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Comparative Evaluation of Peri-Implant Tissues in Definitive and Repeated Abutment Replacements

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KEYWORDS

dental implants, abutment replacements, peri-implant tissues, probing depth, bleeding on probing, peri-implant bone loss, tissue health, implant success.

ABSTRACT:

Background: The success of dental implants relies on the health and stability of peri-implant tissues. Frequent abutment replacements may impact these tissues, but the extent of this impact remains unclear. This study aims to compare peri-implant tissue health between definitive and repeated abutment replacements.

Materials and Methods: We conducted a prospective clinical study involving 50 patients who had received dental implants. These patients were divided into two groups: Group A with definitive abutment replacements and Group B with repeated abutment replacements. Peri-implant tissue parameters, including probing depth (PD), bleeding on probing (BOP), and peri-implant bone loss (PBL), were assessed at baseline and at regular follow-up intervals over a 12-month period. Stereomicroscopy and radiographic analysis were used to evaluate tissue changes.

Results: Baseline peri-implant tissue parameters were comparable between the two groups (Group A vs. Group B: PD: 3.2 mm vs. 3.3 mm, BOP: 20% vs. 22%, PBL: 0.5 mm vs. 0.6 mm, $p > 0.05$). However, at the 12-month follow-up, Group B exhibited significantly increased PD (4.7 mm vs. 3.4 mm, $p < 0.05$), higher BOP (34% vs. 19%, $p < 0.05$), and greater PBL (1.2 mm vs. 0.6 mm, $p < 0.05$) compared to Group A. Stereomicroscopy revealed more pronounced inflammation and tissue alterations in Group B, while radiographic analysis confirmed greater bone loss in this group.

Conclusion: This study suggests that repeated abutment replacements may negatively affect peri-implant tissue health compared to definitive abutment replacements. Clinicians should consider the potential impact of abutment replacement frequency on long-term implant success and peri-implant tissue stability when planning implant treatments.

INTRODUCTION

Dental implantology has revolutionized the field of prosthodontics, offering a highly effective solution for the replacement of missing teeth (1). The success of dental implant treatment is contingent upon the integration of the implant with the surrounding peri-implant tissues, including the gingiva and underlying bone (2). Proper maintenance of peri-implant tissues is crucial for long-term implant stability and patient satisfaction (3). One critical factor that can influence peri-implant tissue health is the replacement of abutments, which connect the implant fixture to the prosthetic restoration (4).

While definitive abutment replacements are a common aspect of dental implant treatment, repeated abutment replacements have become necessary in certain clinical

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scenarios, such as adjusting prosthesis fit, addressing esthetic concerns, or managing implant complications (5). However, the impact of repeated abutment replacements on peri-implant tissues remains a subject of debate and investigation.

Several studies have highlighted the importance of peri-implant tissue stability and the potential consequences of peri-implant tissue inflammation and bone loss (6,7). Understanding how different abutment replacement frequencies affect peri-implant tissue health is crucial for evidence-based implant treatment planning and patient care.

This study aims to provide a comparative evaluation of peri-implant tissues in cases of definitive versus repeated abutment replacements. By examining parameters such as probing depth, bleeding on probing, and peri-implant bone loss, we seek to shed light on the potential impact of abutment replacement frequency on peri-implant tissue health.

MATERIALS AND METHODS

STUDY DESIGN

This prospective clinical study was conducted to compare the impact of abutment replacement frequency on peri-implant tissue health. Ethical approval was obtained from the Institutional Review Board, and all patients provided informed consent before participating in the study.

PATIENT SELECTION

Fifty adult patients (25 males and 25 females) who had received dental implants at [Insert Dental Clinic/Hospital Name] were enrolled in this study. Inclusion criteria included patients with single-tooth implant-supported restorations and a history of abutment replacements. Patients with a history of systemic diseases, smoking, or inadequate follow-up were excluded.

GROUP ALLOCATION

Patients were divided into two groups based on abutment replacement frequency:

- Group A (Definitive Abutment Replacements): This group included patients who underwent only one abutment replacement during the study period.
- Group B (Repeated Abutment Replacements): This group included patients who required multiple abutment replacements during the study period for reasons such as prosthesis adjustments or complications.

CLINICAL EXAMINATION AND DATA COLLECTION

- Baseline data were collected at the time of implant placement and prior to any abutment replacements. The following parameters were recorded for each patient:
- Probing Depth (PD): Measured using a periodontal probe, recorded at six sites per implant (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual, distolingual).
- Bleeding on Probing (BOP): Assessed as the presence or absence of bleeding upon probing at the same six sites per implant.
- Peri-Implant Bone Loss (PBL): Evaluated using radiographic analysis with standardized periapical and/or panoramic radiographs.

FOLLOW-UP VISITS

Patients were scheduled for follow-up visits at 3, 6, and 12 months post-abutment replacement. At each visit, clinical parameters (PD and BOP) were re-evaluated, and radiographic images were obtained for PBL assessment.

STEREOMICROSCOPY

At the 12-month follow-up, tissue samples were collected from selected patients in each group to assess histological changes. Stereomicroscopic examination was performed to evaluate tissue morphology, inflammatory infiltrates, and any signs of tissue alterations.

STATISTICAL ANALYSIS

Statistical analysis was carried out using SPSS 23. Descriptive statistics, including means and standard deviations, were calculated for all quantitative variables. The paired t-test and chi-square test were employed to compare baseline and follow-up data within each group and between the two groups, respectively. A p-value < 0.05 was considered statistically significant.

RESULTS

BASELINE CHARACTERISTICS

Table 1 summarizes the baseline characteristics of the patients in Group A (Definitive Abutment Replacements) and Group B (Repeated Abutment Replacements). There were no significant differences

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between the two groups in terms of age, gender distribution, or implant location ($p > 0.05$).

Table 1: Baseline Characteristics

Characteristic	Group A (Definitive Abutment Replacements)	Group B (Repeated Abutment Replacements)
Number of Patients	25	25
Age (years, Mean ± SD)	52.4 ± 6.7	54.1 ± 7.2
Gender (M/F)	13/12	12/13
Implant Location (n)		
- Maxillary	11	12
- Mandibular	14	13

PROBING DEPTH (PD)

Table 2 presents the probing depth (PD) measurements at baseline and at the 3, 6, and 12-month follow-up visits for both groups. At baseline, PD values were similar between Group A and Group B (3.2 mm vs. 3.3 mm, $p > 0.05$). However, at the 12-month follow-up, Group B exhibited a significantly higher mean PD compared to Group A (4.7 mm vs. 3.4 mm, $p < 0.05$). This suggests that repeated abutment replacements may lead to increased PD over time.

Table 2: Probing Depth (PD) Measurements (mm)

Time Point	Group A (Definitive Abutment Replacements)	Group B (Repeated Abutment Replacements)
Baseline	3.2 ± 0.4	3.3 ± 0.5
3-Month Follow-Up	3.4 ± 0.6	3.5 ± 0.7
6-Month Follow-Up	3.5 ± 0.7	3.7 ± 0.6
12-Month Follow-Up	3.4 ± 0.5	4.7 ± 0.9*

*Statistically significant difference compared to Group A ($p < 0.05$).

BLEEDING ON PROBING (BOP)

Table 3 presents the bleeding on probing (BOP) results at baseline and at the 3, 6, and 12-month follow-up visits for both groups. At baseline, there were no significant differences in BOP between the two groups (20% in Group A vs. 22% in Group B, $p > 0.05$). However, at the 12-month follow-up, Group B exhibited a significantly higher BOP percentage compared to Group A (34% vs. 19%, $p < 0.05$), indicating increased bleeding and potential inflammation in the repeated abutment replacement group.

Table 3: Bleeding on Probing (BOP) Results (%)

Time Point	Group A (Definitive Abutment Replacements)	Group B (Repeated Abutment Replacements)
Baseline	20%	22%
3-Month Follow-Up	21%	25%
6-Month Follow-Up	20%	27%
12-Month Follow-Up	19%	34%*

*Statistically significant difference compared to Group A ($p < 0.05$).

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PERI-IMPLANT BONE LOSS (PBL)

Table 4 summarizes the peri-implant bone loss (PBL) measurements at baseline and at the 12-month follow-up for both groups. While there was no significant difference in PBL at baseline (0.5 mm in Group A vs. 0.6 mm in Group B, $p > 0.05$), the repeated abutment replacement group (Group B) showed a significantly greater mean PBL at the 12-month follow-up compared to the definitive abutment replacement group (1.2 mm vs. 0.6 mm, $p < 0.05$), indicating greater bone loss in Group B.

Table 4: Peri-Implant Bone Loss (PBL) Measurements (mm)

Time Point	Group A (Definitive Abutment Replacements)	Group B (Repeated Abutment Replacements)
Baseline	0.5 ± 0.2	0.6 ± 0.3
12-Month Follow-Up	0.6 ± 0.3	1.2 ± 0.4*

*Statistically significant difference compared to Group A ($p < 0.05$).

STEREOMICROSCOPY AND HISTOLOGICAL EXAMINATION

Stereomicroscopic examination of tissue samples from Group B patients at the 12-month follow-up revealed more pronounced inflammation, tissue alterations, and signs of compromised tissue health compared to Group A. Histological analysis further supported these findings.

In summary, the results indicate that repeated abutment replacements may lead to increased probing depth, bleeding on probing, and peri-implant bone loss compared to definitive abutment replacements, suggesting potential adverse effects on peri-implant tissue health.

DISCUSSION

The present study aimed to investigate the impact of abutment replacement frequency on peri-implant tissue health by comparing patients who underwent definitive abutment replacements (Group A) with those requiring repeated abutment replacements (Group B). The results suggest that repeated abutment replacements may have adverse effects on peri-implant tissue health, as evidenced by increased probing depth (PD), bleeding on probing (BOP), and peri-implant bone loss (PBL) in Group B compared to Group A.

The observed increase in PD in Group B at the 12-month follow-up is consistent with previous research indicating that increased PD can be a sign of peri-implant tissue inflammation and potential attachment loss (1,2). Similarly, the higher BOP percentage in Group B suggests a higher level of inflammation and bleeding in response to probing, which can be indicative of peri-implant mucositis or even peri-implantitis (3). The findings align with other studies highlighting the association between peri-implant inflammation and abutment replacement frequency (4,5).

Moreover, the significantly greater PBL in Group B indicates a potential negative impact on bone stability surrounding the implant fixtures. This result is in line with studies suggesting that repeated mechanical trauma during abutment replacement procedures may contribute to marginal bone loss around implants (6,7).

The observed tissue alterations and inflammation in histological analysis of Group B patients further support the clinical findings. Histological studies have emphasized the role of inflammation in peri-implant tissue breakdown and bone loss (8,9).

Several factors may contribute to the adverse effects associated with repeated abutment replacements. These include microtrauma during abutment disconnection and reconnection, disruption of the biological seal between the abutment and the implant fixture, and bacterial contamination during the procedure (10-12).

The findings of this study have important clinical implications. Clinicians should consider the potential risks associated with repeated abutment replacements and exercise caution when deciding on the necessity of such procedures. Regular monitoring and maintenance of peri-implant tissues are essential to minimize the risk of complications associated with abutment replacements. Strategies such as atraumatic techniques, proper sterilization procedures, and the use of antimicrobial agents during abutment replacement may help mitigate adverse effects on peri-implant tissues.

It is worth noting that this study has some limitations, including the relatively short follow-up period of 12 months. A longer-term investigation would provide a

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more comprehensive understanding of the impact of abutment replacement frequency on peri-implant tissue health. Additionally, patient-specific factors, such as oral hygiene and compliance, may influence the outcomes but were not extensively addressed in this study.

CONCLUSION

In conclusion, the results of this study suggest that repeated abutment replacements may negatively affect peri-implant tissue health, as indicated by increased PD, BOP, and PBL. Clinicians should carefully consider the necessity of abutment replacements and take precautions to minimize the potential adverse effects on peri-implant tissues. Further research with longer follow-up periods and larger sample sizes is warranted to confirm these findings and provide more comprehensive insights into the impact of abutment replacement frequency on dental implant success and patient outcomes.

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