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Quantitative evaluation on the ability of dental plaque adherence to commonly used provisional crowns

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Abstract

Purpose: To evaluate plaque formation on commonly used provisional crowns.

Method: Ten patients undergoing the full veneer crown for lower molar selected for the study. Three different provisional crowns were made from stainless steel, Bis acryl composite, poly methyl methacrylate resin. They were cemented randomly for 24 hour interval. Sterile wooden tooth prick was used to collect the plaque. Micro weighing machine was utilized to evaluate the amount of plaque accumulated. The Data collected was subjected for ANOVA statistical analysis to find the significance among the group and multiple analyses

Results: Chemical composition, surface characteristic plays an important role in plaque accumulation. Stainless crowns had least amount (0.0005 gm) of plaque accumulated,followed by Bis acryl composite (0.0016 gm) and poly methyl methacrylate (0.0025gm) provisional crowns.

Conclusion: Stainless steel crowns were best provisional crown from hygienic point whenever the clinical situation demands long term provisional's. Alternatively Bis Acryl composite provisional crowns can be used in esthetic region.

Key words: Plaque, Provisional crowns, Crown and bridge.

Introduction:

Interim provisional restoration plays a very important, vital role in crown and bridge restoration during the time interval between tooth preparation and final restoration. Apart from

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restoring esthetics and protecting pulp, they also help in preserving periodontium. Certain clinical situation demands provisional crowns to be maintained for the long period of time. These include financial constraints, non availability of time from the patient, to create the proper emergence profile like in the case of ovate pontic, periodontal pathology requiring time to recover to healthy situation before a final definitive prosthesis[1]. To be successful, like any other restorative material's temporary crowns should have good physical, mechanical properties and importantly excellent biocompatibility[2, 3]. Preservation of periodontal health is one of the main biological requirements of the provisional crown; it is as important as protection of tooth pulp. Provisional crowns should not encourage plaque accumulation to prevent gingival inflammation. Presence of gingival inflammation leads to complicated impression taking and difficulty in evaluation of final restoration for marginal adaptation and esthetics[4]. Plaque accumulation may initiate or recur periodontal disease in the susceptible patients[5]. So plaque retentiveness of the provisional restoration is no less important compared to their permanent restorative counterpart.

Many provisional restorative materials are available in the market. These materials enable the dentist to fabricate the temporary crown in direct, indirect or indirect-direct method. Temporary crown materials are mainly of two types, first one is prefabricated external surface form provisional crowns like polycarbonate, stainless steel, steel, aluminum, cellulose acetate. Second type of material help in making custom made provisional crowns, these are basically polymers like polymethyl methacrylate, poly ethyl methacrylate, Bisacryl composite, urethane dimethacrylate. Polymers are used to make custom made external surface form with the help of template made on tooth before preparation.

When varieties of provisional materials are available in the market, the dentist should select the best provisional crown material in the interest of the patient. It is well known that plaque is the main etiological factor in the periodontal diseases. Plaque accumulation varies greatly among the different restorative materials. Compared to provisional crowns, available literature is mainly concentrated on the plaque retaining properties of permanent restorations. Majority of the literature available on provisional restoration is regarding their comparative evaluation of physical and mechanical properties, all important plaque retaining properties are not evaluated enough. Hence authors felt plaque retaining capability of temporary crowns is prominent criteria to be evaluated, enabling the dentist to make informed decision. The study was designed to evaluate the plaque retaining capability of the three commonly used provisional crowns.

Materials and methods:

Total of Ten patients undergoing full veneer crown treatment on a lower first molar were selected for the study. Average age group of the patients was 25-35 years. Approval from Institutional Committee of Ethics Research was obtained for the study. Before the initiation of the treatment, patients were given information about the study, and written informed consent was obtained from all the patients participated in the study. Three different provisional crowns were made on the same prepared lower first molar for each patient with the interval of 24 hours. Influencing factors for plaque accumulation were standardized, since all three temporary crowns were made on the same tooth of an individual. The provisional crowns fabricated were divided into three following groups.
Group-I: The crowns were made from polymethyl methacrylate polymer (Temporary cold v, Major Prodotti Dentari S.p.A. Moncalieri, Italy.)

Group –II: The crowns were made from bisacryl composite (Protemp-II, 3M™ ESPE™ St. Paul, USA).

Group-III: Stainless steel provisional crown (Primary molar crowns,3M™ ESPE™ St. Paul, USA). Additional silicone putty index was made in the metal stock tray on the tooth to be prepared before tooth preparation. Direct fabrication method was used to construct temporary crown from polymethyl methacrylate polymer and Bisacryl composite (protemp-II). After fabrication of Group, I and Group II provisional crowns, they were checked comprehensively for the marginal adaptation and any defect on the external surface with the help of dental magnifying loop and dental explorer. Group I- crowns were properly polished by the pumice/water mix, while Group II were wiped thoroughly with an ethyl alcohol swab. This ensured the provisional crowns had the best surface to discourage plaque accumulation. Group III Stainless steels temporary crowns were selected by measuring the prepared crown width with the caliper. Cervical margins and axial contours were properly adjusted with the special pliers provided. Before the cementation of the crown, margin adaptation and surface were rechecked for any defect. Three different provisional crowns fabricated were cemented on the same tooth in random sequence. These crowns were

replaced with another crown made from different material with intervening gap of 24 hours(one day).All provisional crowns were cemented with non eugenol temporary luting cement. Patients were advised not to brush the provisional crown quadrant for 24 hours. Sterile wooden tooth prick was used to collect the plaque from the provisional crowns. Plaque was collected from external surfaces of the crown (Occlusal, Axial, Proximal surfaces) by scraping the crown thoroughly. Sterile tooth prick was weighed before and after plaque collection in digital micro weighing machine (Sartorius, Data Weighing Systems, Inc.Elk Grove, USA).This provided the weight of the plaque collected for the crown during 24 hours time. Statistical analysis ANOVA and pair wise analysis was performed using SPSS v.18.0 (IBM Corp., Armonk, NY, USA).

Table -1 Collected plaque weight (gm) in Group I, Group II and Group III samples

Sample No	Group-I(PMM)			Group-II(Bis-acryl)			Group-III(S.steel)		
	WBP	WAP	CPW	WBP	WAP	CPW	WBP	WAP	CPW
1	0.1672	0.1717	0.0045	0.1601	0.1631	0.0088	0.1398	0.1411	0.0013
2	0.1567	0.1577	0.001	0.0544	0.0549	0.0005	0.1449	0.1453	0.00041
3	0.1237	0.125	0.0013	0.0408	0.0421	0.0013	0.1429	0.1431	0.00020
4	0.1314	0.1408	0.0094	0.1415	0.1424	0.00090	0.1393	0.1394	0.00009
5	0.1338	0.1408	0.0070	0.1407	0.1416	0.00090	0.1465	0.1474	0.00090
6	0.1406	0.1440	0.0033	0.1416	0.1428	0.0012	0.1465	0.1474	0.00090
7	0.1525	0.1535	0.001	0.1583	0.1592	0.00090	0.1406	0.1440	0.00080
8	0.1323	0.1340	0.0017	0.1515	0.1520	0.0005	0.1413	0.1416	0.00029
9	0.1520	0.1535	0.0015	0.1535	0.1540	0.0005	0.1409	0.1409	0
10	0.1406	0.1440	0.0033	0.1622	0.1631	0.00089	0.1823	0.1828	0.0005

PMM-poly methyl methacrylate. WBP: weight before plaque collection
WAP: weight after plaque collection. CPW: collected plaque weight.

Table 2:Means and standard deviations of plaque weight for each group (Group I, Group II, Group III).

Group	N	Mean	Std Dev	Std Error	95%confidence interval for Mean	
					Lower Bound	Upper bound
Group I	10	0.0025	0.00274	0.00087	0.0006	0.0035
Group II	10	0.0016	0.00253	0.00080	-0.0002	0.0045
Group III	10	0.0005	0.00042	0.00013	0.0002	0.0008
Total	30	0.0016	0.00225	0.00041	0.0007	0.0024

F value=2.1119, P value= 0.140

Table 3: Multiple Comparisons test between the groups

(I) Group	(J) GROUP	Mean difference (I-J)	Std.Error	Sig.	95% confidence interval	
					Lower bound	Upper bound
Group I	Group II	.00089	.00097	.366	-.0011	.0029
	Group III	.00199*	.00097	.050	.0000	.0040
Group II	Group I	-.00089	.00097	.366	-.0029	.0011
	Group III	.00110	.00097	.050	-.0009	.0031
Group III	Group I	-.00199*	.00097	.050	-.0040	.0009
	Group II	-.00110	.00097	-.050	-.0031	.0000

***-The mean difference is significant at the 0.05 level**
Dependent variable: Plaque weight
Least Significant Difference(LSD)

Results:

Table- 1 Depicts total weight of the plaque collected across all three groups.

Table -2 shows the difference in means and standard deviation of accumulated plaque weight. Mean plaque accumulation on the Poly methyl methacrylate provisional crown was 0.025gm, followed by Bis Acryl provisional crown at 0.0016gm,and 0.0005gm for stainless steel crown.

It also displays the statistical analysis by one way analysis of variance (ANOVA) to compare the difference in mean dental plaque weight between the Group I, Group II, Group III. It shows the statistically insignificant difference between all groups with 'F' value of 2.119, and 'p' value of <0.140.

Table-3 shows the pair wise comparison between different groups. There is statistically significant difference between polymethyl methacrlate crown (group-I) and stainless steel crown (group –III) with p value 0.050 , while the difference between other crowns are not statistically significance. ie between protemp(group-II) and polmethyl methacrylate,P value is 0.366,and between Group-II and Group-III is 0.266. Study results indicated the plaque accumulation on provisional crowns made from poly methyl methacrylate was found to be highest and least on the crowns made from stainless steel crown.

Discussion:

It is well documented and proved beyond doubt that the bacteria present in the dental plaque plays the major role in initiation and progression of periodontal diseases as well as dental caries[6]. This plaque comprises of host constituents, cell-free enzymes, polysaccharides and bacteria. Dental plaque is found on all hard surfaces present in the oral cavity, including dental enamel, restorations, crowns, and implants. Provisional restorations are mandatory because of their beneficial contributions like protection of pulp, and periodontium, mechanical contribution includes the protection of prepared tooth from fracture, maintain the tooth position, lastly esthetic needs of the patients. Surface free energy and surface roughness of the restorative materials plays the important role in the plaque accumulation[7.] Large number of studies has been conducted to compare the rate and amount of plaque accumulation on different restorative materials[8,9,10,11]. Studies indicated that the less plaque accumulation on glazed porcelain, Gold restoration compared to the polymers[12.] Chemical composition of restoration surface also plays a very important role in initial bacterial adhesion to the surface[13.] Different provisional restorative materials provide the different surface character and environment for the dental plaque accumulation. So it is important for the dentist to select the best hygienic provisional crown in the interest of a patient.

This study included three provisional crowns fabricated from poly methyl methacrylate, Bisacryl composite and stainless steel material. These provisional crowns are cemented in the patient mouth to evaluate the comparative plaque accumulation on them.

Within in the limitation of the study the stainless steel crowns were most hygienic with the least amount of plaque weight (0.0005 gm) . The metallic surface with its glossy surface showed it to be the best surface to discourage the plaque accumulation. Bis

acryl composite provisional crowns had 0.0016 gm mean plaque accumulation. Polymethyl methacrylate provisional crowns had the highest plaque accumulation (0.0025 gm).Both Bis acryl polymers and polymethymethacrylate composed of hydrophilic polymer resin matrix and monomer content of resin shown to encourage more bacterial proliferation and adhesion.

Summary:

Any restorations to be successful should not encourage the plaque accumulation. So the provisional restorations are no exception to the above-mentioned rule. They should discourage the plaque accumulation to be successful as the good provisional restorative materials. The provisional restorative material which is not hygienic in nature might induce the periodontal diseases, inflammation of residual ridge area and pulpal irritation from bacterial bye products. This study helps the dentist in making the informal decision while selecting the hygienic provisional crowns. Within the limitation of the study following conclusions can be drawn:

1) Among the provisional crown tested stainless steel crowns were found to be best hygienic crowns, followed by bisacryl composite, highest plaque accumulation found on the polymethyl methacrylate crowns.

2) Where ever there is a need for long term provisional crowns according to the study stainless steel crowns (group-I) should be preferred.

3) In the areas of esthetic concern among the provisional crowns tested Bisacryl composite (Group-II) provisional crowns are the best alternative.

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