

AN UPDATE ON THE EFFECT OF CROWN MARGIN LOCATIONS AND MATERIALS ON PERIODONTAL HEALTH

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ABSTRACT

This study aimed to evaluate the clinical effect of crown margin position and crown material on the periodontal health. 200 patients were examined, half of the patients received all ceramic crowns and the rest received porcelain fused to metal crowns. Contra-lateral tooth of same patient served as control. Teeth restored with supragingival margins scored better bleeding index, plaque index and probing pocket depth index as compared to teeth restored with subgingival margins and there was no difference between all ceramic and porcelain fused to metal crowns on periodontal health.

KEY WORDS: Crown margins, periodontal and gingival health, PFM, All ceramic

INTRODUCTION

Fixed prosthesis should be compatible with existing hard and soft tissues and fulfill the functional and aesthetic requirements as well. The relationship between periodontal health and the restoration of teeth is intimate and inseparable. It is important for the treating clinician to be knowledgeable about the interactions of these restorations with oral tissues and consequences of violating the integrity of these structures¹. The correct level of placement for a fixed prosthesis

margin has attracted a lot of debate. Reitemeier et al,² found increased plaque accumulation around crowns with subgingival margins and hence a poor gingival health. In a literature review of 64 studies from 1953 to 2009, Koyifaki et al,³ concluded that although supragingival placement of margins is most beneficial for the gingiva in long term, subgingival margins may be needed in areas of aesthetic concern. De Baker et al,⁴ reported that irrespective of margin configuration, it is the baseline periodontal health that determines the long term periodontal

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success of a fixed restoration. Disagreement exists regarding the effects of type of crown material on gingival health. Al-Wahadni et al,⁵ reported that ceramics attract more plaque irrespective of level of placement of crown margin. Similar findings were reported by Gemalmaz and Ergin⁶ for all ceramic crowns with subgingival margins but contradicted Al-Wahadni et al,⁵ in supragingival margin placement. Weishaupt et al,⁷ 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. However, not much is known about surface finish of the tested restorations. Contrary to the claim made by Weishaupt,⁷ Reitemeier et al,² did not find any effect of the alloy type on gingival health. In spite of overwhelming evidence, some clinicians still prefer sub-gingival margins. The aim of study was to investigate the clinical effect of the crown margin positions and crown materials on the periodontal health.

MATERIAL AND METHODS

This study was conducted at the department of Oral Rehabilitation Sciences, Faculty of dentistry, Beirut Arab University-Lebanon. Two hundred patients with single unit full coverage crowns were selected by convenience sampling. The study population consisted one hundred each of all ceramic and one hundred of porcelain fused to metal crowns. Patients between 23 years to 55 years of age of both

sexes (68 females and 32 males with PFM crowns and there were 73 female and 27 male patients with all ceramic crowns) having prosthesis on vital and 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 or medically compromised. Unrestored, healthy contra lateral teeth in the same individual served as controls. Patients were first briefed about the study. Written consent was obtained and clinical evaluation was performed. Using CPITN periodontal probe, periodontal indices were recorded and included Bleeding index, Plaque index, and Probing pocket depth measurement^{8,9}. One periodontist with more than 10 years of experience assessed all the cases.

During examination, the entire sulcus of the abutment and the control tooth were probed, and a reading was taken at six points. Readings were taken at the mesiobuccal, midbuccal, distobuccal, and corresponding lingual/palatal areas. The probe inserted into the crevice until resistance was met, at which point reading was taken. Similarly readings were recorded for bleeding and plaque index table1, as well as for the level of placement of margins as either supragingival, or sub-gingival. Also, the material of construction (all ceramic or porcelain fused to metal [PFM]). Data was compared using 'Chi Square' test with SPSS for windows version (11), $P < 0.05$ was considered statistically significant.

TABLE (1) Indices used in the study⁸, Bleeding index, Plaque index, and Pocket depth⁹

Value/index	Bleeding Index	Plaque Index	Pocket depth
0	No bleeding on probing	No plaque	Clinical gingival sulcus of 3.5mm or less
1	Bleeding on probing	Looks clean but plaque can be removed from gingival 3rd by probe	>3.5 and < or =5.5
2	Spontaneous bleeding	More than 1mm plaque at cervical margin	>5.5mm
3		Tooth covered with abundant plaque	

RESULTS

Data revealed that 60% among the 100 patient who received PFM to metal crowns had supragingival preparations and the 40% were subgingival. Whereas 64% of all ceramic crowns, had supragingival preparations and 36% had subgingival preparations. The distribution of the crowns by the type of tooth is displayed in table (2).

Bleeding on probing

Table 3 summarizes bleeding on probing scores as number and percentage. Analysis of the data revealed that bleeding on probing was statistically significant with subgingival margins in comparison to supragingival preparations in both PFM and all ceramic crowns (p value<0.01). However, when comparing PFM and all ceramic crowns no statistically significant difference was found (p value>0.1).

Plaque index

Table 4 lists the of plaque index scores as number and percentage. Analysis of the results showed that the difference between plaque index score for supragingival as compared to subgingival margin was statistically significant (p value<0.01). However, no statistically significant difference was found between PFM and all ceramic crowns (p value>0.1).

Probing pocket depth

Table 5 shows the probing pocket depth index scores. The results showed that the difference of probing depth index scores for supragingival as compared to subgingival margin was statistically significant (p value<0.01). Also, no statistically significant difference was found between PFM and all ceramic crowns (p value>0.1).

TABLE (2) The distribution of the crowns by the type of tooth

Tooth type	PFM crowns	All ceramic crowns
Maxillary incisors	16	24
Maxillary canine	3	6
Maxillary premolars	28	25
Maxillary molars	21	17
Mandibular incisors	2	3
Mandibular canine	1	2
Mandibular premolars	17	13
Mandibular molars	12	10

TABLE (3) Bleeding on probing index scores

Margins	PFM crowns		All ceramic crowns	
Supragingival	N=60	Percentage	N=64	Percentage
Bleeding	12	20 %	9	14 %
No bleeding	48	80 %	55	86 %
Subgingival	N=40	Percentage	N=36	Percentage
Bleeding	26	65 %	27	75 %
No bleeding	14	35 %	9	25 %

TABLE (4) Plaque index scores

Margins	PFM crowns		All ceramic crowns	
Supragingival PI	N=60	Percentage	N=64	Percentage
0	55	91 %	60	94 %
1	3	5 %	4	6 %
2	2	4 %	0	0 %
Subgingival PI	N=40	Percentage	N=36	Percentage
0	8	20 %	6	18 %
1	28	70 %	24	64 %
2	4	10 %	6	18 %

TABLE (5) Probing depth index scores

Margins	PFM crowns		All ceramic crowns	
Supragingival PI	N=60	Percentage	N=64	Percentage
0	52	86 %	58	91 %
1	4	7 %	4	6 %
2	4	7 %	2	3%
Subgingival PD	N=40	Percentage	N=36	Percentage
0	8	20 %	6	17 %
1	30	75 %	26	72 %
2	2	5 %	4	11 %

DISCUSSION

Crown restorations are considered as major contributing factor in the etiology of periodontal disease. L  e¹⁰ in his classic study reviewed the reactions of the periodontal tissues to certain restorative procedures and materials. While optimal periodontal health is expected to improve success of dental care, it cannot overcome the effect of a crown restoration that extends into the subgingival area and may be responsible for causing damage to the periodontal tissue. This can occur by increasing

the possibility for mechanical retention of bacteria and/or by a direct irritation effect from using a restorative material that retains more dental plaque. Amsterdam¹¹ wrote a classic treatise on periodontal prosthesis more than 35 years ago, establishing the standard of care for a crown. He described the optimal margin/finish line which should be placed in a healthy sulcus at a minimal depth, just shy of the junctional epithelium. In guidelines still followed today, he suggested that to prevent plaque build up, it is necessary to create optimal crown contours

with proper coronal form, embrasure form, and subgingival fit at the margin.

Results of this study revealed that crowns with supragingival preparations demonstrated superior gingival health indices compared to subgingival preparations which is in contradiction with a study by Richter and Ueno¹² who revealed no difference between subgingival and supragingival placement. Koth¹³ reported that gingival inflammation around subgingival margins can be controlled or minimized if the restorations are adequate and patient maintains his oral hygiene. Also, majority of the inflammatory response can be directly related to the standard of marginal fit of the crown rather than its level.^{14, 15}

Subgingival 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 margins⁹, irregular surface texture and over-contoured morphology leading to improper emergence profile. Some of these drawbacks could be related to difficulty in tissue retraction before impression making and in recording subgingival details. These various factors provide a stagnation area for plaque to collect.^{1, 16, 17, 21}

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.³ Other situations where such margins are considered are deep caries, existing restorations, fractures and root sensitivity.¹⁷ 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 along with the proper oral hygiene maintenance by the patient.^{16, 18}

The results of this study showed that when the scores of both types of materials, i.e. porcelain fused metal and all ceramic crowns were compared for bleeding index, plaque index and probing pocket depth, no statistically significant difference was found (p value > 0.1). This is in agreement with Reitemeier et al,² who reported that type of alloy did not affect the level of plaque accumulation and gingival health was similar around any alloy. Also, Christensen¹⁹ in a comparison of zirconium to metal fused to porcelain crowns also made similar conclusions. Kancyper¹⁵ and Abidi et al,¹ also noted similar findings. It has to be mentioned that with disregard to framework material, (zirconia, metal, or glass ceramic) the veneering porcelain remains relatively the same in regards to composition and surface texture.

Al-Wahadni et al,⁵ reported that all ceramic restorations attract more plaque irrespective of level of placement. Gemalmaz and Ergin⁶ in a clinical trial of IPS Empress crowns reported similar finding. Weishaupt et al,⁷ reported that galvanoceramic 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.

This study incorporated relatively simple, inexpensive and easy to use indices as: the bleeding index, plaque index and the probing pocket depth index. Several other researchers have also used similar indices in their publications^{1, 2, 4, 20}

Restoring a tooth with compromised periodontal health with an appropriate full-crown, using modern materials that are shown to reduce the risk of additional plaque retention or a negative inflammatory response, should now be considered the treatment of choice for maintaining prolonged

dental health. If periodontal health is to be considered the future of success for dental care, it is imperative to use restorative procedures and materials which can help maintain a healthy periodontium.

CONCLUSION

Within limitations of this study, the periodontal health and hygiene were significantly better with supragingival margins compared to subgingival preparations while no differences were found between all ceramic and porcelain fused to metal restorations on periodontal health.

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