use indices, the bleeding index, plaque index and the pocket depth index. Several other researchers have also used similar indices in their publications.2, 9, 12, 46, 47 These indices do not have a steep learning curve and are relatively inexpensive. Other methods to assess health of gingiva include use of laser Doppler flowmetry to record the blood flow and has been reported to be equal in efficacy to the simpler indices.46 Others have proposed innovative ways to assess the margins as it directly influences good periodontal health. Mitchell has proposed profilometry as a non destructive method to judge the margins clinically.49 A surgical operating microscope may be used to assess and improve marginal adaptation, as proposed by Sheets.50

CONCLUSION

We draw following conclusions from this study:

☐ Supra-gingival margins were found to be associated with better periodontal health.

☐ The type of restorative material had no effect on the health of periodontal tissues.

REFERENCES

20. Gilmore N, Sheiham A. Overhanging dental...


