



EVALUATION OF CONTACT AREA ACCURACY IN FIXED PROSTHESIS AND ITS ROLE IN PREVENTING PERIODONTAL DISEASE

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Abstract

Background: Proximal contact areas in fixed prostheses play a vital role in maintaining periodontal health by preventing food impaction, preserving gingival architecture and ensuring long-term restoration success. Inaccurate contacts may contribute to gingival inflammation and periodontal breakdown. This study aimed to evaluate the accuracy of contact areas in fixed prostheses and their association with periodontal health.

Methods: This cross-sectional observational study was conducted in the Department of Prosthodontics, Bangabandhu Sheikh Mujib Medical University (BSMMU) and beau-dent, Dhaka, Bangladesh, from January 2021 to December 2021. A total of 120 patients who received fixed partial dentures and fulfilled the inclusion criteria were enrolled. Demographic characteristics, accuracy of proximal contacts and periodontal status were assessed. Data were analyzed using the Chi-square test to determine associations between contact accuracy and periodontal health.

Results: The mean age of patients was 39.8 years, with females comprising 55.8% of the study population. Accurate contact areas were observed in 68.3% of cases, while 21.7% had open contacts and 10.0% had tight or deficient contacts. Among patients with accurate contacts, 85.4% maintained a healthy periodontium, compared to only 50.0% in the tight contact group and 46.2% in the open contact group. Periodontal disease was detected in 14.6% of patients with accurate contacts versus 52.6% of those with inaccurate contacts, a difference that was statistically significant ($p < 0.001$).

Conclusion: Accurate proximal contacts in fixed prostheses are strongly associated with healthier periodontal status. Proper prosthetic design and precise clinical execution are essential to minimize periodontal complications and ensure long-term success.

Key words: Fixed partial denture, Proximal contact, Periodontal health, Prosthodontics.

Introduction

Fixed prosthodontic treatment plays an essential role in restoring oral function, esthetics and patient comfort. In addition to improving mastication and appearance, fixed partial dentures must maintain harmony with the surrounding periodontal tissues to ensure long-term success [1]. One of the critical determinants of prosthesis success is the accuracy of proximal contact areas between the prosthesis and adjacent natural teeth [2]. Properly established contacts prevent food impaction, maintain arch integrity and support periodontal health, while inadequate or deficient contacts are frequently

associated with gingival inflammation, pocket formation and secondary periodontal disease [3].

Periodontal disease remains one of the leading causes of tooth loss globally, including in developing countries, where the burden of oral diseases is rising due to limited awareness, irregular dental visits and insufficient preventive care [4]. Studies have shown that iatrogenic factors such as overhanging margins, open contacts and improper contour of restorations contribute significantly to localized periodontal breakdown [5]. Food impaction resulting from open or tight contacts is a common clinical complaint in prosthodontic patients and has been linked to discomfort, halitosis and progressive periodontal destruction if left uncorrected. Therefore, careful evaluation of contact area accuracy is vital not only for prosthetic longevity but also for preserving periodontal health [6].

Previous international studies have highlighted the association between defective proximal contacts and periodontal complications; however, evidence from South Asian populations remains limited [7]. Given the variations in oral hygiene practices, dietary patterns, and access to dental care in this region, it is important to assess how prosthodontic factors such as contact area accuracy affect periodontal outcomes [8]. Prosthetic treatment requires particular consideration in patients with periodontal disease [9]. At the time of this study, most clinical evaluations in our context focused on caries prevention and prosthesis survival, while relatively less attention was given to their impact on periodontal health [10,11]. For optimal treatment outcomes, collaboration between prosthodontists and periodontists is essential to increase restoration longevity, support periodontal health, and enhance patients' quality of life [12].

This study was therefore undertaken to evaluate the accuracy of contact areas in fixed prostheses and to investigate their role in preventing periodontal disease in patients attending the Department of Prosthodontics, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. By assessing the relationship between contact accuracy and periodontal status, this research aims to provide baseline data that can guide clinicians in improving treatment quality, preventing prosthesis-related periodontal complications and ultimately enhancing the long-term success of fixed prosthodontic therapy in Bangladesh.

Methodology & Materials

This cross-sectional observational study was conducted in the Department of Prosthodontics, Bangabandhu Sheikh Mujib Medical University (BSMMU) and beau-dent, Dhaka, Bangladesh, over a period of one year from January 2021 to December 2021. A total of 120 patients who received fixed partial dentures and fulfilled the selection criteria were included. The inclusion criteria were patients aged 20 years and above, with at least one fixed prosthesis placed for replacement of missing teeth and willing to participate in the study. Exclusion criteria included patients with systemic conditions affecting periodontal health such as diabetes mellitus or immunocompromised states, those with poor oral hygiene practices, history of smoking, pregnancy, ongoing orthodontic treatment and patients who had received periodontal therapy within the past six months. After obtaining informed consent, each patient was clinically examined to evaluate the accuracy of proximal contact areas of the fixed prosthesis using dental floss and radiographic confirmation where indicated. Contact areas were classified as accurate, open, or tight/deficient. The periodontal status was assessed by examining gingival health, presence of bleeding on probing, periodontal pocket depth and clinical attachment loss. Data were collected in a structured case record form and subsequently entered into a database. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 22.0. Descriptive statistics such as frequency and percentage were calculated for demographic variables, prosthesis contact accuracy and periodontal health outcomes. Inferential statistics including Chi-square test were applied to determine the association between contact area accuracy and periodontal disease, with a p-value < 0.05 considered statistically significant.

Results

Table 1: Demographic Characteristics of Study Population (n = 120)

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
20–29	17	14.2
30–39	42	35.0
40–49	37	30.8
≥50	24	20.0
Gender		
Male	53	44.2
Female	67	55.8

Table 1 presents the demographic characteristics of the study population consisting of 120 patients who received fixed prostheses. The majority of patients were in the age group of 30–39 years (35.0%), followed by 40–49 years (30.8%). A smaller proportion of patients were aged 20–29 years (14.2%), while 20.0% were 50 years or older. Regarding gender distribution, females constituted a slightly higher proportion (55.8%) compared to males (44.2%).

Table 2: Accuracy of Contact Area in Fixed Prosthesis

Contact Area Status	Number of Patients (n)	Percentage (%)
Accurate	82	68.3
Open Contact	26	21.7
Tight/Deficient Contact	12	10

Table 2 shows the distribution of contact area accuracy in fixed prostheses among the study subjects. The majority of prostheses demonstrated accurate contact areas (68.3%), while 21.7% had open contacts and 10.0% showed tight or deficient contacts.

Table 3: Periodontal Status in Relation to Contact Accuracy

Contact Accuracy	Healthy Periodontium n (%)	Gingivitis n (%)	Periodontitis n (%)
Accurate (n=82)	70 (85.4)	10 (12.2)	2 (2.4)
Open Contact (n=26)	12 (46.2)	8 (30.8)	6 (23.0)
Tight Contact (n=12)	6 (50.0)	4 (33.3)	2 (16.7)

Table 3 illustrates the periodontal status of patients in relation to contact area accuracy. Among the 82 patients with accurate contacts, the majority (85.4%) had a healthy periodontium, while only 12.2% presented with gingivitis and 2.4% with periodontitis. In contrast, patients with open contacts showed a higher prevalence of periodontal problems, with nearly half (46.2%) maintaining periodontal health, while 30.8% developed gingivitis and 23.0% suffered from periodontitis. Similarly, in the tight contact group, 50.0% maintained periodontal health, whereas gingivitis and periodontitis were observed in 33.3% and 16.7% of cases, respectively.

Table 4: Association Between Contact Area Accuracy and Periodontal Disease

Contact Accuracy	Periodontal Disease Present n (%)	Periodontal Disease Absent n (%)	p-value
Accurate (n=82)	12 (14.6)	70 (85.4)	<0.001 *
Inaccurate (n=38)	20 (52.6)	18 (47.4)	

*Chi-square test applied, significant at $p < 0.05$

Table 4 demonstrates the association between contact area accuracy and the presence of periodontal disease. Among patients with accurate contacts, only 14.6% exhibited periodontal disease, while the vast majority (85.4%) remained periodontally healthy. In contrast, more than half of the patients with inaccurate contacts (52.6%) presented with periodontal disease compared to 47.4% who did not. The association between contact accuracy and periodontal health was statistically significant ($p < 0.001$).

Discussion

The demographic profile of the study population demonstrated a balanced distribution across age and gender categories, with the largest proportion of participants aged 30–39 years (35.0%) and a slightly higher representation of females (55.8%) compared to males (44.2%). These findings are consistent with the study by Shetty et al.[13], which also reported comparable age and gender distributions among patients receiving fixed dental prostheses. Similar to Shetty et al.[13], the current study highlights the importance of considering demographic factors when evaluating periodontal health in prosthetic patients, as variations in age and gender may influence susceptibility to periodontal changes and prosthesis-related complications. The alignment of demographic characteristics across studies reinforces the representativeness of the present sample and supports the generalizability of the findings in the context of fixed prosthodontic treatment and periodontal outcomes.

The present study evaluated the relationship between contact area accuracy in fixed prostheses and periodontal health in Bangladeshi patients. Out of 120 participants, the majority (68.3%) exhibited accurate contacts, while 21.7% showed open contacts and 10.0% had tight or deficient contacts. Importantly, periodontal disease was present in only 14.6% of patients with accurate contacts compared to 52.6% among those with inaccurate contacts, a statistically significant association ($p < 0.001$). These findings highlight the crucial role of proper proximal contact in preserving periodontal health and preventing disease progression.

The biological and mechanical interrelationship between prostheses and periodontal tissues has been well documented. John et al., emphasized that accurate proximal contacts reduce food impaction, plaque retention and subsequent inflammation, thereby maintaining a healthy periodontium [14]. This supports our observation that 85.4% of patients with accurate contacts maintained periodontal health, whereas gingivitis and periodontitis were significantly higher in the open and tight contact groups.

Previous literature has shown that deficiencies in provisional or definitive restorations can predispose to gingival inflammation and periodontal breakdown. Patras et al., reported that ill-fitting restorations and deficient contacts are among the most common causes of plaque retention and soft tissue irritation [15]. Similarly, Puri et al., highlighted the importance of restorative precision in mitigating the risk of periodontal deterioration, which is in agreement with our finding that 30.8% of patients with open contacts developed gingivitis and 23.0% progressed to periodontitis [16].

Biomechanical considerations also play a significant role. Wakabayashi et al. and Lin et al., demonstrated through finite element analyses that inaccurate stress distribution around dental restorations leads to localized trauma and accelerates periodontal destruction [17,18]. This is particularly relevant in our context, as tight or deficient contacts may exert undue forces on teeth and supporting tissues, explaining why 33.3% of patients in this group developed gingivitis and 16.7% developed periodontitis.

Furthermore, occlusal stability and the preservation of functional bite force are linked to periodontal outcomes. Koc et al., noted that improper occlusal schemes and inaccurate proximal contacts reduce bite efficiency and contribute to periodontal stress [19]. In our study, while most patients with accurate contacts (85.4%) maintained healthy periodontium, nearly half of those with inaccurate contacts (47.4%) showed no clinical disease, indicating that other occlusal or host factors may also influence disease expression.

Kosaka et al., in the Suita Study, highlighted the relationship between occlusal support and masticatory performance, showing that compromised periodontal support leads to impaired function [20]. Our results resonate with this evidence, as patients with inaccurate contacts not only showed increased periodontal pathology but may also experience reduced functional efficiency over time.

Biologic width integrity is another essential factor. Nugala et al., described that restorative violations of biologic width due to improper contact or marginal discrepancies predispose to inflammation and attachment loss [21]. In our study, the presence of periodontitis in 23.0% of the open contact group and 16.7% of the tight contact group reinforces this concept, suggesting that disruption of natural tooth–tissue harmony accelerates periodontal damage.

Technical complications of prostheses, as described by Quaranta et al., further support the current findings [22]. They reported that restoration design and technical inaccuracies increase biological complications, which parallels our evidence that more than half (52.6%) of patients with inaccurate contacts developed periodontal disease.

The clinical relevance of our findings is underscored by Carr and Brown, who emphasized that the long-term success of prosthodontic treatment depends on meticulous adaptation of prostheses to periodontal structures [23]. This is consistent with the present study, where accurate contacts were strongly associated with healthier outcomes.

Finally, Chambrone et al., discussed the detrimental effects of occlusal overload on supporting tissues, particularly in implant settings [24]. Although our study focused on natural dentition, the principle remains applicable: excessive or uneven forces from inaccurate contacts may aggravate periodontal deterioration.

Taken together, these findings strongly affirm the perio-restorative interrelationship and emphasize that the design and accuracy of fixed prostheses are not merely esthetic or mechanical concerns but central determinants of periodontal health.

Limitations of the study

This study was conducted on a relatively small sample size of 120 patients from a single institution, which may limit the generalizability of the findings to the wider population. In addition, the cross-sectional design restricted the ability to establish a causal relationship between contact area accuracy and periodontal disease. Other potential influencing factors such as oral hygiene practices, dietary habits and systemic conditions were not fully controlled, which could have affected periodontal outcomes.

Conclusion

Within the limitations of this study, it can be concluded that accurate proximal contact areas in fixed prostheses play a crucial role in maintaining periodontal health. Patients with accurate contacts showed significantly lower rates of periodontal disease compared to those with inaccurate contacts. These findings emphasize the importance of precise prosthetic design and clinical execution in preventing periodontal complications and ensuring long-term success of fixed prosthodontic treatments.

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Conflicts of interest

There are no conflicts of interest.

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