

Original Article

# Analysis of Plaque index and Bleeding on Probing around the Single Tooth Implant with Cement and screw-Retained Implant Prosthesis

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**Abstract** - This prospective comparative experimental clinical study aimed to investigate the long-term clinical success of dental implants restored with cemented or screw retention systems. A total of 100 participants were enrolled for this study with the following inclusion criteria: (1) Patients having a single implant with cement and screw-retained Implant prosthesis, (2) Patients with good oral hygiene, (3) Non-alcoholic and Nonsmoker patients, (4) Age between 20 - 65years. They were divided into two groups where 50 participants received cemented (Group A) and 50 received screw (Group B) retentive implant prosthesis, and a follow-up period of at least 24 months was integrated into this study. The modified plaque index (MPI) and bleeding on probing (BOP) were measured. Statistical analysis was done by SPSS (Statistical Package for Social Science). The results were reported, and comparisons were done by Chi-square test, Fisher exact test, and a P-Value of <0.05 was considered significant. The results revealed that after 18 and 24 months of implantation, participants in Group-A had a significantly higher number of teeth with plaque (90.0% and 96.0%, respectively) than Group B (28.0% and 54.0%, respectively). Furthermore, the tooth of Group A had a significantly higher number of teeth with BOP (70.0% and 94.0%, respectively) than the tooth of Group B (14.0% and 46.0%, respectively). It can be concluded that the screw-retained implant prosthesis is preferable to the cemented prosthesis concerning their periodontal status.

**Keywords** - Bleeding on probing, Cement retained prosthesis, Screw-retained prosthesis.

## I. INTRODUCTION

The dental implant is considered one of the most effective alternative treatment options for replacing a lost tooth.<sup>1</sup> However, it is also a concern that the success of dental implants is depended on several factors, such as the retention of the prosthesis and their effect on the periodontium.<sup>2</sup> The retention of the implant prosthesis is usually performed either by cemented or screw system. In screw-retained restorations, it provides a solid joint between the restoration and the implant abutment, while in the cement-retained prosthesis, the retentive screw is eliminated.<sup>1,2</sup> However, in many cases, during the cementation procedure, removal of the excess luting agent is difficult, and the presence of residual cement is thought to be a risk factor for gingivitis (mucositis) and peri-implantitis.<sup>3</sup> Furthermore, when removing the cemented prosthesis is required, the entire restoration is damaged. Moreover, several studies have reported that different biological complications such as peri-implant inflammation, soft tissue swelling, and bleeding on probing occur in this type of prosthesis.<sup>2,4,5</sup> The only advantages of screw-retained implant restorations are their predictable retention, irretrievability, and lack of potentially retained sub-gingival cement.<sup>1,6,7</sup>

According to previous studies, periodontal diseases such as peri-implantitis are responsible for implant failure, which is usually evaluated through plaque index and bleeding on probing of soft tissue around implants.<sup>4,6</sup> Furthermore, many researchers have indicated that the prosthetic reconstruction of endogenous implants is performed by using either cement or screw-retained on the osseointegrated root. Therefore the



long-term success depends on the condition of the periodontium around the dental implants.<sup>8</sup>

The previous studies verify the effect of the cement and screw-retained restorations on the periodontium. In the cemented restoration, although losing the screw could be prevented, gingivitis and peri-implantitis are more frequent following the completion of the therapy.<sup>4,9</sup> On the other hand, in the screw-retained restoration, the results of the previous studies differ from the cemented restoration in that losing the screw is greater. Still, it is associated with fewer incidences of gingivitis and peri-implantation and bleeding on probing.<sup>2,7,10</sup> Furthermore, at least 5 mm height of the abutment is required for proper retention and resistance of cement-retained prosthesis. Therefore, the screw-retained prosthesis is indicated in that situation where inter arch space dictates an abutment shorter than 5mm.<sup>2</sup>

Based on the previous studies, it can be hypothesized that the screw-retained implant prosthesis might be preferable to the cemented prosthesis concerning their periodontal status.<sup>7,10</sup> However, before concluding, the effect of screw-retained implant prosthesis on periodontium is needed to be justified. Therefore, in this comparative experimental clinical trial, the effect of the screw-retained dental implant on the peri-implant tissue employing modified plaque index (MPI) and bleeding on probing (BOP) was assessed, and the results were compared with the results of the cemented retained prosthesis.

**II. METHODS**

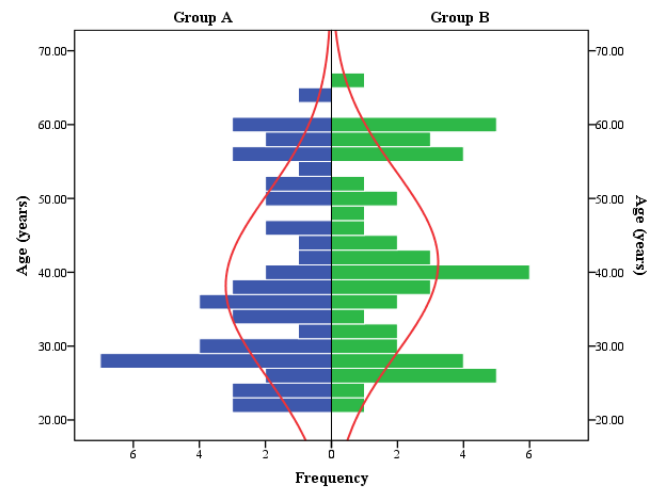
This prospective comparative experimental clinical trial was conducted in the Department of Prosthodontics of Holy Family Red Crescent Medical College Hospital (HFRCMCH) and different Dental clinics in Dhaka. A total of 50 cement retained (Group A) and 50 screw retained (Group B) participants in their single tooth implant prosthesis were selected with the following inclusion criteria: 1. The patient has a single implant with cement and screw-retained Implant prosthesis. 2. Patients with good oral hygiene. 3. Non-alcoholic and Non-smoker patient. 4. Age between 20 - and 65 years. A standard clinical and laboratory procedures were followed, and each patient was evaluated after 6, 12, 18 and 24 months of fixation. The periodontal status around the implant prosthesis was evaluated using the Modified Plaque index (MPI) and Bleeding on probing. The collected data were recorded and statistically analyzed to see the result's significance. Statistical analysis was done by SPSS (Statistical Package for Social Science). The results were reported, and comparisons were done by Chi-square test, Fisher exact test, and a P-Value of <0.05 was considered significant.

**III. TABLES & FIGURES**

**Table 1. Distribution of the study subjects according to age (N=100)**

Age (years)	Group A f (%)	Group B f (%)	df	t	p-value
21 - 30	19 (38.0)	13 (26.0)			
31 - 40	13 (26.0)	14 (28.0)			
41 - 50	6 (12.0)	9 (18.0)			
51 - 60	11 (22.0)	13 (26.0)			
>60	1 (2.0)	1 (2.0)			
Total	50	50			
Mean ± SD	38.16 ± 12.46	41.30 ± 12.35	98	1.266	0.209 <sup>ns</sup>
Min-max	21 - 63	22 - 65			

An unpaired t-test was done to measure the level of significance.  
ns – not significant



**Fig. 1 Histogram of the age of the study subjects in two groups (N=100)**

**Table 2. Distribution of the study subjects according to gender (N=100)**

Gender	Group A f (%)	Group B f (%)	df	χ <sup>2</sup>	p-value
Male	30 (60.0)	28 (56.0)	1	0.164	0.685 <sup>ns</sup>
Female	20 (40.0)	22 (44.0)			
Total	50	50			

A Chi-Square test was done to see the level of significance  
ns – not significant

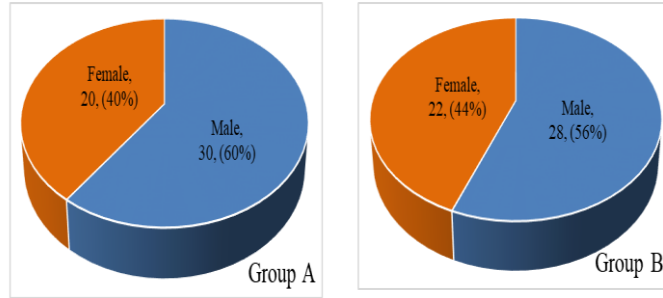


Fig. 2 Gender-wise distribution of the study subjects in two groups

Table 3. Plaque status at baseline and after the procedures at different follow-ups (N=100)

Plaque status	Group A f (%)	Group B f (%)	df	$\chi^2$	p-value
Baseline	0	0			
After 6 months	7 (14.0)	0	1	7.52	<sup>a</sup> 0.012*
After 12 months	26 (52.0)	3 (6.0)	1	25.69	<sup>a</sup> <0.001***
After 18 months	45 (90.0)	14 (28.0)	1	39.72	<sup>b</sup> <0.001***
After 24 months	48 (96.0)	27 (54.0)	1	23.52	<sup>b</sup> <0.001***

<sup>a</sup> Fischer's Exact test and <sup>b</sup>Chi-Square test were done to see the level of significance

\* significant

\*\*\* highly significant

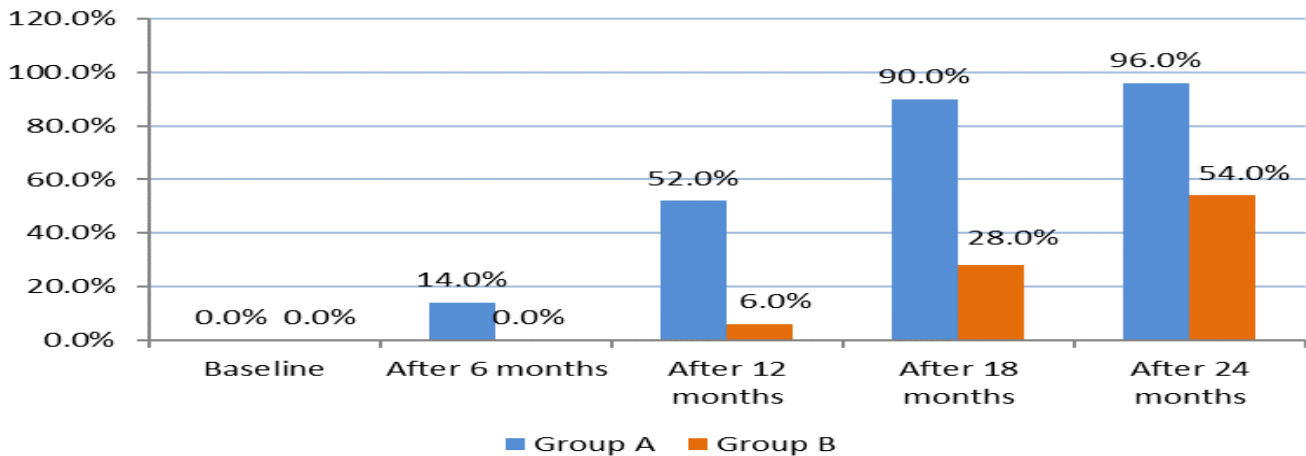


Fig. 3 Plaque status at baseline and after the procedures at different follow-ups

Table 4. Bleeding on probing status at baseline and after the procedures at different follow-ups (N=100)

Bleeding on probing	Group A f (%)	Group B f (%)	df	$\chi^2$	p-value
Baseline	10 (20.0)	0	1	11.11	<sup>a</sup> 0.001*
After 6 months	7 (14.0)	0	1	7.52	<sup>a</sup> 0.012*
After 12 months	19 (38.0)	2 (4.0)	1	17.42	<sup>a</sup> <0.001***
After 18 months	35 (70.0)	7 (14.0)	1	32.18	<sup>b</sup> <0.001***
After 24 months	47 (94.0)	23 (46.0)	1	27.42	<sup>b</sup> <0.001***

Fischer's Exact test and <sup>b</sup>Chi-Square test were done to see the level of significance

\* significant

\*\*\* highly significant

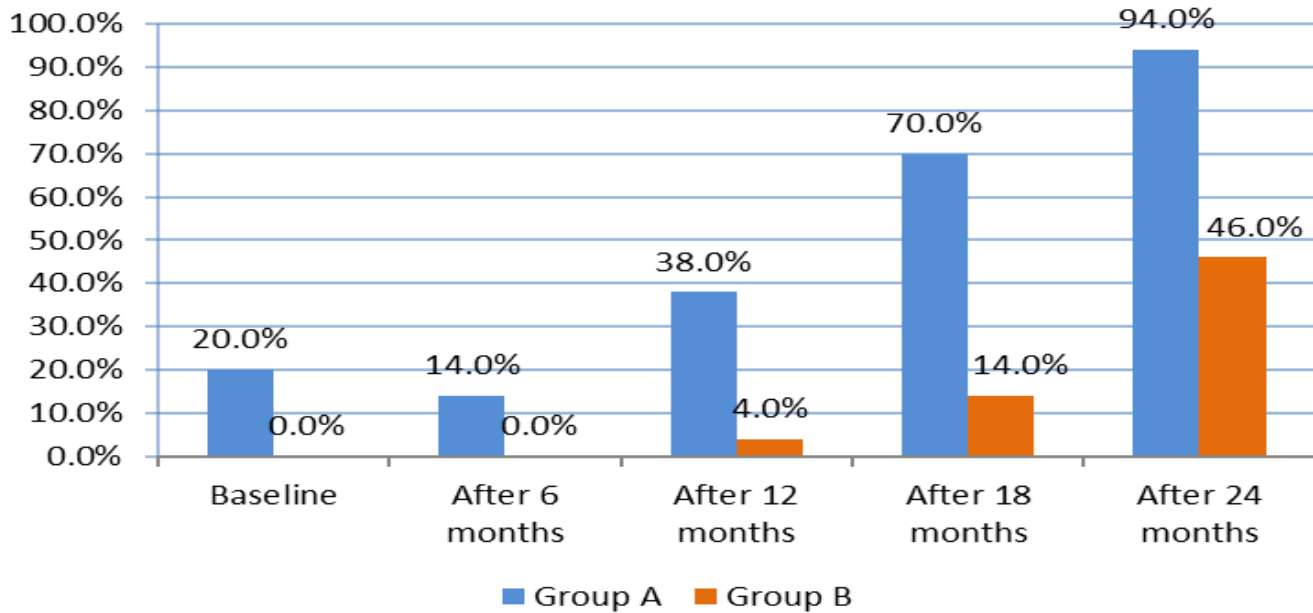


Fig. 4 Bleeding on probing status at baseline and after the procedures at different follow-ups

#### IV. RESULTS

The distribution of patients based on age is shown in Figure 1 and the appendix. The ages of the patients ranged from 20 to 65 years. The mean age of the patients in Group-A was  $38.16 \pm 12.46$  years, ranging from 21 to 63 years, and the mean age of the patients in Group-B was  $41.30 \pm 12.35$  years, ranging from 22 to 65 years. The highest frequencies of patients were from the age group 21-30 years in Group-A and 31-40 years in Group-B. On the other hand, the lowest frequencies were found in the age group  $> 60$  years in both patients.

A total of 100 patients were treated and evaluated in this study. Males were enrolled more than females in both groups. In Group-A, the male was 60.0%, and the female was 40.0%, while in Group-B, the male was 56%, and the female was 44% (Fig.2). The male patients were higher in frequency and percentage than female patients. A Chi-square test was done to measure the level of significance. The difference in frequency and percentage between male and female patients was not statistically significant.

After six months of implantation, the plaque was formed on 14.0% of the teeth in Group-A patients but not on any of the teeth in Group-B patients had plaque ( $P=0.012$ ). The plaque was formed on a significantly greater number of teeth (52.0%) in Group A patients after 12 months of implantation than in (6.0%) teeth of Group B patients ( $P<0.001$ ). Similarly, after 18 months and 24 months of implantation, Group-A patients had a significantly higher tooth with plaque, 90.0%, and 96.0%, than Group B patients, 28.0% and

54.0%, respectively ( $P<0.001$ ). The difference in plaque status between the two groups was statistically highly significant.

After six months of implantation, 14.0% of the teeth in Group-A patients had bleeding on probing (BOP), but none of the teeth in Group-B patients had BOP ( $p=0.012$ ). Group A patients had a considerably higher number of teeth with BOP (38.0%) than Group B patients (4.0%) after 12 months of implantation ( $p<0.001$ ). Group A patients had a considerably higher number of teeth with BOP (70.0%) than Group B patients (14.0%) after 18 months of implantation ( $p<0.001$ ). Similarly, Group A patients had a considerably larger number of teeth with BOP (94.0%) than Group B patients (46.0%) after 24 months of implantation ( $p<0.001$ ).

#### V. DISCUSSION

The present study results confirmed the hypothesis that the screw-retained implant prosthesis is preferable to the cemented prosthesis concerning their periodontal status. The evaluation techniques (MPI and BOP) used in the present study were originally based on some of the previous studies; the alteration in peri-implant tissue was observed after placement of the prosthetic crown, which may compromise the esthetics of the prosthesis and lead to a compromised clinical result and patient dissatisfaction.<sup>11,12,13</sup> Furthermore, the present study results revealed that the complications related to peri-implant tissues are frequently associated with dental plaque and bleeding on probing. However, the results found in the present study had some similarities and dissimilarities with that of the previous studies.

After six months of implantation, the plaque was formed on 14.0% of the teeth in Group-A (Cement) participants but not on any teeth in Group-B(Screw). The plaque was formed on a significantly greater number of teeth (52.0%) in Group A after 12 months of implantation than in Group B (6.0%). Similarly, after 18 and 24 months of implantation, participants in Group-A had a significantly higher number of teeth with plaque (90.0% and 96.0%, respectively) than in Group B (28.0% and 54.0%, respectively). The results correspond to the previous studies that biological complications occurred due to plaque deposition around cement-retained implant restorations.<sup>14,15,16</sup> This is also supported by the previous studies that the deposition of soft debris results in mucositis. It may be induced by modified plaque index more in response to cement-retained prosthesis but rare with screw-retained prosthesis.<sup>17,18,19</sup> These studies have coincided with the results of the present study.

Regarding the bleeding on probing (BOP), the present study results revealed bleeding on probing was observed on 14.0 % of the teeth in Group-A after six months of implantation but not on any of the teeth in Group B. After 12 months of implantation, Group A patients had a significantly higher number of teeth having BOP (38.0%) than Group B (4.0%). Similarly, after 18 and 24 months of implantation, the tooth of Group A had a significantly higher number of teeth with BOP (70.0% and 94.0%, respectively) than a tooth with Group B (14.0% and 46.0%, respectively). Previous studies also revealed a significantly greater amount of undetected cement when the marginal position was deeper.<sup>20,21,22</sup> better soft tissue concealing, and relatively shallow cement margin of tissue-level implants could be the possible reason for BOP positive sites of cemented crowns. Previous studies also support that the overflow or the remaining residual cement around the implant results in peri-implant inflammation followed by swelling and bleeding on probing.<sup>23,24,25</sup> These studies have coincided with the results of the present study.

## VI. CONCLUSION

It can be concluded that the screw-retained implant prosthesis is preferable to the cemented prosthesis concerning their periodontal status.

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