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Impact of Removable Partial Denture Type on Patient Satisfaction and Abutment Survival Rate-RCT

Sherif A. Sadek[1, 2*], Dina Elawady[3]

[1]Department of Prosthodontics, Faculty of Oral and Dental Medicine, Cairo University, Cairo, Egypt; [2]Department of Prosthodontics, Alfarabi Private College for Dentistry and Nursing, Jeddah, Kingdom of Saudi Arabia; [3]Department of Prosthodontics, Faculty of Dentistry, Modern Science and Arts University (MSA), Cairo, Egypt

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Keywords: Removable partial dentures; Thermopress material; Patient's satisfaction; Bone loss

***Correspondence:** Sherif A. Sadek. Department of Prosthodontics, Faculty of Oral and Dental Medicine, Cairo University, Cairo, Egypt; Department of Prosthodontics, Alfarabi Private College for Dentistry and Nursing, Jeddah, Kingdom of Saudi Arabia. E-mail: sherifalysadek@gmail.com

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Abstract

BACKGROUND: Patient's satisfaction and the preservation of abutments is the most important outcomes that the clinician seeks during fabrication of any dental treatment, especially when it is concerned with removable prosthodontic rehabilitation.

AIM: The present study evaluates three different Removable Partial Denture (RPD) types restoring mandibular class II modification I edentulous cases with regards to patient's satisfaction and abutments survival.

METHODS: Forty-two partially edentulous patients were divided into three groups (Group I rehabilitated with Vitallium RPD, Group II rehabilitated with Vitallium RPD where the modification area restored with the surveyed bridge, Group III rehabilitated with Thermopress RPD). The patients were followed up for twenty-four months. Using a questionnaire, prosthodontic maintenance required was documented at the delivery and after 3 months.

RESULTS: There was a significant difference regarding patient satisfaction for group III (P-value <0.05) while for groups I and II there was a non-significant difference (P-value >0.05). Regarding the survival rate, there was a non-significant difference between the three groups (P-value >0.05) at the end of twenty-four months of follow up.

CONCLUSION: Patient satisfaction and abutment survival were better with Thermopress RPD than conventional Vitallium RPD or Vitallium RPD with a surveyed bridge restoring the modification area. Although a non-statistically significant difference was found in the survival rate of abutments between groups, a clinically important result was revealed as no abutments failures were reported in the Thermopress group.

Introduction

Patient satisfaction is a prime concern when constructing removable partial denture (RPD). Improving phonetics, mastication and aesthetics are considered goals during partial denture (PD) designing [1]. Preservation of the remaining structures is also one of the main objectives of the RPDs. It is considered crucial for clinicians to prevent abutment loss in PD's patients.

To avoid the problems of distal extension cases, efforts should be made to preserve the posterior teeth by every means. Upon failure of these efforts, the selection of the suitable type of RPD becomes challenging especially when it comes to the relationship between the distal surface of the abutment teeth at the site of the distal extension and the framework of RPD [2].

Support is considered as the main problem in distal extension edentulous ridge as Kennedy class II partially edentulous cases. A serious problem results from the difference in compressibility between the periodontal ligament of the abutment teeth and the mucoperiosteum covering the ridge. Due to the presence of the difference in compressibility between the periodontal ligaments of the abutment teeth and the mucosa of the residual alveolar ridge, a rotational movement results causing tissue ward movement of

the denture base resulting in excessive torque forces to the abutment teeth leading to its early loss [2].

Although in Kennedy class II modification 1 mandibular cases, the anterior abutment on the tooth-supported side is secondary, serving to support and retain one end of the tooth-supported segment and adding horizontal stabilisation to the denture [2], the rotational movement is still encountered.

The problems of these cases have been solved by various concepts beginning from using the conventional RPD until introducing implants as a solution in many treatment options. Despite the problems associated with the use of the conventional partial denture; it remains the commonly used restoration [3], [4], [5].

The traditional prosthetic rehabilitation for these cases is metallic RPD or restoring the modification space with the surveyed bridge before fabricating the metallic RPD. Thermopress RPD is another option which could be considered as an alternate material overcoming the problems of the cast metal RPDs, especially with the recent improvements. This material has a superior advantage when it comes to mechanical properties as creep resistance, fatigue endurance, flexibility, dimensional stability and wear resistance. It is also light in weight and esthetically can match both the tooth and tissue colours. It also provides biocompatibility similar to that of the casted RPDs [6].

Better patient satisfaction was reported due to their flexibility and ability to engage hard and soft tissue undercuts; the RPDs made from flexible resins are more naturally felled and more comfortable in the mouth. They also improve the esthetic requirements by using invisible clear clasps on the abutment teeth [7], [8]. Flexibility allows for better distribution of the masticatory forces rather than individual support points, and they do not only engage the abutment tooth for support and retention but also engage the ridge undercuts [9], [10].

On the other hand, choosing a satisfactory path of insertion especially in the presence of soft and hard tissue undercuts aiming to maintain a superior adaptation to the tissues is considered as a challenging aim in flexible RPD. Also, the flexible RPDs are made bulkier to compensate its low impact strength making them bulky than the cast metal RPDs and makes it difficult to design occlusal rests [11], [12], [13], [14].

Designing occlusal rests are considered vital for class II mod.1cases. In metallic RPD, the framework fulcrum line “when denture base is displaced toward residual ridge” runs from the east abutment of the free end to the posterior abutment on the modification area. When forces tend to displace denture away from its basal seat, supportive element (distal occlusal rest) of direct retainer assembly on the anterior abutment of the modification area serves as an indirect retainer. If the occlusal rest on the secondary abutment lies away from the fulcrum line, it may work for indirect retention adequately (dual function) (tooth support for one end of the modification area and support for an indirect retainer).

Therefore, this study aimed to evaluate the influence of RPD type on patient satisfaction and the abutment teeth’s survivals in class II mod. 1 mandibular partially edentulous patient.

Material and Methods

Forty-two partially edentulous patients were selected from the outpatient clinic of the Removable Prosthodontics Department, Faculty of dentistry, MSA University. They were medically free ageing from 45-60 years old. Patients were Kennedy Class II modification 1 mandibular partially edentulous with existing periodontally healthy remaining teeth and opposing natural maxillary teeth (Figure 1).

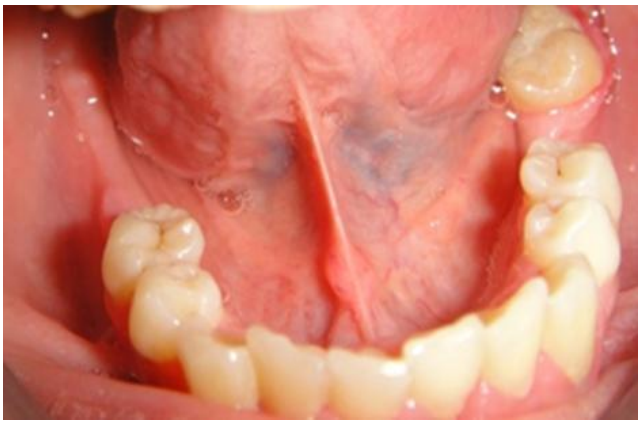


Figure 1: Intraoral photo of the mandible (occlusal view)

The patients were given a detailed explanation concerning the present state, alternative treatment plans and the proposed procedures. All patients were informed about the study protocol and objectives before they signed informed consent. The study was reviewed and approved by the Research Ethics committee of MSA University.

The selected patients were randomly divided and equally distributed fourteen patients in each group of the three groups. Each group received a different type of RPD; Group I: Vitallium RPD, Group II: Vitallium RPD with surveyed bridge restoring the modification area, Group III: Thermopress RPD. For the three groups, preoperative diagnostic panoramic radiographs and periapical radiographs for abutments were performed. Face bow records, and mounting of diagnostic casts on semi-adjustable articulators (Bioart A7 plus articulator) were implemented followed by surveying of the preliminary casts. Mouth

preparations (teeth scaling and necessary teeth fillings or another type of restoration if needed) were accomplished (Figure 2, and Figure 3 A, B, and C), (Figure 4 A, B, C, and D).

Group I: Secondary impressions were made to make the master cast. The metallic RPD framework was constructed and tried on the master cast and in the patient mouth (Figure 2D). Altered cast impressions were made and poured (Figure 2E) then the occlusion blocks were fabricated on the frameworks which were fitted on the altered cast (Figure 2F).

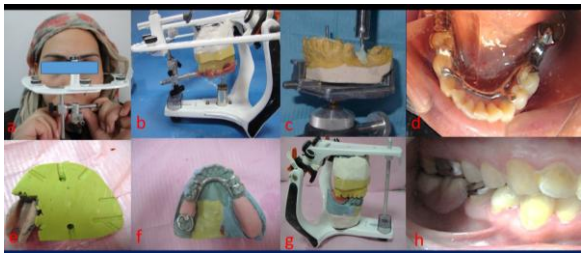


Figure 2: Vitallium RPD; A) Face bow record (facial view); B) Face bow transfer (profile view); C) Primary surveying (mandibular cast) – left side showing survey line); D) Metal try-in of the mandibular framework; E) Sawing of cast; F) Framework fitted on altered cast; G) Mounting on articulator (right side); H) Occlusion (right)

Group II: Preparation of the abutments to receive the surveyed bridge was performed. The wax pattern of the bridge was surveyed, and rest seats, as well as guiding planes, were prepared in the pattern (Figure 3D). Metal try-in of the bridge was done (Figure 3E) then cementation of the final surveyed bridge (Figure 3F). The metallic RPD framework was cast and tried first on the cast (Figure 3G) then in the patient mouth. Altered cast impression was made (Figure 3H) and poured then the occlusion blocks were fabricated on the frameworks which were fitted on the altered cast (Figure 3I).

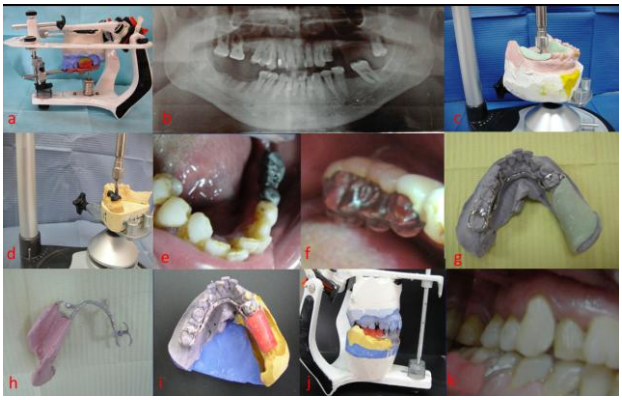


Figure 3: Vitallium RPD with surveyed bridge restoring the modification area; A) Face bow transfer (profile view); B) Panoramic radiograph; C) Surveying the cast. (path of insertion); D) Surveying the wax pattern of the bridge; E) Metal try in of surveyed bridge; F) Cementation of surveyed bridge; G) Metal try-in of the RPD framework on the cast and preparation of the tray for altered cast; H) Altered cast impression; I) The poured altered cast with the framework fully seated and wax rim prepared for jaw relation record; J) Mounted master casts (right side); K) Denture insertion (profile)

Group III: Secondary impression was made to pour the master cast, and occlusion blocks were fabricated on the master cast.

For the three groups, Jaw relation was registered then mounting of the occlusion blocks, and setting of artificial teeth was done (Figure 2G, Figure 3J, and Figure 4E) followed by the try in step. For groups, I and II heat-cured acrylic resin were used to process the PD base, while the flexible resin was used for processing the PD base of group III.

Thermopress 400 injecting unit was used for the fabrication of thermoplastic PD. The selected cartridge of the injecting material (quantity and colour) was selected and the preheating temperature (220°C), time (20 minutes) and the injecting pressure (5 bars) were adjusted according to the manufacturer's instructions. A vaseline based lubricant was applied before introducing the selected cartridge into one of the two heating cylinders where the cartridge membrane was pointed to the flask chamber. The excess of the lubricant was wiped out from the margin of the heating cylinder with a highly absorbent paper.

After processing of the dentures, denture insertion (Figure 2H, Figure 3K, Figure 4G and H) was performed, and selective grinding for intra-oral adjustments of occlusion was carried on whenever indicated.

Instructions for proper denture hygiene were stressed upon; not to wear dentures during sleeping hours and to keep it in tap water, clean the dentures after each meal under tap water only, not to use any mouthwashes or denture cleansers during the study period. They were also instructed not to use any denture adhesives.

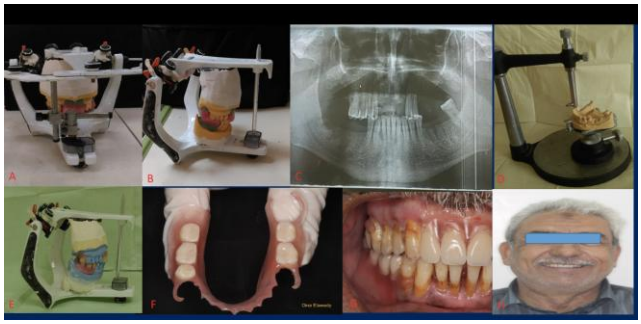


Figure 4: Thermopress RPD; A) Face bow transfer (facial view); B) Mounted diagnostic casts (left side); C) Panoramic radiograph; D) Primary surveying (mandibular cast) – right side showing survey line; E) Artificial setup on articulator (left side); F) Flexible lower partial denture; G) Denture Insertion (right); H) Extra-oral photo facial (smiling)

Patient satisfaction

Patients of the three groups were subjected to Oral Health-Related Quality of Life Measures (OHRQoL), and Chewing Function Quality (CFQ) questionnaires were taken for each group at delivering the partial denture as a baseline and after three months of function.

Patient satisfaction questionnaire based on a visual analogue scale (VAS) consisting of 12-Item short-form Oral Health-Related Quality of Life Measures (OHRQoL) with a scale from 0 to 4 (Never, Hardly ever, Occasionally, Fairly Often and Very Often) were taken from each group. The hypothesised framework included four primary dimensions: physical function, psychosocial function (with three subdimensions of role function, distress, and worry), impairment, and perceptions.

The Chewing Function Quality questionnaire consisting of 10 items with a scale from 0 to 4 (Never, Hardly ever, Occasionally, Fairly Often and Very Often) were taken from each group to prevent the mixing between psychosocial impact of a disturbed chewing function and its influence to a patient's quality of life and chewing function Disorders.

The collected data were tabulated and statistically analysed.

Survival Rate

The survival rate of abutments was evaluated. The abutments were considered surviving if they were clinically stable, functioning without any mobility. Survival analysis was done using Kaplan Maier statistics calculating the mean survival time for each group with their 95%CI (Cumulative incidence) and the corresponding survival graphs. The comparison was made between the different factors by Log-rank method using Cox-Mantel equation. P-values less than 0.05 were considered statistically significant.

Statistical analysis performed with computer program IBM SPSS 20 (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA), Graph Pad Prism (Graph Pad Technologies, USA) and Microsoft Excel 2016 (Microsoft Co-operation, USA) with the significant level set at $P \leq 0.05$. Data were presented as means and standard deviation (SD).

Results

Patient satisfaction

Oral Health Outcome Measures

Oral health outcome measures were evaluated through a written questionnaire delivered by the patient or relatives who answered twelve closed-ended questions through Likert Scale (out of 4), as listed in Table 1.

Two surveys were evaluated through this study, one considered as a baseline at the time of denture insertion and other after three months.

Table 1: Oral Health-Related Quality of Life questionnaire

Questions	Never	Hardly Ever	Occasionally	Fairly Often	Very Often
1. Have you had to avoid eating some foods? (Physical function; OHIP 28)	0	1	2	3	4
2. Have you found it difficult to relax? (Distress; OHIP 35)	0	1	2	3	4
3. Have you felt depressed? (Distress; OHIP 36)	0	1	2	3	4
4. Have you been upset? (Distress; OHIP 34)	0	1	2	3	4
5. Have you felt uncomfortable about the appearance of your teeth, mouth, or dentures? (Worry; OHIP22)	0	1	2	3	4
6. Have you been worried about dental problems? (Worry; OHIP19)	0	1	2	3	4
7. Have you had trouble getting along with other people? (Social function; OHIP 41)	0	1	2	3	4
8. Have you avoided going out? (Social function; OHIP 39)	0	1	2	3	4
9. Have you been unable to function? (Social function; OHIP 48)	0	1	2	3	4
10. How often did you feel nervous or self-conscious because of problems with your teeth, gums, or dentures? (Worry; GOHAI 10)	0	1	2	3	4
11. How much pain or distress has your teeth or gums caused you? (Pain; OHQOL 0B31)	0	1	2	3	4
12. Have you had uncomfortable dentures? (Denture; OHIP 18)	0	1	2	3	4

Regarding baseline, one-way analysis of variance (One Way ANOVA) was performed followed by Tukey`s post hoc test for multiple comparisons which revealed slight insignificant lower of group III as P-value > 0.05, as showed in Figure 5.

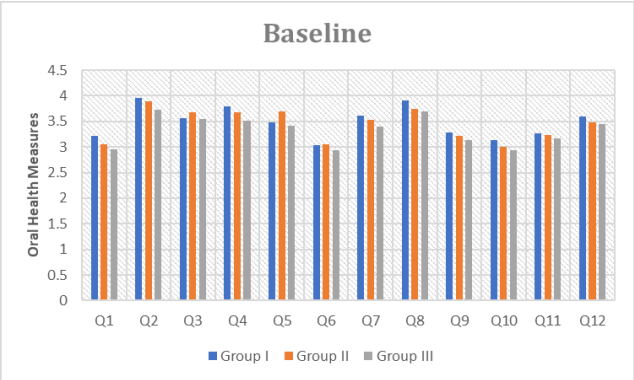


Figure 5: Means of Scale at Baseline between Studied Groups

Regarding three months, one-way analysis of variance (One Way ANOVA) was performed followed by Tukey`s post hoc test for multiple comparisons which revealed significant lower of group III as P-value < 0.05, as showed in Figure 6.

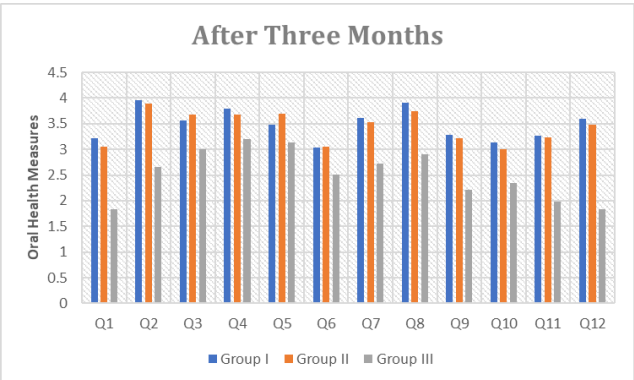


Figure 6: Means of Scale after Three Months between Studied Groups

Chewing Function Assessment:

Statistical analysis performed with SPSS 20®, Graph Pad Prism® and Microsoft Excel 2016 with a significant level set at P ≤ 0.05. Data were presented as means and standard deviation (SD).

Chewing function assessment was evaluated through a written questionnaire delivered by the patient or relatives who answered ten closed-ended questions through Likert Scale (out of 4), as listed in Table 2.

Table 2: Chewing Function Quality questionnaire

Questions	Never	Hardly Ever	Occasionally	Fairly Often	Very Often
1. Have you had any difficulty chewing apples / raw carrots, or foods of similar consistency?	0	1	2	3	4
2. Have you had any difficulty baked or fried firm meat, or foods of similar consistency?	0	1	2	3	4
3. Have you had any difficulties chewing biscuits, crackers, tea biscuits, or foods of Similar consistency?	0	1	2	3	4
4. Have you had any difficulty chewing fresh bread, doughnut or foods of similar consistency?	0	1	2	3	4
5. Have you had any difficulty chewing nuts /walnuts /almonds /macadamia/peanuts, or similar food?	0	1	2	3	4
6. Have you had any difficulty chewing lettuce, raw cabbage, or similar food?	0	1	2	3	4
7. Have you felt insecure when you are Chewing?	0	1	2	3	4
8. Have you had any difficulty when biting Different foods (food incision)?	0	1	2	3	4
9. Have you noticed food catching or food remaining stacked between or on your teeth or dentures during or after meals?	0	1	2	3	4
10. Have you had any difficulty chewing Chewing gum?	0	1	2	3	4

Two surveys were evaluated through this study, one considered as a baseline at the time of denture insertion and other after three months.

Regarding baseline, one-way analysis of variance (One Way ANOVA) was performed followed by Tukey`s post hoc test for multiple comparisons which revealed slight insignificant lower of group III as P-value > 0.05, as showed in Figure 7.

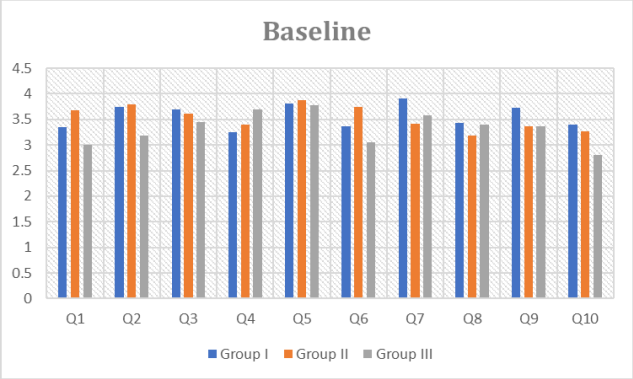


Figure 7: Means of Scale at Baseline between Studied Groups

Regarding three months, one-way analysis of variance (One Way ANOVA) was performed followed by Tukey`s post hoc test for multiple comparisons which revealed significant lower of group III as P-value < 0.05, as showed in Figure 8.

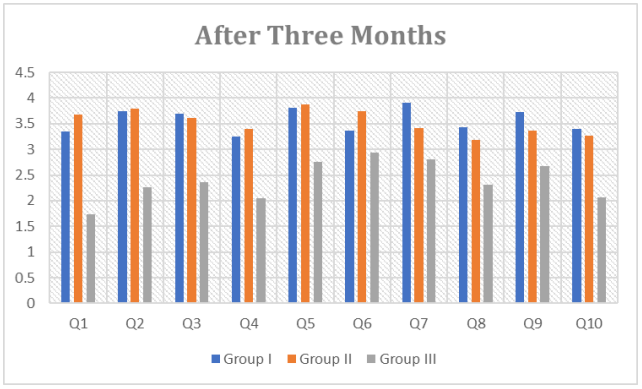
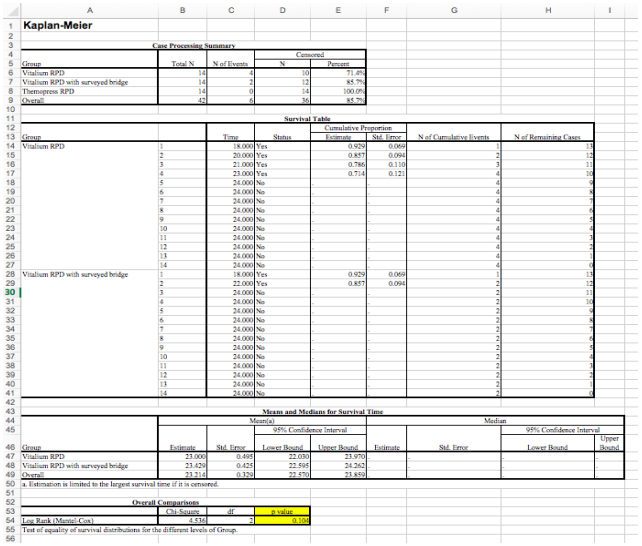


Figure 8: Means of Scale after Three Months between Studied Groups

Survival Rate

The survival rate of abutment teeth after twenty-four months of follow up in the Vitallium RPD group was 71.4%, while for RPD with surveyed bridge group was 85.7% and for Thermopress RPD group was 100% with overall survival 85.7%.


Kaplan-Meier

Case Processing Summary

Group	Total N	N of Events	Censored N	Censored Percent
Vitallium RPD	14	4	10	71.4%
Vitallium RPD with surveyed bridge	14	2	12	85.7%
Thermopress RPD	14	0	14	100.0%
Overall	42	6	36	85.7%

Survival Table

Group		Time	Status	Cumulative Proportion Estimate	Cumulative Proportion Std. Error	N of Cumulative Events	N of Remaining Cases
Vitallium RPD	1	18.000	Yes	0.929	0.069	1	13
	2	20.000	Yes	0.857	0.094	2	12
	3	21.000	Yes	0.786	0.110	3	11
	4	23.000	Yes	0.714	0.121	4	10
	5	24.000	No			4	9
	6	24.000	No			4	8
	7	24.000	No			4	7
	8	24.000	No			4	6
	9	24.000	No			4	5
	10	24.000	No			4	4
	11	24.000	No			4	3
	12	24.000	No			4	2
	13	24.000	No			4	1
	14	24.000	No			4	0
Vitallium RPD with surveyed bridge	1	18.000	Yes	0.929	0.069	1	13
	2	22.000	Yes	0.857	0.094	2	12
	3	24.000	No			2	11
	4	24.000	No			2	10
	5	24.000	No			2	9
	6	24.000	No			2	8
	7	24.000	No			2	7
	8	24.000	No			2	6
	9	24.000	No			2	5
	10	24.000	No			2	4
	11	24.000	No			2	3
	12	24.000	No			2	2
	13	24.000	No			2	1
	14	24.000	No			2	0

Means and Medians for Survival Time

Group	Mean(a) Estimate	Mean(a) Std. Error	Mean(a) 95% CI Lower Bound	Mean(a) 95% CI Upper Bound	Median Estimate	Median Std. Error	Median 95% CI Lower Bound	Median 95% CI Upper Bound
Vitallium RPD	23.000	0.496	22.030	23.970	.	.	.	.
Vitallium RPD with surveyed bridge	23.429	0.425	22.595	24.262	.	.	.	.
Overall	23.214	0.329	22.570	23.859	.	.	.	.

a. Estimation is limited to the largest survival time if it is censored.

Overall Comparisons

	Chi-Square	df	p-value
Log Rank (Mantel-Cox)	4.536	3	0.104

Test of equality of survival distributions for the different levels of Group.

Figure 9: Survival analysis using Kaplan Meier statistics

A statistically non-significant difference in survival rate (P-value = 0.104) was revealed between the three groups.

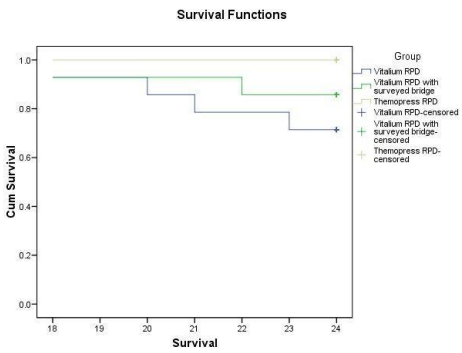


Figure 10: Kaplan Meier survival analysis

Discussion

This study was conducted to compare the patient satisfaction and survival rate of abutments outcomes of three different designs for cases with Kennedy Class II modification 1 for removable partial denture construction. Group I: Vitallium RPD; Group II: Vitallium RPD and surveyed bridge restoring the modification area; Group III: Thermopress RPD.

Patient selection was very critical to prevent the influence of some factors on the partial denture rehabilitation [15], [16], which can affect patient satisfaction results. This was crucial for the reliability and validity of the results. To exclude the effect of mechanical factors, patients having ridges with undercut areas were not included. To eliminate the effect of salivary factors, patients with Xerostomia or excessive salivation [17] and patients undertaking medications that affect salivary flow (e.g. diuretics) [18] were excluded. Similarly, patients with systemic diseases that may affect the amount or consistency of saliva (e.g. uncontrolled diabetes mellitus… etc.) were excluded.

For most of the previously mentioned reasons, patients older than 65 years were not included, to eliminate the effect of senility. Senile patients usually suffer from muscle atrophy, decreased neuromuscular coordination, stomatitis, as well as age-related limited manual dexterity [19].

In this study, Thermopress showed a significant satisfaction in all the points of satisfaction evaluated and these results may be due to the increased retention due to the decreased gap formed by the Thermopress and the underlying tissue as revealed and investigated in research work which stated that the Thermopress acryl showed an increased adaptation to the underlying tissues [20].

The results of the present study coincide with the clinical studies/observations reached by researchers [21], [22], [23]. They all concluded that the usage of flexible acryl technique plays a great role in attaining partial denture retention, providing a comfortable base and an increase in the functional denture performance.

Abutment survival prediction in RPD wearers is a major challenge for evidence-based dentistry. The factors affecting the preservation of abutments have been investigated in many studies [24], [25], [26], [27], [28], [29]. Occlusal support, pocket depth and crown root ratio are prognostic factors suggested by a study to assess the multifactorial risk factors [30]. However, no randomised controlled trials were conducted to compare the influence of the RPD type.

The influence of various types of RPDs on gingival inflammation was investigated in a study, and it was revealed that the response of the gingiva to the metallic RPD was less than the resin dentures, but these results must be related to the rate of porosity and the trapped plaque done by various types of acryl used [31]. However, the abutment loss in the present study was greater in metallic RPD groups (due to the torquing forces resulted from the difference in compressibility) compared to flexible acrylic group which may be attributed to the decreased porosity and increased plaque control of flexible acrylic resin with its flexibility nature which decreases the harmful effects of the torquing forces.

Although a statistically non-significant difference in survival rate (P-value = 0.104) was detected in this study between the three groups, a clinically important result was revealed as no abutment loss was found in the Thermopress RPD group.

Moreover, abutment loss in our study was mostly due to periodontal disease rather than due to caries which agrees with a study done in 1982 [(32)] which found that no marked increase in caries is caused by wearing RPDs.

The results could be used to aid the dentist to carefully select the type of the RPD aiming to restore the function, the comfort of the patient and preserve the longevity of the abutments; facilitating an evidence-based clinical decision making.

From the results of the present study, it can be concluded that the treatment for Kennedy class II modification 1 cases with Thermopress removable partial denture is satisfactory for the majority of cases. Although a non-statistically significant difference was revealed in the survival rate, a clinically important result favoured the Thermopress material as no abutments failures were reported in the patients using this type of partial denture.

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