Evaluation of the Periodontal Status of Abutment Teeth in Removable Partial Dentures

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The purpose of this study was to evaluate whether the use of removable partial dentures affects the periodontal status of abutment teeth. An observational cross-sectional study was done on a sample of patients rehabilitated with removable partial dentures (2010 to 2013). At a recall appointment, a clinical examination was done to collect data related to the rehabilitation and periodontal status of the abutment teeth. Of 145 invited patients, 54 attended the requested follow-up appointment (37.2%). Mean patient age was 59.1 years, and the study population was 42.6% male and 57.4% female. The mean follow-up time for the prosthesis was 26 months. Abutment teeth had higher values in all periodontal variables ($P < .001$). Occlusal clasps had the worst results in relation to clasps with a gingival approach ($P < .005$). Significant differences were also found in mandibular abutment teeth of Kennedy Class I and II compared to Class III ($P < .048$). The periodontal status of the abutment teeth of removable partial dentures is affected by these rehabilitations. A recall program for these patients involving removable prosthodontics and periodontology appointments is mandatory.
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Removable partial denture (RPD) is an effective treatment option for partially edentulous patients when the treatment plan and prosthesis design and manufacturing are correctly performed based on the partial edentulism present and the status of the hard and soft tissues of the oral cavity. If the biomechanical principles of the rehabilitation are not respected and oral hygiene is not good, there is an increased risk of periodontal disease and dental caries in the abutment teeth that may ultimately lead to a failure of the prosthetic rehabilitation.[1–13]

Several types of RPD designs associated with insufficient oral hygiene and low frequency of regular appointments may raise or change the bacterial flora present in the oral cavity, promoting an increase of plaque formation. The plaque increase can impair the abutment teeth/periodontal support in direct contact with the prosthesis. Patients with regular follow-up after RPD placement showed less plaque accumulation and gingival bleeding.[11,12,14,15]

The aim of this study was to evaluate whether the use of RPD affects the periodontal status of the abutment teeth when compared to nonabutment teeth and if there was any relationship between the type of edentulism and the clinical periodontal parameters examined.

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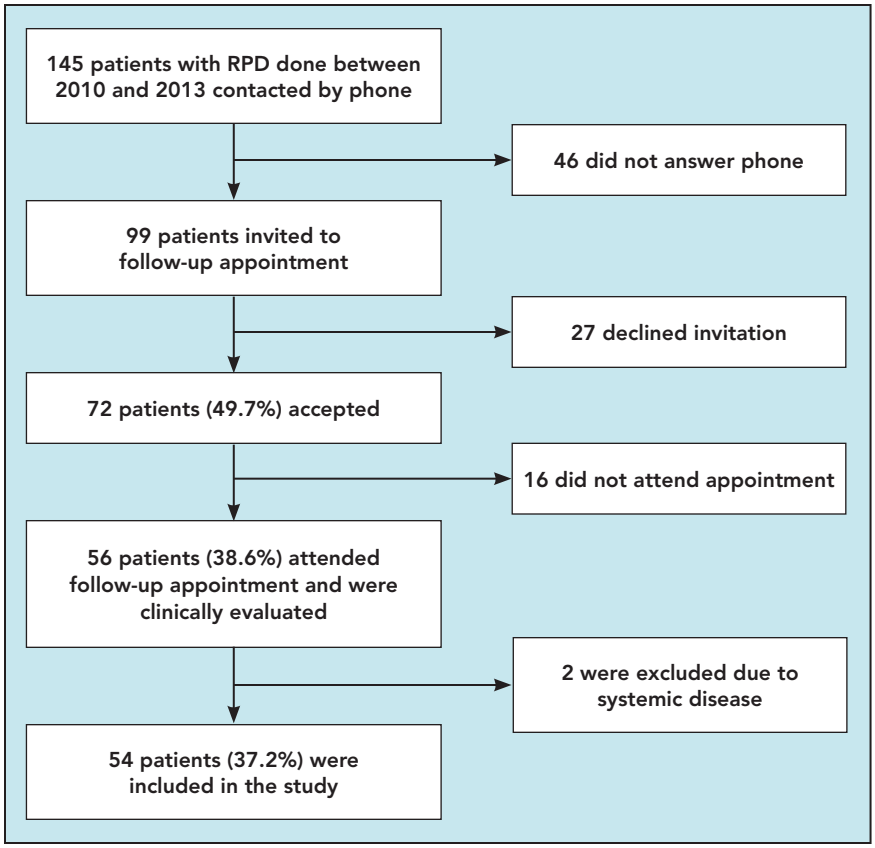

Fig 1 *Flowchart of the recall appointment procedure.*

The periodontal variables analyzed in this study were probing depth (PD), gingival recession (GR), Plaque Index (PI), tooth mobility (TM), and Gingival Index (GI), which were measured on abutment and nonabutment teeth.

Materials and Methods

The research methodology was accepted by the local ethics committee of the Health Sciences Department of the Catholic University of Portugal, and written consent was obtained from each patient.

A total of 145 patients with RPD performed in the Removable Prosthodontics Unit of the University Clinic of the Catholic University of Portugal, in Viseu, between 2010 and 2013 were contacted by phone and invited to participate in the present study. Of these patients, 54 (37.2%) were enrolled in the study (Fig 1).

The measurements were done by a single examiner according to the methodology described by Zlatarić[5] to reduce bias.

For each patient the following data was collected: RPD hygiene, RPD habits of use, and Kennedy partial edentulism classification.[16,17] The hygiene classification was determined as follows: good (no plaque on the dental prosthesis), regular (presence of a visible plaque film on the denture surface or detected with a probe), and bad (abundance of soft matter on the denture surface).

All the RPDs were done according to the teaching methodology of the Unit. All teeth included as abutments were considered capable of withstanding the support, stability, and retention of the prosthesis. All teeth were periodontally stable. Restorations of abutment teeth were not considered an excluding factor, as long as the restoration fulfilled all its biologic and functional criteria. None of the abutment teeth had full-contour crowns.

The same dental technician did the RPDs, and the frameworks were all done in a cobalt-chromium alloy.

To verify the periodontal status of abutment and nonabutment teeth, a periodontal examination was conducted, following the methodology described by Zlatarić et al.[5] The following variables were determined:

- Plaque Index (PI) was assessed according to the Silness/Loe Index.[18]
- Gingival Index (GI): assessing the state of gingival inflammation. Measurements were conducted at six points of the tooth, and the results were considered according the following criteria: 0 – no bleeding when a probe is passed along the gingival margin; 1 – isolated bleeding spots visible; 2 – blood forms a confluent red line in the margin; 3 – heavy or profuse bleeding.[19]

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Table 1 Distribution by Hygiene of Prosthesis

	n	%
Bad	20	37.0
Regular	29	53.7
Good	5	9.3
Total	54	100.0

Table 2 Distribution by Prosthesis Use

	To leave home		During meals		During the day		At all times	
	n	%	n	%	n	%	n	%
Maxillary RPD	2	4.9	2	4.9	33	80.5	4	9.8
Mandibular RPD	2	4.2	4	8.3	39	81.2	3	6.2

Table 3 Distribution by Kennedy Classification

	Class I		Class II		Class III		Class IV	
	n	%	n	%	n	%	n	%
Maxillary	8	19.5	16	39.0	17	41.5	0	0.0
Mandibular	21	43.8	8	16.7	19	39.6	0	0.0

- Probing pocket depth (PD) was measured at six points of the tooth from the crest of the gingival margin to a probable pocket depth using a Williams Probe, and the highest value was recorded for each tooth.[5]
- Gingival recession (GR) was measured at six points of the tooth from the cementoenamel junction to the gingival margin, and the highest value was recorded for each tooth.[5]
- Tooth mobility (TM) was recorded according to a scale from 0 to 3: 0 – no mobility; 1 – < 1 mm movement in the horizontal plane; 2 – > 1 mm movement in the horizontal plane; 3 – movement in the apical direction.[5]

Data Analysis

Several descriptive statistics (absolute and relative frequencies, averages, standard deviation, maximum and minimum values) were calculated for each variable. For each of the quantitative variables, assumption of normal distribution was analyzed using Kolmogorov-Smirnov test, considering that adherence to normality was ensured when $P > .05$. To compare the distributions in the variables with three or more sample groups, analysis of variance or its nonparametric equivalent, the Kruskal-Wallis test, was used. $P < .05$ was considered significant.

Statistical analysis was done using IBM SPSS Statistics version 21.0.0 and Microsoft Excel.

Results

Study Population and Dentures Characteristics

Of the 145 contacted patients, 54 were included in this study (37.2%). There were 23 males (42.6%) and 39 females (57.4%) with a mean age of 59.09 ± 11.12 years.

A total of 87 RPDs were examined, and each RPD was considered a statistically independent case.

When distributing the sample by groups according to the number of abutment and nonabutment teeth to ease statistical analysis, it was found that most patients had 5 to 8 abutment teeth (59.3%; n = 32). On the other hand, most of the patients had 9 to 12 nonabutment teeth (31.5%; n = 17), followed by 13 to 16 (25.9%; n = 14) and 4 to 8 (24.0%; n = 13).

The great majority of patients had regular hygiene for the prosthesis (Table 1). Most patients used the prosthesis correctly, using it during the day and removing it overnight (Table 2). A total of 41 maxillary and 46 mandibular RPDs were examined. The most prevalent type of partial edentulism was Kennedy Class III (Table 3). The mean time of RPD use was 2.2 years.

Clinical Periodontal Parameters

Comparing abutment teeth with nonabutment teeth, it was possible

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Table 4 Comparative Analysis of Periodontal Variables of Abutment Teeth Compared to Nonabutment Teeth

	Mean	SD	Max	Min	*P*
PD abutment (mm)	3.21	0.82	5.88	2.00	< .001
PD nonabutment (mm)	2.25	0.52	3.50	1.17	
GR abutment (mm)	1.83	1.20	4.50	0.00	< .001
GR nonabutment (mm)	0.87	0.92	5.50	0.00	
PI abutment	1.90	0.54	3.00	1.00	< .001
PI nonabutment	1.49	0.52	3.00	0.92	
TM abutment	0.52	0.43	1.50	0.00	.011
TM nonabutment	0.39	0.42	2.00	0.00	
GI abutment	1.77	0.61	3.00	0.75	< .001
GI nonabutment	0.89	0.56	3.00	0.00	

PD = pocket probing depth; GR = gingival recession; PI = Plaque Index; TM = teeth mobility; GI = Gingival Index.

Table 5 Comparative Analysis of Periodontal Variables of Abutment Teeth with Occlusal Clasps and Abutment Teeth with Gingival Clasps

	Mean	SD	Max	Min	*P*
PD occlusal clasps (mm)	3.43	0.96	2.00	7.00	.002
PD gingival clasps (mm)	2.96	0.83	2.00	6.00	
GR occlusal clasps (mm)	2.05	1.29	0.00	5.00	.037
GR gingival clasps (mm)	1.61	1.29	0.00	5.00	
PI occlusal clasps	2.10	0.57	1.00	3.00	< .001
PI gingival clasps	1.67	0.67	1.00	3.00	
TM occlusal clasps	0.56	0.42	0.00	1.60	.770
TM gingival clasps	0.54	0.59	0.00	2.00	
GI occlusal clasps	2.02	0.78	0.00	3.00	.003
GI gingival clasps	1.47	0.93	0.00	3.00	

PD = pocket probing depth; GR = gingival recession; PI = Plaque Index; TM = teeth mobility; GI = Gingival Index.

to verify that the values of all periodontal parameters (PD, GR, PI, GI, and TM) showed statistically significant differences, with worst results for the abutment teeth (Table 4).

The mean PD, GR, PI, and GI were superior for the abutment teeth with occlusal clasp compared to the abutment teeth with gingival clasp ($P < .01$) (Table 5).

No statistically significant differences were found for any of the variables when relating Kennedy classes with periodontal variables for maxillary abutment teeth ($P > .05$) (Table 6).

Only the mobility of mandibular abutment teeth showed statistically significant differences ($P = .048$). The mandibular abutment teeth classified as Kennedy Class I and II showed higher values compared to Kennedy Class III (Table 7).

Discussion

This study was performed to compare five periodontal variables (PD, GR, PI, GI, and TM) between the abutment teeth of a RPD and nonabutment teeth. Statistically significant differences were found for all variables ($P < .001$). The mean PD, GR, PI, TM, and GI were significantly higher for the abutment teeth when compared with the average obtained for the nonabutment teeth.

A study with a similar methodology by Zlatarić et al[5] noted that the values obtained for the abutment teeth were significantly higher for all periodontal variables when compared with the values obtained for nonabutment teeth. Amaral,[20] after a longitudinal assessment over 12 months of periodontal condition of the abutment and nonabutment teeth in patients with RPD, found that the abutment teeth showed higher values for PD, GR, GI, and PI. Yeung et al[11] showed that there was a higher prevalence of plaque, gingivitis, and gingival recession, especially on surfaces in proximity to the RPD elements (< 3 mm).

However, there is no consensus in the literature regarding possible harm that RPD might cause to the periodontal health of the remaining teeth. Vanzeveren et al[10] did not

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obtain statistically significant differences when comparing the values obtained for the abutment teeth and nonabutment teeth. Piwowarczyk et al[21] did not find differences in terms of PD but obtained differences in TM.

In the present study, no statistically significant results were obtained ($P > .05$) for PD, GR, and TM in the mandibular abutment teeth with different Kennedy classifications. However, in repeating the procedures for the mandibular abutment teeth it was found that TM was significantly influenced ($P < .05$). Kennedy Class I and II had the highest values compared to patients with Class III, which can be explained by the fact that these rehabilitations have free saddles. If these saddles are not controlled and properly adjusted over time, a lever effect can be exerted by this distal part of the prosthesis over the abutment teeth. Using a different methodology, Jorge et al[7] observed changes in the TM values of the abutment teeth in patients with Kennedy Class I, II, and III over a period of 6 months using the Periotest. There were minimal changes with increased mobility of the abutment teeth, particularly in Kennedy Class I and II.

The results obtained in the present study can be explained by higher plaque accumulation values, demonstrated in the high PI values for the abutment teeth, that consequently led to an increase in inflammation of the gingival margin, also demonstrated by a higher GI in the abutment teeth.

The present study also evaluated possible differences in periodontal variables between abutment teeth with occlusal clasps and those with gingival approach clasps. All periodontal variables except TM had statistically significant differences, with the worst results for the abutment teeth with occlusal clasps.

Table 6 Descriptive Statistics for PD, GR, and TM of Maxillary Abutment Teeth in Each Kennedy Class and Comparison Tests of Distribution

	Maxillary Kennedy Classification				
	I (n = 8)	II (n = 16)	III (n = 17)	IV (n = 0)	*P*
PD abutment teeth (mm)					
Mean	3.15	3.47	3.35	–	.738
SD	1.06	1.05	0.81	–	
Max	4.50	6.00	5.60	–	
Min	2.00	2.00	2.30	–	
GR abutment teeth (mm)					
Mean	2.30	1.50	1.52	–	.291
SD	1.57	0.91	1.38	–	
Max	4.30	3.00	3.50	–	
Min	0.00	0.00	0.00	–	
TM abutment teeth					
Mean	0.71	0.61	0.67	–	.972
SD	0.64	0.41	0.52	–	
Max	1.70	1.30	2.00	–	
Min	0.00	0.00	0.00	–	

PD = pocket probing depth; GR = gingival recession; TM = tooth mobility.

Table 7 Descriptive Statistics for PD, GR, and TM of Mandibular Abutment Teeth in Each Kennedy Class and Comparison Tests of Distribution

	Mandibular Kennedy Classification				
	I (n = 21)	II (n = 8)	III (n = 19)	IV (n = 0)	*P*
PD abutment teeth (mm)					
Mean	3.03	3.26	3.30	–	.911
SD	0.87	0.57	0.75	–	
Max	6.00	4.00	4.75	–	
Min	2.00	2.30	2.30	–	
GR abutment teeth (mm)					
Mean	2.63	2.10	1.68	–	.054
SD	1.45	1.08	0.89	–	
Max	5.00	4.00	3.30	–	
Min	0.00	0.30	0.30	–	
TM abutment teeth					
Mean	0.78	0.50	0.33	–	.048
SD	0.61	0.41	0.37	–	
Max	2.00	1.00	1.00	–	
Min	0.00	0.00	0.00	–	

PD = pocket probing depth; GR = gingival recession; TM = tooth mobility.

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Jorge et al[22] compared the results obtained for TM of abutment teeth with occlusal clasps and gingival approach clasps and found no statistically significant differences.

The periodontal variable with the most statistically significant difference was PI ($P < .001$). As mentioned in the literature,[23] the authors of the present study believe this may be associated with a greater accumulation of plaque related to the clasp design. The two arms in the occlusal clasps (retentive and reciprocal) have more surface area in contact with the tooth, which may promote more plaque accumulation when compared to the simple gingival clasp design.

The main limitation of this study was related to the sample size and its source. Further work should be done with a larger sample to obtain conclusions that could be extrapolated to the general population.

Conclusions

Within the limitations of this study, it can be concluded that no relationship exists between partial edentulism type and RPD abutments in PD and GR, lower abutments had a higher average mobility in Kennedy Classes I and II, the periodontal status of abutment teeth is more compromised than that in nonabutment teeth, and the periodontal status of abutment teeth with occlusal clasps is more compromised than in gingival approach clasps, except for TM.

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