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Patient-Reported Outcomes Following Delivery of Removable Partial Dentures for Periodontitis Patients: A Retrospective Study

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ABSTRACT

Periodontitis patients experience a poor oral health-related quality of life (OHrQoL) due to the disease burden; thus having a denture would add load on oral health care, comfort and clinical health. This study aimed to determine the patient-reported outcomes among periodontitis patients receiving removable partial dentures (RPD). Clinical notes of 268 patients issued with RPDs at a public university-led dental clinic within 24 months before the study were screened. Subsequently, patients were invited to either a phone call or self-administered survey on their perceived oral health-related quality of life using the Geriatric/General Oral Health Assessment Index (GOHAI) and satisfaction following treatment received and also invited to a periodontal health examination. Thirty-one patients responded to the survey (mean age 56 + 12.6 years, 60% female), and had missing teeth of 12.4 +7.7 that were replaced by a total of 48 RPDs with either acrylic (66.7%) or cobalt-chrome (33.3%) in previous 3-24 months (average 11.6). Although there were some discomfort and chewing dysfunction (mean GOHAI 1.22-3.13), most never worried about their teeth (58.1%), limited contact with others (64.5%) or used medications to relieve pain (83.9%). The periodontal treatment provided significantly improved periodontal health ($p<0.05$ for missing teeth, deep sites/PPD, and mobile teeth). In conclusion, most periodontitis patients provided with RPDs were satisfied and found their new dentures to be well-tolerated. Our findings suggest a continuous need to evaluate the resources on patient care to produce optimal returns for oral health and quality of life in the management of periodontitis.

1. INTRODUCTION

Tooth loss is a widespread complication of periodontitis when at its advanced stages and remains a concern for clinical dentistry and dental education despite numerous advances in dental technology. Having missing teeth can considerably affect a person's appearance, speech, comfort, oral health, and function such as eating and chewing, and subsequently, their quality of life. As a solution, these missing teeth may be clinically replaced using either a bridge, implant or removable dentures. Of these, removable partial dentures (RPD) are the most accessible and affordable option, with positive reports of improvements in oral health-related quality of life [1], [2]. Alternatively, RPD has also been cautioned to cause a serious threat to the remaining teeth and their supporting structures [3]. The design of the RPD itself may influence abutment teeth loss, but this is primarily due to an increase in plaque accumulation in these additional areas [4]. While maintaining the hygiene of the abutments with RPDs in the mouth is an added challenge [5], it is only with effective oral and denture hygiene care that optimal oral health and long-term use of prostheses may be attained [6]. Individuals must have a good level of knowledge and motivation on denture care and hygiene habits as a prerequisite to achieving this end [7].

It is established in the literature that for the dental prosthesis not to cause any adverse periodontal reactions, the patient must maintain meticulous oral hygiene and good periodontal health even at the pre-prosthetic stage [8- 10]. Patients who suffer from periodontitis and have experienced tooth loss will require that periodontal infections be stabilised before undergoing prosthodontic treatment. Furthermore, patients who receive regular periodontal supportive therapy have been reported to have a better oral health-related quality of life (OHrQoL) compared to patients with untreated periodontitis [11- 14]. These studies showed that non-surgical periodontal therapy could improve the patients' OHRQoL within one week after therapy, and by improving the health of periodontal tissues, further risk of tooth loss caused by periodontitis can be reduced. The use of RPD as a relatively cheaper alternative has been demonstrated to improve functionality and aesthetics for edentulous patients due to periodontitis by ensuring a balanced distribution of forces to the supporting tissues [15]. Stable periodontal health has also been reported for up to as long as 5 to 12 years after RPDs among periodontitis patients; nevertheless, these successful outcomes depend on the strategic planning of supportive periodontal care [16].

In the provision of care for patients with both periodontal and prosthodontic treatment needs, the undergraduate dental school training clinical protocol requires that these patients undergo a basic periodontal assessment at the initial visit to ensure optimal periodontal health before the start of prosthodontics treatment. For most dental schools, treatment provided by dental students is generously subsidised and learning to be competent in managing and fabricating dentures for patients requires substantial resources [17]; what more if these patients also require intensive periodontal therapy? There is a need to ensure that the resources expended on patient care at university-led dental clinics can produce optimal returns for oral health and quality of life. Hence, the current study determines the clinical and patient-reported outcomes of periodontal and prosthodontic treatment among periodontitis patients at a public university-led dental clinic facility.

2. MATERIALS AND METHODS

2.1 Study design

Patients who received RPDs from 1st January 2016 until 30th September 2017 in a public dental training school in Kuala Lumpur formed the sampling frame for this study. Records were obtained and screened to select patients who had periodontitis before prosthodontic treatment. From 268 registration numbers, 218 case notes were retrieved (81.3%), and out of this, 51 (23.4%) patients had complete clinical records prior to RPD delivery. These patients were called and invited to come for a recall visit and only 31 (60.8%) agreed to

participate. They were last seen at the dental clinics between 3-24 months (an average of 11.6) before the recall visit. At the recall visit, they were given a full dental and periodontal assessment and asked to fill out a questionnaire survey form. We obtained approval to conduct this study from the University's Research and Ethics Committee (PPI/111/8/JEP-2017-199).

2.2 Questionnaire survey

A self-administered questionnaire survey form was developed to obtain information on the following three components:

i. Patient background profile – age, gender, number of missing teeth and types of RPDs received

ii. Patient satisfaction with the RPDs received at the clinic – function, structure and hygiene care (14 questions). There are five response categories for each question and a score has been assigned for each response category (5=strongly agree, 4=agree, 3=uncertain, 2=disagree, and 1=strongly disagree). However, these scores were not used as a composite measurement but were reported as separate items.

iii. Oral health-related quality of life measurement. – We used the 12-item Geriatric/General Oral Health Assessment Index (GOHAI) which had been translated and validated to be used in the Malay language [18]. Five response categories for each question and a score has been assigned for each response category (l=never, 2=seldom, 3=sometimes, 4=quite often, and 5=very often).

The questionnaire had been pre-tested before the study.

2.3 Clinical examination

The clinical dental examination was performed for plaque score, gingival score, and dental and periodontal charting by two calibrated examiners (periodontists). These clinical parameters were then compared to those before the delivery of the RPD.

2.4 Analysis of data

Data analyses were performed using the statistical software package IBM-SPSS version 20.0 [19]. The descriptive analysis reported means and standard deviation for quantitative variables and percentages for qualitative variables. For patient satisfaction, items were reported to contribute to good satisfaction when responded to as Agreed or Strongly Agreed. The GOHAI score was calculated by adding up the scores of the responses to the 12 questions. A maximum score of 60 will indicate high satisfactory oral health [20]. The mean GOHAI score and standard deviation (SD) were reported for each GOHAI item. The Wilcoxon Signed-Rank Test was used to compare differences in clinical parameters before and after the prosthodontic treatment with a level of significance set at 5%.

3. RESULTS

3.1 Patients' profile

Periodontitis patients who participated in this study had a mean age of 56 $\pm$12.6 years old (range 29-78 years) and mostly 60% were females. The average number of missing teeth was 12.48 $\pm$7.7. Patients had both upper and lower dentures (17, 54.6%) or separate upper/lower dentures (7, 22.6% respectively), and mostly in the Kennedy Class and III (18, 37.5% each) followed by Class IV (10, 26.3%) and Class II (2, 5.3%). The majority (32, 66.7%) wore acrylic as opposed to cobalt-chrome (16, 33.3%) dentures.

3.2 Patient satisfaction with RPD

Responses towards the RPD function was good, with more than half of the patients feeling satisfied with all the items measured (Table 1). Only a few (6, 19.4%) experienced pain, while almost half (15, 48.4%) felt some discomfort and some (12, 38.8%) were unable to eat well while wearing their new dentures. Concerning

the RPD design, more than 70% were satisfied with the RPD size, colour and tooth arrangement, and liked how they looked when wearing the denture. While 80.7% reported that their RPD was easy to clean, 61.2% agreed that food would get stuck underneath the denture and some had difficulties keeping their mouths clean (38.8%).

Table 1. Patient satisfaction with dentures and oral health status

Satisfaction items	Agree and Strongly Agree, n (%)
I. The function of removable denture	
1. I feel comfortable when I wear the denture.	18 (58.1)
2. I can easily insert and remove the denture without any problem.	25 (80.5)
3. I feel comfortable eating, chewing and swallowing when using the denture.	15 (48.4)
4. I cannot eat hard food when wearing the denture.	12 (38.8)
5. The denture fits well in my mouth.	19 (61.3)
6. I feel comfortable when I speak while using the denture.	22 (71.0)
7. I feel pain when I use the denture.	6 (19.4)
II. Structure/Design of removable denture	
8. I like the size of the denture.	22 (77.4)
9. I like the colour of the artificial teeth.	28 (90.3)
10. I like the arrangement of teeth.	22 (71.0)
11. I feel comfortable when I wear the denture.	22 (74.2)
III. Denture and mouth hygiene care	
12. The denture is easy to clean.	22 (80.7)
13. Food is always stuck underneath the denture.	19 (61.2)
14. I have difficulty keeping my mouth clean when wearing the denture.	12 (38.8)

3.3 OHRQoL impacts

In Table 2, responses to the GOHAI items that reflected the highest impacts were those answered as “Always” and “Often” experienced. The highest prevalence was for the items “trouble biting/chewing foods” (45.2%) and “unable to swallow comfortably” (35.5%). The highest response for items scored as “Sometimes” was “self-conscious” (29.0%). For reverse-scored items, “able to eat without discomfort” was scored highest as “Never” (29.0%) and “Seldom” (29.0%). The mean Add-GOHAI score for these patients was 26.2 (S.D. 8.0). Nevertheless, there was no statistical significance in the relationship of any of the patients’ characteristics with their reported OHRQoL (Table 3).

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Table 2. Frequency distribution of patients-reported OHRQoL (GOHAI scores)

Item	n (%)					Mean ± SD
	Never	Seldom	Sometimes	Often	Always	
1. Limit certain kinds of food.	11 (35.5)	6 (19.4)	7 (22.6)	5 (16.1)	2 (6.5)	2.39 ±1.31
2. Trouble biting /chewing food.	7 (22.6)	4 (12.9)	6 (19.4)	6 (19.4)	8 (25.8)	3.13 ±1.52
3. Able to swallow comfortably.	7 (22.6)	4 (12.9)	8 (25.8)	3 (9.7)	9 (29.0)	3.10 ±1.54
4. Unable to speak clearly.	11 (35.5)	7 (22.6)	7 (22.6)	6 (19.4)	0 (0)	2.26 ±1.15
5. Able to eat without discomfort.	9 (29.0)	9 (29.0)	8 (25.8)	1 (3.2)	4 (12.9)	2.42 ±1.31
6. Limit contact with people.	20 (64.5)	3 (9.7)	7 (22.6)	0 (0)	1 (3.2)	1.68 ±1.05
7. Pleased with looks.	8 (25.8)	7 (22.6)	6 (19.4)	6 (19.4)	5 (12.9)	2.71 ±1.40
8. Used medication for relief.	26 (83.9)	3 (9.7)	2 (6.5)	0 (0)	0 (0)	1.22 ±0.56
9. Worried about teeth/gums /dentures.	18 (58.1)	4 (12.9)	5 (16.1)	4 (12.9)	0 (0)	1.84 ±1.13
10. Self-conscious of teeth, gums or dentures	12 (38.7)	5 (16.1)	9 (29.0)	3 (9.7)	2 (6.5)	2.29 ±1.27
11. Uncomfortable eating with people.	12 (38.7)	8 (25.8)	5 (16.1)	3 (9.7)	3 (9.7)	2.26 ±1.34
12. Sensitive to hot/cold/ sweet.	11 (35.5)	19 (32.3)	6 (19.4)	2 (6.5)	2 (6.5)	2.16 ±1.19

Table 3. Association between patients demographics and OHrQoL

Items	mean GOHAI score	SD	p value
1. Gender: Male Female	 2.24 2.37	 0.75 0.53	0.571
2. Ethnic groups: Malay Chinese Indian	 2.21 2.63 2.56	 0.70 0.36 0.49	0.304

	Others	1.17	0.00	
3.	Medical status: No medical comorbidities 1 systemic disease >1 systemic disease	 2.19 2.28 2.50	 0.59 0.48 0.92	0.363
4.	Smoking status: Smoker Non-smoker	 2.03 2.32	 0.67 0.63	0.519
5.	Type of denture received Upper only Lower only Upper and lower	 2.40 2.44 2.18	 0.56 0.79 0.67	0.603

Independent t-test (gender, smoking status), One-way ANOVA (ethnic group, medical status, type of denture received). significance level at $p<0.05$

3.4 Clinical outcomes of RPD

The current status of teeth and periodontal health of patients compared to the status before they received RPD is shown in Table 4. The total number of teeth present and decayed had reduced (P=0.002 and P=0.042), while the number of filled teeth did not differ significantly (P=0.438) after delivery of RPD. Meanwhile, the oral hygiene status indicated by plaque score (FMPS) did not show much change from the initial visit before delivery of RPDs (P=0.376), but the gingival inflammation status represented by FMBS change showed significant improvements after the delivery of RPD (P=0.046). There was also a significant reduction in the number of sites with probing pocket depth (PPD) of more than 4mm and 6mm, furcation involvement and tooth mobility.

Table 4. Patient oral health status before and after delivery of RPDs

Clinical parameters	**Mean ± SD**		**p value**
	Before	**After**	
Total teeth present	18.6 (7.5)	16.86 (7.3)	0.002*
Decayed teeth (D)	0.69 (1.5)	0.07 (0.26)	0.040*
Missing teeth (M)	12.48 (7.7)	15.03 (7 - 28)	<0.001*
Filled teeth (F)	2.34 (4.1)	2.38 (3.7)	0.438
Full mouth plaque score (%)	63.69 (24.4)	66.65 (20.0)	0.376
Full mouth bleeding score (%)	47.2 (26.1)	37.58 (25.1)	0.046*
Sites with PPD ≥ 4mm	13.69 (11.8)	7.14 (6.9)	<0.001*
Sites with PPD ≥ 6mm	13.4 (21.6)	2.89 (5.9)	<0.001*
SItes with furcation involvement	0.93 (1.8)	0.17 (0.5)	0.019*

Teeth with mobility	4.65 (5.4)	1.79 (2.7)	0.006*

PPD - probing pocket depth. *Wilcoxon signed rank test, p <0.05 as significant level

4. DISCUSSION

The adoption of patient-reported outcomes upon receiving dental treatment has often been side-lined when assessing treatment outcomes of RPDs in periodontitis patients, despite its recognition as a useful indicator of dental treatment outcomes [21], [22]. Factors such as dental services provided, dentists' and dental teams' communication with patients, staff helpfulness, and structural aspects of the practice are established indicators to evaluate patient satisfaction [23]. More importantly, items such as functional and design of dentures, which include appearance, fit, effects on speech, need for adjustment, use for eating, chewing difficulty, limits on the choice of foods, taste, food under RPD, difficulty in keeping the mouth and denture clean, are equally important elements to be included when measuring patient satisfaction upon delivery of a new denture [24]. Further, impacts of the RPDs on patients' daily life are essential measures of patient-reported outcomes as they measure oral health-related quality of life impacts [25], [26]. Used alongside clinical outcomes, patient-reported outcomes offer a broader spectrum of improvement items in the care given by the dentist and dental team [27]. In this study, we used GOHAI as a patient-reported outcome measure for RPD, which has been validated to be administered in the Malay language [18]. Although it was developed earlier for assessing geriatric oral health, the GOHAI assessment index has been accepted to be used for all ages to evaluate the impacts of pain and discomfort in the mouth and physical and psychosocial functions on quality of life. A recent study used GOHAI to measure the impacts of tooth loss on OHRQoL in a Malaysian population with and without dental prostheses [28].

More than half of the respondents expressed dissatisfaction with their current dentures in terms of function, whereby a quarter had experienced discomfort when eating with the dentures in. From the case notes of these patients, we found that about half did not attend a post-insertion review, and five patients admitted during the recall visit that they no longer wore the dentures because of some discomfort. Hence, there was no maintenance regime to continuously monitor the patient's comfort and coping mechanism with the prostheses. A 'settling period of 1 to 1.5 months following the insertion of new RPDs has been suggested, during which changes in jaw movement, the adaptation of oral tissues to the denture, properties of the alveolar mucosa, or changes in chewing points of the dentures will take place [8]. It is, therefore, imperative to ensure that patients attend review sessions following denture delivery and subsequently make any adjustments required following this settling period to secure maximum patient comfort in learning to adapt to new dentures. In contrast, there was general satisfaction with the structure and hygiene care of dentures, reflecting the structural quality of the denture fabrication.

These observations related to denture function agree with responses to GOHAI, whereby the highest prevalence of impacts was also associated with function items, which are "trouble biting/eating foods", "not able to swallow comfortably", and "not able to eat without discomfort". Albeit their prevalence was experienced by less than half of the patients. This finding is consistent with other studies, reporting that at least 20% of denture wearers would experience discomfort and chewing dysfunction [22]. The mean GOHAI score in this study was 26.2, below half of the maximum score of 60, suggesting that negative impacts on their daily function were tolerable. Conversely, the absence of GOHAI scores at the pre-prosthetic stage disallows a before-and-after comparison. Therefore, it is impossible to determine changes in the OHRQoL as a treatment outcome. According to a study by [1] high satisfaction with dentures was related to high GOHAI scores, indicating a lower impairment of quality of life because of denture-wearing. This association was, however, not demonstrated in this study. The impaired function of the RPD did not appear to impact the

patient's OHRQoL significantly. One reason for this could be related to the number of missing teeth or the location of the edentulous space in the arch. [29] reported that elderly patients losing more than 25 teeth or those with edentulous areas located anteriorly would be more affected by their OHRQoL than patients who had missed less than 25 teeth. In this study, the mean number of teeth missing was 12.5 at the start of treatment and 15.0 following the delivery of RPDs. However, we did not study the location of edentulous spaces in this present study.

There is evidence that successful long-term retention of periodontally compromised teeth with advanced bone loss is possible for patients with periodontitis [30]. In this study, we found the improvements in the main periodontal parameters to be statistically significant. There was evidence of reduced periodontal pockets and several mobile teeth, suggesting a good prognosis for long-term retention. This indicated that the periodontal treatment provided for the patients before the delivery of RPD had successfully improved the periodontal health of the patients, which could be sustained up to n three to twelve months after patients received the dentures.

The cost of training undergraduate dental students, specifically in denture fabrication, has been quantified to be substantial, so much so that a more financially sustainable model to fund dental training has been suggested [17]. The experience with the COVID-19 pandemic further magnifies funding issues in dental education and affects dental access and optimal operating hours at the students' dental clinics; there is a dire need to reorganise and make efficient use of physical service resources so that optimal treatment outcomes for periodontal and prosthodontic treatment shall not be compromised [31]. Despite the small number of patients in this study, we found sufficient evidence that while there was good periodontal health among these denture wearers, there are limitations within the patient management system, especially in compliance with post-prosthodontic follow-ups and supportive periodontal care. These findings explicitly call for an immediate measure to improve the institution's patient case notes management and emphasise supportive periodontal care during and after the denture construction and timely reviews of denture evaluation following delivery.

5. CONCLUSION

There was overall satisfaction towards their RPDs, and the low mean GOHAI score was found to be of unremarkable concern, suggesting that the discomfort was well-tolerated by the patients except for a small number who chose to no longer wear the dentures. In addition, the periodontal treatment regime provided has resulted in overall significant improvements in the periodontal health of denture wearers in this study.

In line with the study findings, we emphasize the role of continuous evaluation in the undergraduate dental school clinical protocol to ensure that all patients requiring prosthodontics undergo pre-prosthetic periodontal health assessment before the start of any definitive prosthodontic treatment planning. Subsequently, it is equally important to ascertain that patient exits from the planned protocol with follow-up appointments and supportive care.

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