



ORIGINAL ARTICLE

## Effects of acrylic removable partial dentures on periodontal health of abutment teeth.

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**Article Citation:** Shafiq S, Yazdanie N. Effects of acrylic removable partial dentures on periodontal health of abutment teeth. Professional Med J 2022; 29(3):382-388. <https://doi.org/10.29309/TPMJ/2022.29.03.6109>

**ABSTRACT... Objective:** To assess the outcomes in patients wearing particularly designed acrylic removable partial dentures at different time intervals. **Study Design:** Descriptive Case Series Study. **Setting:** Department of Prosthodontics, FMH College of Dentistry, Lahore. **Period:** October 2017 to April, 2018. **Material & Methods:** Sixty five (65) abutments of acrylic removable partial denture wearers were included in the study for assessment of Mean Clinical Attachment Level (CAL), Tooth Mobility (TM) and Mean Gingival Index (GI). These periodontal parameters were clinically assessed at the day of insertion, 30<sup>th</sup> day and 60<sup>th</sup> day of insertion. Mean Clinical Attachment Level (CAL) was measured by William's Probe. Tooth Mobility (TM) was assessed using Miller's Classification. Gingival health was evaluated using the Gingival Index (GI) of Loe and Silness. Mean and standard deviation were calculated for patient's age and all the periodontal scores of abutment teeth. Data was stratified for age and gender to identify the effect modifiers. Pearson chi-square test was used for Mean Gingival Index, and Mean Tooth Mobility. Post-stratification student t-test for Mean Clinical Attachment Level was used to compare the results with  $p \leq 0.05$  considered as significant. **Results:** Statistically insignificant results for all the periodontal parameters, i.e. the Mean Gingival Index (GI), Tooth Mobility (TM) and Mean Clinical Attachment Loss (CAL) were observed, age being not influencing the periodontal health of abutments. The only statistically significant ( $p= 0.01$ ) result was observed for the Tooth Mobility (TM) in gender categories at the day of insertion and the 30<sup>th</sup> day of insertion. **Conclusion:** All the periodontal parameters, except tooth mobility (TM) assessed in the study, were not affected by the acrylic removable partial denture wearing.

**Key words:** Abutment Teeth, Acrylic Removable Partial Dentures, Periodontal Health.

### INTRODUCTION

A removable partial denture is a prosthetic restoration that replaces the missing teeth in a partially dentate arch. It derives its support from the underlying tissues and the abutment teeth.<sup>1</sup> Impaired oral functions (esthetics, phonetics and mastication) are the main indication for removable partial dentures. Thus, the main goal of prosthodontic treatment is to improve these functions for the individual<sup>2</sup> and to preserve the remaining teeth.<sup>3</sup>

Clinicians can offer a variety of treatment regimens to the partially dentate patients and majority of the prescriptions consist of Removable Partial Dentures (RPDs).<sup>4</sup> The dentures can be made with a variety of materials, but acrylic resin or a

combination of cast metal alloy (Co/Cr) framework and acrylic resin are the most frequent materials used for this purpose. Removable partial denture (RPD) is an adequate form of the prosthodontic treatment for partially dentate patients as these dentures represent an acceptable and economical treatment modality.<sup>5</sup>

However, RPDs are accompanied by a high biological price with increased risk of caries and periodontal diseases reported in denture wearers.<sup>4</sup> The most common documented adverse effects of RPDs include; gingivitis, periodontitis and mobility of abutment teeth. These detrimental changes occur due to poor oral hygiene, increased plaque and calculus accumulation.<sup>5</sup> The RPD in the mouth has the

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**Article received on:** 29/09/2020  
**Accepted for publication:** 16/07/2021

potential for increased plaque<sup>5-6</sup> and biofilm formation<sup>1</sup> on the abutment teeth receiving clasps or attachments.<sup>5</sup> Periodontal structure can be protected from damage by periodic professional dental checkups recalls, adequate oral hygiene measures<sup>6-7</sup> and simplicity in denture design.<sup>8</sup> Only a few studies have demonstrated the adverse effects of acrylic partial dentures on the health of oral soft tissues.<sup>8-12</sup>

Acrylic removable partial dentures can be fabricated according to different design concepts but the previous studies<sup>8-12</sup> had a gap in defining the design specifications of the acrylic RPDs observed, so it is difficult to generalize the results for their clinical application. Therefore, the effects of one particular design of acrylic removable partial dentures on periodontal health of abutment teeth are being assessed in partially dentate patients visiting a tertiary care hospital in Lahore.

## MATERIAL & METHODS

An Institutional Review Board Approval (FMK-03-2020-IRB-756-M) was secured and the study was conducted in the Department of Prosthodontics, FMH College of Dentistry, Lahore from October 2017 to April 2018. It was a Descriptive Case Series Study. The study included sixty five (65) abutment teeth. Non-probability consecutive sampling technique was adopted for data collection. Patients of both genders and age group ranging from 40-60 years were included in the study. The denture design comprised of cast metal alloy (Co/Cr) clasp assembly for support and retention. Also, full coverage acrylic lingual plate and palatal plate/ palatal strap major connectors were fabricated for mandibular and maxillary arches, respectively. Only the first time denture wearing patients facilitated with these particularly designed heat cured acrylic removable partial dentures were considered in the study.

On the contrary, patients diagnosed with generalized Gingivitis or Periodontitis, psychiatric conditions, systemic diseases (Sjogren Syndrome, diabetes, and hypertension), alcohol or drug intoxication and smokers were excluded. Also, patients with poor oral and denture hygiene

maintenance and daily denture use of more than 16 hours after denture insertion were considered as dropouts of the study.

Each of the eligible patients was clinically examined by the operator at the day of insertion, 30<sup>th</sup> and 60<sup>th</sup> day of insertion.

Following periodontal parameters were recorded for each tooth:

1. Mean Clinical Attachment Level (CAL) was measured by William's Probe and read to the nearest millimeter (mm) at four areas (i.e. mesiobuccal, distobuccal, mesiolingual, and distolingual) of each abutment tooth. The mean value of all the four areas was considered for statistical evaluation.
2. The tooth mobility was clinically assessed by using Miller's Classification.<sup>13</sup>
3. The gingival health condition was assessed by using the Gingival Index (GI) of Loe and Silness.<sup>14</sup>

The collected data was entered and analyzed in SPSS (version 20.0 for windows). Mean and standard deviation were calculated for patient's age and all the periodontal scores of abutment teeth (i.e. Mean GI, Mean TM and Mean CAL). Frequency and percentages were calculated for qualitative data i.e. gender. Data was stratified for age and gender to identify the effect modifiers. Pearson chi-square test was used for Mean GI, and Mean TM. Post-stratification student t-test was used to compare the results with  $p \leq 0.05$  considered as significant.

## RESULTS

A total of sixty five (65) abutments of patients (both genders) were enrolled for the assessment of periodontal parameters, out of which 52.3% were male patients and 47.7% were female patients with mean age of  $49.22 \pm 6.64$  years. The assessment was done at the day of insertion, 30<sup>th</sup> and 60<sup>th</sup> day of insertion.

The overall effects of acrylic removable partial dentures on Mean GI, Mean TM and Mean CAL in age category have been illustrated in Tables-I,II and III, respectively. Likewise, the effects of acrylic

removable partial dentures on Mean GI, Mean TM and Mean CAL in gender category have been presented in Tables-IV,V and VI, respectively.

Statistically insignificant findings were observed for Mean GI in age category, indicating that age had no influence on the GI at each follow-up (p-values of 0.28 and 0.35 respectively) (Table-I). Likewise, GI at 30<sup>th</sup> day and 60<sup>th</sup> day of insertion indicated that gender had no influence on the GI as p-value proved to be statistically insignificant for each follow-up with p-values of 0.28, and 0.35 respectively (Table-IV).

Similar statistically insignificant findings were observed for Mean TM at 30<sup>th</sup> and 60<sup>th</sup> day

of insertion with p-values of 0.45 and 0.48 respectively, indicating that age was not an effect modifier on the TM at each follow-up (Table-II). On the contrary, Mean Tooth Mobility (TM) at 30<sup>th</sup> day of insertion depicted that gender had positive impact on the tooth mobility with p-value = 0.01 (Table-IV).

Mean CAL was found to be insignificant in age category at 30<sup>th</sup> and 60<sup>th</sup> days of insertion, p-value being 0.06 and 0.40 respectively (Table-III). The same statistically insignificant results for Mean CAL were observed at all the follow-ups in gender category, p-values being 0.97, 0.15 and 0.70 respectively. (Table-VI).

	Age Categories	Normal	Mild	Moderate	Severe	P-Value (Chi-square)
Gingival Index at the Day of Insertion	40-50	17	24	=	=	0.75
	51-60	9	15	=	=	
Gingival Index at 30 <sup>th</sup> Day of Insertion	40-50	4	28	9	=	0.28
	51-60	0	18	6	=	
Gingival Index at 60 <sup>th</sup> Day of Insertion	40-50	6	20	15	0	0.35
	51-60	2	9	12	1	

**Table-I. Mean Gingival Index at the Day of Insertion, 30<sup>th</sup> Day and 60<sup>th</sup> Day of Insertion in Age Categories.**

	Age Categories	Normal; within physiologic limit	Tooth Mobility; greater than physiologic limit	Tooth Mobility; 1mm or more in lateral direction Only	P-Value (Chi-square)
Tooth Mobility at the Day of Insertion	40-50	15	26	=	0.29
	51-60	12	12	=	
Tooth Mobility at 30 <sup>th</sup> Day of Insertion	40-50	4	29	=	0.45
	51-60	2	20	=	
Tooth Mobility at 60 <sup>th</sup> Day of Insertion	40-50	9	24	8	0.48
	51-60	6	16	2	

**Table-II. Mean tooth mobility at the day of insertion, 30<sup>th</sup> Day and 60<sup>th</sup> Day of insertion in age categories.**

	Age Categories	n	Mean	SD	P-Value
Mean Clinical Attachment Loss at the Day of Insertion	40-50	41	1.55	0.60	0.68
	51-60	24	1.60	0.34	
Mean Clinical Attachment Loss at 30 <sup>th</sup> Day of Insertion	40-50	41	1.72	0.55	0.06
	51-60	24	1.97	0.47	
Mean Clinical Attachment Loss at 60 <sup>th</sup> Day of Insertion	40-50	41	1.71	0.47	0.40
	51-60	24	1.81	0.39	

**Table-III. Mean clinical attachment level at the day of insertion, 30<sup>th</sup> day and 60<sup>th</sup> day of insertion in age categories.**

	Gender	Normal	Mild	Moderate	Severe	P-Value (chi- square)
Gingival Index at the Day of Insertion	Male	10	24	=	=	0.06
	Female	16	15	=	=	
Gingival Index at 30 <sup>th</sup> Day of Insertion	Male	1	25	8	=	0.52
	Female	3	21	7	=	
Gingival Index at 30 <sup>th</sup> Day of Insertion	Male	2	16	15	1	0.31
	Female	6	13	12	0	

**Table-IV. Mean gingival index at the day of insertion, 30<sup>th</sup> day and 60<sup>th</sup> day of insertion in gender categories.**

	Gender	Normal; Within physiologic limit	Tooth Mobility; greater than physiologic limit	Tooth Mobility; 1mm or more in lateral direction Only	P-Value (chi- square)
Tooth Mobility at the Day of Insertion	Male	9	25	=	<b>0.01</b>
	Female	18	13	=	
Tooth Mobility at 30 <sup>th</sup> Day of Insertion	Male	1	24	9	<b>0.01</b>
	Female	5	25	1	
Tooth Mobility at 60 <sup>th</sup> Day of Insertion	Male	4	24	6	0.07
	Female	11	16	4	

**Table-V. Mean tooth mobility at the day of insertion, 30<sup>th</sup> day and 60<sup>th</sup> day of insertion in gender categories.**

	Gender	n	Mean	SD	P-Value
Mean Clinical Attachment Loss at the Day of Insertion	Male	34	1.57	0.38	0.97
	Female	31	1.57	0.65	
Mean Clinical Attachment Loss at 30 <sup>th</sup> Day of Insertion	Male	34	1.90	0.50	0.15
	Female	31	1.71	0.56	
Mean Clinical Attachment Loss at 60 <sup>th</sup> Day of Insertion	Male	34	1.77	0.42	0.70
	Female	31	1.72	0.48	

**Table-VI. Mean clinical attachment loss at the day of insertion, 30<sup>th</sup> day and 60<sup>th</sup> day of insertion in gender categories.**

## DISCUSSION

As in the loss of any body part, tooth loss can result in compromised function as well as loss of self-esteem and feeling of being aged. Once teeth are lost, the restoration of function and aesthetics, without causing additional complications and further tooth loss poses a challenge to the prosthodontists.<sup>15</sup>

Removable dentures are particularly frequent among older people in the industrialized world.<sup>16</sup> Some countries report that one-third to half of the older people wear full dentures while up to three-quarters wear removable complete and/or partial dentures.<sup>17-18</sup> According to the American College of Prosthodontics, it is estimated that over the next 15 years, approximately 200 million people

will be using dentures of some kind.<sup>19-20</sup> A major public health challenge is to plan oral healthcare for this group of patients in whom avoidance of further tooth loss is of particular importance.<sup>21</sup> Removable partial dentures are one of the most widely accepted means of replacement of lost teeth and associated soft tissues. These prostheses are generally anchored by means of clasps/retainers to hold the denture in the designated place. The introduction of partial dentures in the mouth has the potential for altering the oral environment and causing further damage, especially to the abutment teeth, to which the clasps are anchored.<sup>15,22</sup>

This study assessed the outcomes of the effects of acrylic removable partial dentures with cast

clasp assemblies on the periodontal health of the abutment teeth. The previous clinical studies<sup>8-12</sup> related to the subject had a gap in defining the design specifications for the acrylic removable partial dentures, which may have resulted in unreliable findings. Therefore, it was observed most appropriate to first describe the prosthodontics design specifications for the prosthesis fabrication and then assess the effects of these standardized prostheses on the periodontal health of the abutment teeth on scheduled recall appointments.

In this study, patients of both genders with mean age of  $49.22 \pm 6.64$  years participated and majority of them was males with a percentage of 52.3. The dropouts of the study based on the exclusion criteria were compensated by enrolling more patients to achieve the estimated sample size of 65 abutments.

Patient age and gender had no significant influence on the Mean GI and Mean CAL assessed at the day of insertion and the subsequent recall appointments, i.e. 30<sup>th</sup> and 60<sup>th</sup> day of insertion (Table-I, III, IV and VI). These findings are in agreement with the results of a number of previous studies.<sup>22-27</sup> Wilding and Reddy<sup>28</sup>, also reported in a study that pocket depths in abutment teeth were not significantly greater than pocket depths of non-abutment teeth. These findings are attributed to the meticulous oral and denture hygiene maintenance protocols and regular attendance at recall visits.<sup>29-33</sup>

On the contrary, Mean TM was the only periodontal parameter that was significant in gender category at the day of insertion and the 30<sup>th</sup> day of insertion (Table-V). This result has also been validated by Jorge et al,<sup>1</sup> and Jayasinghe et al.<sup>34</sup> One of the possible reason of this finding might be the clasping of the abutments, as it renders the abutments to bear additional forces that can cause tooth mobility.<sup>35-38</sup> Tooth mobility might also be attributed to the fact that partial dentures in the mouth increase plaque formation<sup>39-45</sup>, particularly on tooth surfaces in contact with the partial denture.<sup>40</sup>

The Mean TM at the 60<sup>th</sup> day of insertion proved to be statistically insignificant ( $p$ -value= 0.07) (Table-II). This statistical finding points towards the significance of the recall visits. There seems to be a general agreement that the periodontal problems associated with the wearing of RPDs are related to the oral and denture hygiene practices and regular attendance at recall appointments by the denture wearers. Qudah and Nassrawin<sup>9</sup>, also support the significance of regular recall visits, as they play a vital role in re-evaluation the RPDs and execution of the necessary adjustments, rendering the applied loads in a favorable direction. In this way, the destruction of the periodontal apparatus is kept to a minimum and the integrity of the abutment can be preserved.

Simple, careful and logical partial denture design not only makes oral and denture hygiene practices easily for the denture wearers<sup>39</sup>, but also contribute to the general oral health of the patients.

## CONCLUSION

This study concluded in statistically insignificant results for all the periodontal parameters, i.e. the Mean Gingival Index (GI), Tooth Mobility (TM) and Mean Clinical Attachment Loss (CAL), suggesting that age had no influence on the periodontal health of abutments. There was a statistically significant result observed only for the Tooth Mobility (TM) in gender categories at the day of insertion and the 30<sup>th</sup> day of insertion.

These findings could be attributed to the patient education and counselling regarding maintenance of oral and denture hygiene, and periodic recall appointments.

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1	Samia Shafiq	Principal investigator, data collection, literature search, manuscript write-up.	
2	Nazia Yazdanie	Conceptualization of the study, literature search, proof reading and editing of the manuscript.	