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One Year Clinical Follow-Up of Oral Health Status in Cobalt-Chromium Removable Partial Denture Wearers

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Abstract

Objective: To investigate the effect of conventional removable partial dentures (RPDs) on oral tissue in terms of periodontal condition and caries incidence for Saudi female patients in Riyadh.

Methods: This is a clinical trial in which 61 female patients were treated with conventional RPDs in College of Dentistry, Riyadh, Saudi Arabia. A base line examination was done one week after denture insertion which included plaque index, probing depth, tooth mobility, and caries. The same examination was performed in a recall visit one year later. Data were statically analyzed and significance level was set to 0.05.

Results: A statistically significant difference was detected between base line examination and the recall in plaque index, probing depth, mobility, and caries incidence ($p<0.05$).

Conclusion: Plaque index, probing depth, tooth mobility, and caries increased after one year of wearing Cobalt Chromium RPDs.

Keywords: Removable partial dentures; Prosthesis; Caries; Plaque index; Tooth mobility; Probing depth

Introduction

Removable partial dentures (RPDs) are considered a valid therapeutic means for the restoration of edentulous areas. These dentures are widely provided as a treatment option for replacing missing teeth because of their reasonable cost with conservative treatment [1,2]. However the pathological perspective of removable partial dentures has been extensively documented. Increased plaque accumulation [3-5], caries [6-8], poor oral hygiene and increased gingival inflammation and mobility of abutment teeth [8-10] have all been attributed to the wearing of partial dentures. Nevertheless, studies reported the contrary, that RPDs per se did not necessarily cause any harmful effects if good oral hygiene measures and continual professional dental care were provided to the patients [11]. The existing literature is contradictory on the effect of RPD wearing on oral tissues. The use of RPD reduced the prevalence of caries [8], while the risk of caries was much higher in RPD than in fixed partial denture patients [6]. It was reported that wearing Cobalt Chromium (Co-Cr) RPD was related to a higher prevalence of plaque, gingivitis and gingival recession, and high incidence of root caries [7]. Few studies evaluated the periodontal status in patients with fixed and removable prostheses in Kingdom of Saudi Arabia [3,12]. Few investigations reported a significant increase in plaque index of surveyed crown teeth between the day of denture placement and 2 years later [3]. However, the plaque accumulation did not show any significant signs of gingival inflammation provided short interval visits and hygiene instructions are instituted. On the other hand, a study to assess the periodontal status of adult females who had received regular oral prophylaxis following insertion of fixed partial denture indicated that the abutment teeth are more prone to periodontal inflammation than non-abutment teeth [12].

In view of this disagreement, and taking into consideration of the lack of studies that evaluate the effect of RPD on oral structure in the Kingdom of Saudi Arabia (KSA), the objective of this study was to investigate the effect of conventional RPDs on the oral tissues regarding periodontal condition and incidence of caries among Saudi female patients in the College of Dentistry, King Saud University, Riyadh, one year after RPD insertion. The null hypothesis was that RPD would have no effect on the health of oral tissues.

Methods

In this clinical trial a total of 150 Saudi female patients were treated with conventional Cobalt Chromium (Co-Cr) RPDs. The College of Dentistry's Research Centre (CDRC) Ethical committee (1595/2009) reviewed and approved the study. This study was undertaken with the understanding and written consent of each subject and in accordance with World Medical Association Declaration of Helsinki.

The dentures were made by dental students under the supervision of a prosthodontist at the Department of Prosthetic Dental Sciences, College of Dentistry, King Saud University, Riyadh, Saudi Arabia. Patients with diseases that could adversely affect oral health, e.g. diabetes mellitus, epilepsy with anticonvulsant therapy, were excluded. Every patient received:

- Oral hygiene instructions and motivation.
- Scaling and polishing.
- Extraction of hopeless teeth.
- Restorative treatments.
- Conventional Co-Cr RPDs, post-insertion and denture hygiene instructions.

The patients were examined one week after RPD insertion and this was considered the baseline examination. One year later the patients were recalled for follow up. One examiner conducted the examination, 10% of the patients were re-examined within one week of the first visit

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and the follow up visit. The duplicate examinations showed that intra-examiner reproducibility of the measurements was very good as Kappa statistical test and Cronbach's Alpha were 0.882 and 0.925 respectively.

The clinical parameters performed for the abutment teeth were:

Plaque index

Plaque identification was done using an Erythrosine disclosing solution (Due-Active tablets, Lactona Europe B.V., Bergen op Zoom, Netherlands) based on Silness and Loe plaque index 1964 [13]. The patients were given the following scores based on observation.

- Score 0 = No plaque
- Score 1 = A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface.
- Score 2 = Moderate accumulation of soft deposits within the gingival pocket, or on the tooth and gingival margin, which can be seen with the naked eye.
- Score 3 = Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin.

Probing depth

Probing depth was measured for each tooth with a standard William's graduated periodontal probe (Hu-Friedy, Chicago, IL, USA). The mesial, buccal, distal and lingual aspects were measured to the nearest millimeter and recorded as <3 mm and ≥3 mm.

Tooth mobility

Tooth mobility was recorded according to Miller classification [14] by the aid of two mirror handles applied to tooth surface on opposite sides, as follows:

- 0 for no mobility
- 1 for <1 mm movement buccolingually
- 2 for >1 mm movement buccolingually
- 3 for movement in the apical direction

Caries

A carious lesion was recorded when a distinct decalcification or loss of tooth structure could be felt with an explorer and or seen with the eye or on a radiograph.

The clinical parameters were recorded on a prepared form for each patient and the data was tabulated and Statistical procedures were performed using SPSS-20 software. Frequency, percentage, and Chi-square test were used to study the significance of the correlation between the base line and the one year recall for the qualitative variables: Plaque index, Tooth mobility, and Probing depth. Mean, standard deviation, standard errors and paired-t test were used for quantitative data i.e., caries variable in abutment and non-abutment teeth. Significant P-value was accepted at p<0.01 (probing depth, tooth mobility and caries), p<0.05 (plaque index).

Results

Sixty-one patients (41%) with 96 RPDs (46 upper and 50 lower) completed the study and attended the recall examination appointment.

Plaque index

Almost 93.44% (n=57) of patients had a score 0 in plaque index at base line examination, while at recall majority 66% (n=40) recorded a score of 1 and 23% (14) recorded a score of 2 respectively , this shows an increase in plaque index which was found to be statistically significant (P<0.05) (Table 1).

Probing depth

Probing depth values were increased in 13 (21.30%) of the patients, and found to be statistically significant (P<0.0) (Table 2).

Tooth mobility

48 (78.70%) patients exhibited no mobility of examined teeth at base line examination, on the other hand at recall appointment 25 showed grade 1 mobility with only 21 patients at the base line and 9 patients showed grade 2 mobility of the abutments teeth and this difference was found to be statistically significant (P <0.0) (Table 3).

Plaque Index			One Year Recall			Total	Chi-Square	p-Value (p<0.05)	Correlation
			0	1	2				
Base line	0	Count*	7	39	11	57	6.619	0.037	0.3
		% of Total	11.48%	63.93%	18.03%	93.44%			
	1	Count	0	1	3	4			
		% of Total	0.00%	1.64%	4.92%	6.56%			
Total		Count	7	40	14	61			
		% of Total	11.48%	65.57%	22.95%	100%			

*Count= Number of patients

Table 1: Descriptive statistics for plaque index at baseline and recall visit in the studied sample.

Pocket Depth			One Year Recall		Total	Chi-Square	p-Value (p<0.01)	Correlation
			<3 mm	≥3 mm				
Base line	<3 mm	Count	41	13	54	16.21	0.0	0.516
		% of Total	67.20%	21.30%	88.50%			
	≥3 mm	Count	0	7	7			
		% of Total	0.00%	11.50%	11.50%			
Total		Count	41	20	61			
		% of Total	67.20%	32.80%	100%			

Table 2: Descriptive statistics for the probing depth of the studied sample at baseline and one year recall.

Tooth Mobility			One Year Recall			Total	Chi-Square	p-Value (p<0.01)	Correlation
			Non	Grade 1	Grade 2				
Base line	Non	Count	27	21	0	48	40.964	0.0	0.819
		% of Total	44.30%	34.40%	0.00%	78.70%			
	Grade 1	Count	0	4	9	13			
		% of Total	0.00%	6.60%	14.80%	21.30%			
Total		Count	27	25	9	61			
		% of Total	44.30%	41.00%	14.80%	100%			

Table 3: Descriptive analysis of the mobility of the studied sample at base line and one year recall.

Number of Non-abutments with Caries	Number of Patients	% of Total
0	50	82%
1	10	16.40%
2	1	1.60%
Total	61	100%

Table 4: Number of caries teeth at a one year recall visit of the non-abutments teeth.

Number of Abutments with Caries	Number of Patients	% of Total
0	33	54.10%
1	9	14.80%
2	8	13.10%
3	6	9.80%
4	2	3.30%
5	2	3.30%
6	1	1.60%
Total	61	100%

Table 5: Number of caries teeth at a recall visit of the abutment teeth.

Caries

Tables 4 and 5 showing the number of carious teeth between abutments and non-abutment teeth in the studied sample, after one year of wearing RPD, caries were more in abutments teeth than non-abutments, 67 of the abutments teeth developed new caries, conversely 12 non-abutment teeth had a new caries, the increase in caries incidence was found to be statistically significant (P =0.00) (Tables 6 and 7).

Discussion

The results of this study showed that RPDs with inadequate oral hygiene will lead to periodontal and carious lesions. In proportion to these results, several authors [5,8,10] agree with the idea that RPD has a potential for an increase in plaque accumulation, especially on abutment teeth. It has been observed that RPDs can result in detrimental changes in the quality and quantity of plaque [15,16]. A number of clinical studies have concluded that to control the plaque accumulation in RPD, patients need a regular recall visit and oral hygiene reinforcement [10,11,18]. In the present study, the worsening of the pocket depth of the abutment teeth could be attributed to plaque index increase. This is in consistent with do Amaral et al., Chiba et al., Rissin et al. and Ao et al. [5,9,10,17]. While Bergman et al. found no significant changes in pocket depth. This may be due to regular oral hygiene instructions given to their patients over the period of their study [11]. On the other hand Schwalm et al. found a statistically significant decrease in pocket depth, however all patients in that study were examined by undergraduate students and verified by instructors, therefore it was not possible to measure the variability between examiners or standardize their techniques [18]. The increase in pocket depth should be avoided.

Rehmann et al. stated that RPDs designed according to hygienic principles are clinically successful [20]. Therefore, RPD design is important to minimize the pathological consequences on the supporting structures, as the retainers are more susceptible to accumulate plaque, besides impeding the self-cleansing action performed by saliva, tongue and cheeks with improper oral hygiene, plaque index increase over time, developing periodontal diseases and dental caries. RPD design should be simple and self-cleansing. The present study showed increased mobility of teeth after 1 year of RPD use, these results are in agreement with Jorge et al. and Rissin et al [8,10].

Schwalm et al. reported no change in tooth mobility with RPD [18], while Jorge et al. reported no significant changes in tooth mobility, but their study consisted of follow-up after 3 and 6 months and not 12 months.in addition this may be due to other factors that may influence tooth mobility among them are local factors of occlusal forces and oral hygiene, splinting action of metal framework, better distribution of occlusal stresses and dissipation of functional stresses by clasp design [19].

In this study the RPDs were made by dental students under the supervision of a prosthodontist following similar and basic principles of RPD fabrication (stress breaker retainers for distal extension cases with mesial rest seat, rigid major connectors, indirect retainer, altered cast technique and proper occlusion).

In the present study sample, almost half of the patients developed new caries in 1 year, this was comparable with some studies like Schwalm et al. and Budtz-Jorgensen et al. [6,18], but is higher than Yeung et al. [7]. In that latter study most of the patients regularly brushed their teeth with fluoride toothpaste.

The results of the present study were statistically significant (P<0.05) for plaque index, probing depth, tooth mobility, caries after one year of wearing Co-Cr RPDs. Accordingly the null hypothesis was rejected.

Although this study was limited to female patients at KSU, It is the first to investigate the effect of RPD on the health of oral structures in

Caries	Mean	Standard Error	Standard Deviation	Minimum	Maximum	95% Confidence Interval of the Difference	
						Lower	Upper
Non abutment	0.2	0.056	0.44	0	2	0.08	0.31
Abutment	1.1	0.195	1.524	0	6	0.71	1.49

Table 6: Paired sample of caries in abutments and non-abutments teeth at recall visit.

Caries	Paired Differences					t	p-Value (p<0.01)
	Mean	Standard Deviation	Standard Error Mean	95% Confidence Interval of the Difference			
				Lower	Upper		
abutments – non-abutments	0.902	1.375	0.176	0.55	1.254	5.122	0.0

Table 7: t-test of the caries between abutments and non-abutments teeth at one year recall.

Saudi Arabia, and could aid in establishment of baseline results of RPD treatment for further studies.

Conclusion

Within the limitations of this study, it can be concluded that plaque index, probing depth, tooth mobility, and caries were statistically significant after one year of wearing Co-Cr RPDs. Special need for regular oral hygiene reinforcement is necessary for RPD wearers. Patients must be educated about the importance of oral hygiene and proper use of RPDs. Moreover, topical fluoride should be regularly applied to teeth to prevent dental caries.

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