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The effect of fixed partial dentures on periodontal status of abutment teeth

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Abstract This study was aimed to assess the periodontal status of Saudi adult females who had received regular oral prophylaxis following the insertion of fixed partial dentures. The effects of sub- and supra-gingivally placed crown margins were also assessed. The study sample included 78 females who had fixed partial dentures made by senior students at the College of Dentistry of King Saud University in Riyadh, Saudi Arabia. From each study participant, two paired eligible sites, one for the abutment and one for the matched non-abutment teeth, were selected. The plaque index, gingival index, probing pocket depth, tooth mobility and locations of the crown margins were assessed and recorded by one calibrated examiner. The abutment teeth scored significantly higher plaque and gingival indices and greater probing pocket depth than non-abutment teeth (p -value < 0.05). In addition, the abutment teeth scored greatest mean values of the clinical parameters in subjects who were 46 year-old or older and those who had their functioning fixed partial dentures for more than 5 years. The teeth with supra-gingivally placed crown margins had significantly higher mean values of plaque index, gingival index and probing pocket depth than teeth with sub-gingival crown margins (p -value < 0.05). The results of this study indicated that in subjects with fixed partial dentures, the abutment teeth are more prone to periodontal inflammation than the non-abutment teeth. Additionally, the individual's age, duration of insertion of fixed partial dentures and location of the crown margins affect the periodontal health of the abutments.

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1. Introduction

The fixed partial denture (FPD) is a common treatment available for the restoration of partially edentulous ridges, as it serves as excellent means of replacing missing teeth, where the dental implant is relatively or totally contraindicated.¹ The replacement of missing teeth with fixed partial dentures is largely dependent upon the health and stability of the surrounding periodontal structures. The gingival tissues should exhibit scalloped margins, sulcus depth within the range of

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1–3 mm and an adequate width of attached gingiva.² The knowledge of the responses of periodontal tissues to fixed partial dentures is crucial in the development of treatment plan with predictable prognosis. The most important factor controlling the effects of restorations on gingival health is the localization of the crown margin relative to the gingival margin.³

Several studies indicated that poor marginal adaptation,^{4–6} sub-gingival margin placement,^{7–13} and over-contoured crowns^{14–16} can contribute to localized periodontal inflammation. These studies have forced clinicians and researchers to focus on the qualities of FPDs and crowns in order to reduce the periodontal inflammation. Since most of the relevant studies were carried out in different European countries^{4–16} because of the lack of such studies from other parts of the world, it would be interesting to investigate in other populations with different cultural, ethnic and dietary backgrounds. Thus, the aim of the present cross sectional study was to assess the periodontal conditions in a group of Saudi adult females who had received regular oral prophylaxis following the insertion of FPDs. In addition, the effects of the sub- and supra-gingivally placed crown margins were also assessed.

2. Materials and methods

The study was conducted on Saudi adult females. They were selected from those who received FPDs, made by senior students, at the female campus of the College of Dentistry, King Saud University in Riyadh, Saudi Arabia. The inclusion criteria were: (1) adult females who were systemically healthy, non-pregnant, non-smokers, and who had their FPDs for at least one year and (2) abutment teeth with plaque and gingival indices less than 2 and probing pocket depth less than 4 mm after initial periodontal therapy. Informed consents were obtained from the enrolled subjects after explaining the nature of the study and possible risks and discomfort.

Prior to the intraoral examination, two paired eligible sites, one for the abutment (crowned) tooth and one for the matched, non-abutment tooth, were selected from each subject in either the maxilla or the mandible. The clinical parameters were plaque index,¹⁷ gingival index,¹⁸ probing pocket depth and tooth mobility.¹⁹ The probing pocket depth was measured at six sites per tooth (mesio-buccal, buccal, disto-buccal, disto-lingual, lingual and mesio-lingual) using the William's periodontal probe. The location of the crown margins was also assessed. The margins were considered sub-gingivally located if they were 1 mm or more below the gingival margin.

The study subjects were subdivided into 3 groups according to the age and duration of insertion of FPDs. The age groups were: 18–30 years, 31–45 years, and 46 years or more. The durations of insertion of FPDs were: 1–2 years, more than 2–5 years, and more than 5 years. All clinical parameters were recorded by one examiner who was calibrated to attain an acceptable intra-examiner variation by following the calibration protocol of Smith et al.²⁰ The collected data were statistically analyzed using the Statistical Package for Social Sciences (SPSS) version 15. The descriptive statistical analyses were made and the differences in the clinical parameters between the abutment and non-abutment teeth were assessed with the paired sample *t*-test. The level of significance was set at *p*-value < 0.05.

3. Results

78 subjects fulfilled the inclusion criteria and constituted the study sample. Of these, 18 (23.1%) subjects were 18–30 year-old, 38 (48.7%) were 31–45 year-old, and the remaining 22 (28.2%) subjects were 46 year-old or older. 18 subjects (23.1%) had their FPDs for 1–2 years, 36 (46.2%) for more than 2–5 years, and 24 subjects (30.8%) for more than 5 years.

4. Plaque index

74 study subjects (94.9%) showed an increase in the plaque index with an average change of +0.85. In addition, the abutment teeth had significantly higher mean values of plaque index than the non-abutment teeth (1.53 versus 0.66; *p*-value < 0.05) (Fig. 1).

5. Gingival index

76 study subjects (97.4%) presented an increase in the gingival index. The average change was +0.76 and furthermore, the mean gingival index for the abutment teeth was significantly higher than the non-abutment teeth (1.46 versus 0.67; *p*-value < 0.05) (Fig. 1).

6. Probing pocket depth

All participants revealed an increase in the probing pocket depth. The average change was +0.77 mm. Additionally, the abutment teeth had significantly greater mean probing pocket depth than the non-abutment teeth (3.09 mm versus 2.3; *p*-value < 0.05) (Fig. 1).

7. Tooth mobility

The tooth mobility increased in 27 (34.6%) subjects. It increased from grade 0 to grade I in 25 individuals and from grade I to either grade II or III in two individuals only. In comparison to the non-abutment teeth, the abutments showed

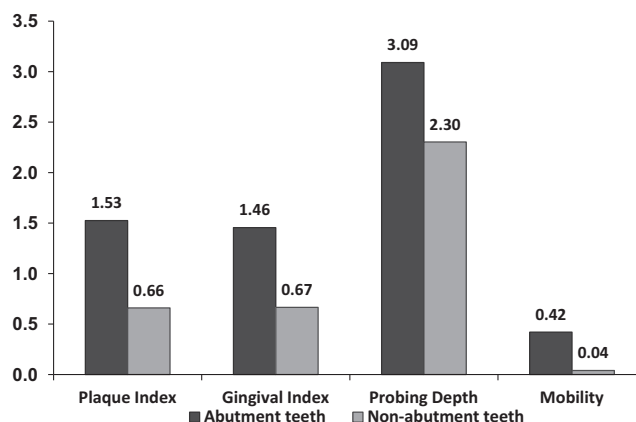


Figure 1 Mean values of the clinical parameters for the abutment and non-abutment teeth.

insignificant increase in the tooth mobility (0.42 versus 0.04; p -value > 0.05) (Fig. 1).

8. Clinical parameters and individual's age

The abutment teeth of the study subjects who were 46 year-old or older had the highest mean values of plaque index, gingival index, probing pocket depth and increased tooth mobility. Furthermore, the abutment teeth in all age groups, recorded significantly higher means of plaque and gingival indices as well as probing pocket depth than the non-abutment teeth (p -value < 0.05) (Table 1).

9. Clinical parameters and duration of insertion of FPDs

The abutment teeth in individuals who had their functioning FPDs for more than 5 years scored the highest mean values of all clinical parameters (Table 2). During all durations of insertion of FPDs, the abutment teeth revealed significantly higher mean values for plaque index, gingival index and probing pocket depth than the non-abutment teeth (p -value < 0.05) (Table 2).

10. Location of the crown margins

In 31 (39.7%) participants, the abutment teeth had sub-gingival crown margins and presented with significantly higher mean values of plaque index, gingival index and probing pocket depth in comparison to abutments with supra-gingivally placed crown margins (p -value < 0.05) (Table 3).

11. Discussion

This study was designed to assess the periodontal status of a group of Saudi adult females following the insertion of FPDs. Such an assessment is considered valuable since the FPD is still a very common replacement option for edentulous ridges and it seems essential to adequately understand the oral health status of such patients in order to establish effective preventive programs. The reasons for performing the study on females only was that all study participants were recruited from those who were treated by the senior female students at the female campus of the College of Dentistry, King Saud University.

The study results showed an increase in the plaque and gingival indices in majority of the study subjects ($> 94\%$). In

Table 1 Mean values of the clinical parameters and individual's age ($N = 78$).

Age (years)	Clinical parameter	Mean \pm SD		P -value
		Abutment teeth	Non-abutment teeth	
18–30 ($N = 18$)	Plaque index	1.15 \pm 0.38	0.52 \pm 0.31	< 0.01
	Gingival index	1.29 \pm 0.47	0.44 \pm 0.23	< 0.02
	Probing pocket depth	2.04 \pm 0.82	1.22 \pm 0.39	< 0.01
	Tooth mobility	0.25 \pm 0.45	0.00 \pm 0.00	NS
31–45 ($N = 38$)	Plaque index	1.52 \pm 0.52	0.62 \pm 0.34	< 0.002
	Gingival index	1.24 \pm 0.42	0.83 \pm 0.29	< 0.01
	Probing pocket depth	3.00 \pm 0.25	2.30 \pm 0.30	< 0.001
	Tooth mobility	0.42 \pm 0.58	0.04 \pm 0.20	NS
46 or more ($N = 22$)	Plaque index	1.75 \pm 0.47	0.71 \pm 0.38	< 0.001
	Gingival index	1.57 \pm 0.47	0.83 \pm 0.39	< 0.001
	Probing pocket depth	3.69 \pm 0.76	2.72 \pm 0.31	< 0.01
	Tooth mobility	0.57 \pm 0.85	0.07 \pm 0.27	NS

Table 2 Mean values of the clinical parameters and duration of insertion of FPDs ($N = 78$).

Duration (years)	Clinical parameter	Mean \pm SD		P -value
		Abutment teeth	Non-abutment teeth	
1–2 ($N = 18$)	Plaque index	1.38 \pm 0.64	0.71 \pm 0.29	< 0.01
	Gingival index	1.42 \pm 0.50	0.63 \pm 0.34	< 0.001
	Probing pocket depth	3.07 \pm 0.82	2.21 \pm 0.33	< 0.01
	Tooth mobility	0.33 \pm 0.45	± 0.00	NS
> 2 –5 ($N = 36$)	Plaque index	1.46 \pm 0.51	0.56 \pm 0.27	< 0.001
	Gingival index	1.21 \pm 0.63	0.55 \pm 0.27	< 0.001
	Probing pocket depth	3.22 \pm 0.69	2.30 \pm 0.29	< 0.001
	Tooth mobility	0.21 \pm 0.52	0.06 \pm 0.21	NS
> 5 ($N = 24$)	Plaque index	1.62 \pm 0.58	0.68 \pm 0.29	0.00
	Gingival index	1.53 \pm 0.64	0.68 \pm 0.87	0.00
	Probing pocket depth	3.58 \pm 0.42	2.33 \pm 0.35	0.00
	Tooth mobility	0.53 \pm 0.25	0.00 \pm 0.00	NS

Table 3 Mean values of the clinical parameters for the sub- and supra-gingivally placed crown margins.

Clinical parameter	Mean \pm SD		P-value
	Sub-gingival margins	Supra-gingival margins	
Plaque index	1.61 \pm 0.58	1.47 \pm 0.51	<0.001
Gingival index	1.56 \pm 0.62	1.38 \pm 0.53	<0.001
Probing pocket depth	3.43 \pm 0.88	2.87 \pm 0.51	<0.01
Tooth mobility	0.55 \pm 0.31	0.10 \pm 0.83	NS

addition, the abutment teeth scored significantly higher mean scores of plaque and gingival indices than the non-abutment teeth. These findings are consistent with several other studies reporting more plaque accumulation and gingival inflammation on the crowned teeth,^{21–25} and there is a general acceptance of high correlations between the dental plaque and presence of gingivitis.^{26–28}

The probing pocket depth increased in all study participants and the abutment teeth presented significantly greater mean values of probing pocket depth compared to the non-abutments. This observation can be considered as an outcome of increased plaque accumulation and gingival inflammation. Valderhaug and Birkeland⁹ suggested that factors related to crown fabrication could contribute to increased attachment loss. Although Silness⁷ and Bader et al.¹² reported similar results, Ericsson and Marken,²⁹ however, found no significant differences in the probing pocket depth between the abutment and non-abutment teeth.

In the present study, only 34.6% of the participants showed an increase in the mobility of abutments and it was not statistically significant.

The highest scores of all clinical parameters were recorded in the study subjects who were 46 year-old or older and those who had their functioning FPDs for more than 5 years. Similar observations were reported previously by Holm-Pedersen et al.³⁰, Grossi et al.³¹ and Kinane³² who found that periodontal diseases were more prevalent in older age groups and they considered ageing as one of the identified risk factors for periodontitis. However, Wennström et al.³³ reported that periodontal diseases were more prevalent and severe in the elderly because of the cumulative destruction over a lifetime period rather than an age-related intrinsic deficiency or abnormality that affects susceptibility to periodontal infection.

Considering the location of the crown margins, the present study showed that teeth with sub-gingivally placed crown margins had significantly higher mean scores of plaque and gingival indices in addition to greater mean values probing pocket depth than teeth with supra-gingival crown margins. A similar observation was reported previously.³⁴ It has been reported that the sub-gingival crown margins can contribute to localized periodontal inflammation because these margins can provide a protected environment in which the indigenous microbes mature into a more periodontopathic flora.^{7–13}

12. Conclusions

Within the limitations of the present study, it can be concluded that:

1. In subjects with FPDs, the abutment teeth are more prone to plaque accumulation, gingival inflammation and

development of periodontal pockets than the non-abutment teeth.

2. The individual's age and duration of insertion of the FPD can affect the periodontal conditions of the abutment teeth.
3. The abutment teeth with sub-gingivally placed crown margins are likely to have higher scores of plaque and gingival indices and greater probing pocket depth than abutments with supra-gingival crown margins.

Conflicts of interest statement

None.

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