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Retention, Chewing Efficiency and Masticatory Performance of Maxillary Flexible versus CAD/CAM Partial Dentures Opposing Fixed Implant Retained Prosthesis

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Abstract

Background/Aim: Maxillary Kennedy Class I cases, often treated with removable partial dentures (RPDs) employing metallic frameworks. Recent alternatives like polymethyl methacrylate (PMMA) milled by computer-aided design and computer-aided manufacturing (CAD/CAM) technology and polyamide flexible resin (Valaplast) offer advanced options, overcoming the risks accompanying metallic RPDs.

Objectives: This study aimed to assess and compare retention, chewing efficiency, and masticatory performance of Valaplast versus CAD/CAM RPDs in maxillary Kennedy class I cases opposing fixed implant retained prosthesis.

Materials and Methods: Twenty-two patients with maxillary Kennedy Class I were selected and randomly divided into two groups: Group I patients received milled PMMA RPD (MRPD), while Group II patients received Polyamide RPD (PRPD). Denture retention was measured using digital force gauge, masticatory performance through electromyography (EMG), and chewing efficiency via the Chewing Function Quality questionnaire at RPD delivery and after 1, 3, and 6 months. The collected data were tabulated and statistically analyzed.

Results: In Group I (MRPD), retention was significantly superior than Group II (PRPD). Retention significantly increased in both groups after one month but decreased significantly after six months. In masticatory performance, improvement appeared after one month with no significant disparity between both groups. Regarding chewing efficiency, there was no significant distinction between both groups at different follow-up visits, but they displayed significant improvement after one month.

Conclusion: MRPD and PRPD are acceptable treatment options for restoring maxillary Kennedy class I that showed improvement in retention, muscle activity and chewing efficiency after one month, but PRPD showed lower retentive properties than the MRPD.

Keywords
Retention, Chewing efficiency, Masticatory performance, Maxillary partial denture**,** CAD/CAM,
Polyamide flexible resin, Implant retained prosthesis

INTRODUCTION
Partial edentulism is a commonly prevalent challenge in dentistry among individuals seeking rehabilitation particularly the maxillary Kennedy class I (bilateral free-end saddle) cases where one of its fundamental and frequently employed treatment modalities is removable partial denture (RPD) conventionally including metallic framework. The Cobalt-chromium (CoCr) alloy utilized for RPD metallic framework fabrication has endless demerits such as inferior esthetics, oral galvanism, metallic sensation, and allergic response stimulation. Accordingly, digital technology and advancement in polymer-based materials took place for the utilization of non-metallic and a range of thermoplastic products as an RPD scaffold (Takaichi et al., 2022, Guo et al., 2022, Muhammad et al., 2022, Refai et al., 2022).

The innovation of computer-aided design and computer-aided manufacturing (CAD/CAM) technology has transformed RPD construction. Digitizing the design and manufacturing process enhances precision, reduces errors, and shortens production time. CAD/CAM RPDs offer superior fit, comfort, and properties, revolutionizing removable dentistry and improving patient treatment outcomes. On the other hand, Polyamide (Valplast) RPDs represent a significant advancement in denture materials. These flexible prosthetics provide superior esthetics, compliance, and functionality. Valplast RPDs are light in weight, biocompatible, and metal-free, making them ideal for patients seeking a discreet and comfortable alternative to conventional rigid dentures. Their flexibility ensures a snug fit, reducing pressure points and enhancing patient comfort. Additionally, Valplast RPDs offer excellent durability and resistance to fracture, providing long-lasting performance (Fayyad et al., 2022, Manzon et al., 2019, Mostafa et al., 2023, Akl et al., 2022).

Furthermore, advancements in materials, such as flexible polymers in addition to manufacturing process as CAD/CAM technology, allow for customized precision-fit RPDs, that inevitably affect retention capabilities. Adequate RPD retention is pivotal for ensuring the effectiveness and clinical success of RPD. The interaction and harmony between retention, muscle activity, and chewing efficiency in RPD is crucial, ensuring stability during mastication allowing wearers to chew with confidence. Optimal retention reduces excessive muscle effort, promoting favorable muscle coordination and minimizing fatigue. Efficient muscle activity is directly linked to improved chewing efficacy, enabling wearers to process various types of food with great comfort. Conversely, poor retention can lead to increased muscle activity as a compensation, affecting both chewing efficiency and overall comfort. Therefore, a well-designed RPD with superior retention not only enhances muscle coordination but also significantly improves chewing efficiency, ensuring a more satisfying functional prosthetic experience (Abdulkareem et al., 2020, Sharma et al., 2017, Araujo et al., 2023).

Electromyography (EMG) aids in precise, quantitative evaluation of masticatory muscle function in RPD wearers, detecting alterations in muscle activity, contraction intensity, and coordination. This method encompasses masseter and temporalis muscles, analyzing their activity across diverse food types in relation to different RPD materials.

Chewing efficiency evaluation involves various methods, but one of the most commonly preferred approaches is subjective opinions. This method relies on self-reported feedback from individuals, collected through questionnaires. Patients express their experiences and perceptions regarding mastication and RPDs' function through these questionnaires, accordingly providing valuable insights (Homsi et al., 2023).

Although rigid CAD/CAM and flexible velaplast removable partial dentures offer vast benefits, studies indicate variations in retention, masticatory performance, and chewing efficiency of RPD among partially edentulous patients. This research aimed to evaluate and compare the retention, masticatory performance, and chewing efficiency of CAD/CAM rigid poly methyl methacrylate (PMMA) versus polyamide flexible resin (Valaplast) removable partial dentures in maxillary Kennedy Class I cases with bilateral free-end saddles, opposing fixed implant-retained prostheses.

MATERIALS AND METHODS
Sample size
According to previous research by (Waleed et al., 2019), the sample size was calculated as the response within each subject group normally distributed with a standard deviation of 2.92, the estimated mean difference was 4 when the power was (80%) and type I error probability was (0.05). The minimally accepted sample size was 9 patients per group. The total sample size increased to 11 patients per group (total of 22 patients in both groups) to compensate for the 15 % dropout. Power and sample size program version 3.1.6 was used to calculate the sample size.

Ethical Approval and Clinical Trial Registration
The study has been approved by the Medical Research Ethical Committee (MREC) of the National Research Centre (NRC), Cairo, Egypt with agreement number 34312012023 which is in accordance with Code of Ethics of the World Medical Association, following the ethics stated in the Declaration of Helsinki in 1975. The study was registered on clinical trials gov under the identifier number NCT05999760.

Study Design and Patients' Selection

Twenty-two patients having Kennedy class I partially edentulous maxilla were selected from the outpatient dental clinic of the Medical and Scientific Centre of Excellent (MSCE) of the National Research Centre. Patients fulfilling the criteria were randomly categorized into two groups according to the definite maxillary prostheses they received. Group I received milled removable partial dentures (MRPD) while group II had flexible Polyamide removable partial dentures (PRPD). Patients were selected according to the following inclusion criteria; Partially edentulous males with maxillary Kennedy class I aged from 50-60 years. Angle's Class I maxillomandibular skeletal relationship with appropriate inter-arch space, good oral hygiene, favorable periodontal condition of abutments teeth, opposing implant retained mandibular fixed prostheses, and cooperative patients. While the exclusion criteria were patients having abutments with Grade II or III mobility, badly decayed abutments, malaligned teeth, and patients having xerostomia, medically compromised or receiving radiotherapy. Similarly, patients having temporo-mandibular joint disorder or parafunctional habits were excluded. Retention, masticatory performance and chewing efficiency of the two types of removable partial denture prostheses were assessed at delivery and after 1, 3, and 6 months.

Patient Examination and Preparation

All patients were assessed clinically and radiographically to assure the eligibility of criteria. Primary impressions (CA37; Cavex Holland BV, Haarlem, Netherlands) were registered and primary casts were obtained. Then, diagnostic jaw relation record was utilized to mount the obtained primary casts. The primary casts were initially surveyed to get the required mouth preparation. All needed mouth preparations were achieved by the aid of the study casts. Then, secondary impression (Elite HD+, Zhermack SpA, Polesine, Italy) with a putty wash technique were registered. Casts were poured and occlusion blocks were fabricated on master casts. A face-bow (Bio-Art Elite Face Bow, Bio-Art, São Carlos, Brazil) record and an interocclusal record using wax wafer technique (Cavex set up wax, Haarlem, Netherlands) were performed for mounting both upper and lower casts on semi adjustable articulator (A7 plus Articulator, Bio-Art, São Carlos, Brazil). Then, patients were randomly allocated in two groups.

In group I (MRPD) the master casts were scanned with a dental optical scanner (Ceramill Map400, Amann Girrbach AG. Koblach, Austria). The standard tessellation language (STL) file of the scanned MRPD was transferred to the CAD software (Exocad Dental CAD, GmbH) to design the RPD and then milled with (Cercone, Dentsply Sirona) form pre-polymerized PMMA disc (Ivotion base and tooth discs, Ivoclar Vivadent, Schaan, Liechtenstein).

Whereas, in group II (PRPD) the design was planned on the master cast and then duplicated utilizing vinyl-polysiloxane silicone which was poured with class IV hard plaster (Ventura SuperDie Rock, Masespa, Toledo, Spain) to have a duplicate cast on which wax pattern was designed including the retentive clasps that will be fabricated from the polyamide PMMA. Holes were made in the selected acrylic teeth to allow their mechanical retention to the polyamide denture base. The wax pattern was sprued, invested and wax was burned out. After that the polyamide (Valplast, United States) was injected following the injection mold technique, the PRPD was finished and polished. Each RPD was tried in the patient's mouth, occlusion was checked, any required modification was completed, and denture hygiene instructions were given to each patient. The retention, masticatory performance, and chewing efficiency were evaluated at RPD delivery and after 1,3, and 6 months.

Evaluation of Retention (Dislodging Force)

Both types of RPD retention were evaluated employing a digital force gauge (HF-100 Digital Force Gauge, Jinan Hensgrand Instrumentation Co., Ltd., Jinan, China). The force gauge hook was affixed to a metal ring at the center of the palatal area of the RPD using self-curing acrylic resin (Acrostone Cold Cure, Acrostone Dental and Medical Supplies, Cairo, Egypt). The dislodging force was measured five times by the same investigator within three-minute intervals. Measurements were recorded in Newtons, the display was adjusted to zero before each measurement via the reset button. The patients were instructed to sit in an upright position and tilt their head backward until the applied dislodging force was nearly perpendicular to the RPD. The dislodging force was applied until the RPD dislodged.

Evaluation of Masticatory Performance

Masticatory performance was evaluated utilizing the Electromyography (EMG), which recorded muscle activity in both masseter and temporalis muscles while chewing hard and soft food. Assessments were conducted at delivery of RPD and after 1, 3, and 6 months. EMG records were obtained utilizing bipolar surface electromyography equipment (Deymed TRU-TRACE EMG NCV 4-channel System machine, AU7-12060002), available at the Rheumatology and Nerve Conduction and Electromyography clinic of MSCE of NRC.

Patients were directed to sit upright without head support. Active electrodes were positioned on the superficial belly of the masseter and temporalis muscles, with a reference electrode placed on the chin. These electrodes were affixed to the patient's skin via adhesive tape after disinfection with 70% ethanol. Then, patients were asked to chew carrots and bananas cubes, which represented hard and soft food, respectively, while wearing their RPD.

The settings were adjusted to a one-second sweeping speed and 200 μV sensitivity. Signal amplification, smoothing, and filtering were applied within the frequency range of 20 Hz to 10 kHz. Specific regions of facial muscle contraction were identified, generating impulses. This process was repeated three times for each food type, involving both muscles, with a 5-minute rest period between repetitions. All tests were conducted by a single experienced practitioner who was blinded to the study. The collected data were printed and analyzed using the device software.

Evaluation of Chewing Efficiency

The Chewing Function Quality questionnaire (Sadek et al., 2019) comprised 10 items designed to evaluate difficulties experienced while chewing various common foods such as apples or carrots (Q1), meat or bacon (Q2), biscuits or crackers (Q3), fresh bread (Q4), different nuts (Q5), lettuce or raw cabbage (Q6), gum (Q10). Additionally, some items focused on feelings of lacking confidence during chewing (Q7), difficulty while biting food (Q8), and issues related to food sticking or catching on the teeth or dentures (Q9). Participants rated their responses on a scale from 0 to 4 (ranging from "Never" to "Very Often"). Accordingly, a lower score indicates higher chewing efficiency. This questionnaire was used to assess the chewing efficiency of Group I (MRPD) and Group II (PRPD).

Statistical analysis

Data analytics was executed by the aid of IBM SPSS Statistics 23 (SPSS, Inc, IBM Company, IBM Corporation, Chicago, Illinois) at P<0 .05 significance level. Data normality were assessed by Kolmogorov and Shapiro-Wilk tests (P< .05). All data was normally distributed and presented as mean and standard deviation. Accordingly, comparison between group I & II was executed by using Independent t test, while comparison between various intervals was executed by the aid of Tukey`s Post Hoc test in cases of multiple comparisons preceded by Repetitive One-Way ANOVA test.

RESULTS

I. Evaluation of Retention

Group I (MRPD) demonstrated significant higher retention then group II (PRPD) as value was P<0.0001 at delivery, after 1, 3, and 6 months. Comparing the follow-up intervals to estimate the time impact of Group I (MRPD) revealed significant increase in retention from (16.57 ± 0.99) at delivery to (20.31 ± 1.02) after 1 month, then there was insignificant decrease to (19.75 ± 0.94) after 3 months, while after 6 months there was a significant decrease to (14.99 ± 0.75). While group II (PRPD), revealed significant increase in retention from (15.11 ± 0.60) at delivery to (17.25 ± 0.75) after 1 month, then there was insignificant decrease to (16.87 ± 0.47) after 3 months, while after 6 months there was a significant decrease to (11.38± 0.22), as presented in table (1).

Table 1 Retention of both groups at different follow up intervals

Follow up	G I (MRPD)		G II (PRPD)		P value
	M	SD	M	SD	
At delivery	16.57 [a]	0.99	15.11 [a]	0.60	<0.0001*
After 1 month	20.31 [b]	1.02	17.25 [b]	0.75	<0.0001*
After 3 months	19.75 [b]	0.94	16.87 [b]	0.47	<0.0001*
After 6 months	14.99 [c]	0.75	11.38 [c]	0.22	<0.0001*
P value	<0.0001*		<0.0001*		

M: Mean **SD:** standard deviation **Highly significant difference as P<0.001
Means with the same superscript letters were insignificantly different as P>0.05
Means with different superscript letters were significantly different as P<0.05

II. Evaluation of Masticatory Performance

Regarding masticatory performance, there was insignificant difference between group I (MRPD) and group II (PRPD) as P values were P>0.05 at delivery, after 1, 3, and 6 months. In group I (MRPD) regarding hard food, there was a significant increase from (115.87 ± 4.79) and (96.78 ± 3.99) at delivery to (121.54 ± 4.86) and (102.25 ± 4.01) after 1 month, then there was insignificant gradual increase to (122.45 ± 4.90) and (105.89 ± 4.24) after 6 months regarding both masseter and temporalis muscle activity respectively. Similarly, in soft food there was a significant increase from (45.59 ± 2.02) and (34.11 ± 1.56) at delivery to (51.78 ± 2.07) and (40.89 ± 1.64) after 1 month, then there was insignificant gradual increase to (53.54 ± 2.14) and (42.57 ± 1.82) after 6 months regarding both masseter and temporalis muscle activity respectively.

Group II (MRPD) results regarding hard food showed that there was a significant increase from (114.01 ± 5.96) and (95.14 ± 4.96) at delivery to (121.11 ± 6.01) and (101.78 ± 5.04) after 1 month, then there was insignificant gradual increase to (122.39 ± 6.14) and (106.34 ± 5.32) regarding both masseter and temporalis muscle activity respectively. Likewise, in soft food there was a significant increase from (44.29 ± 2.05) and (33.41 ± 1.58) at delivery to (52.35 ± 2.09) and (40.42 ± 1.66) after 1 month, then there was insignificant gradual increase to (54.11 ± 2.16) and (41.78 ± 1.87) regarding both masseter and temporalis muscle activity respectively, as presented in Table (2).

Table 2 EMG activity of masseter and temporalis muscles for patients with RPD at different follow-up periods in all studied groups

Food	Muscle	Follow up	Group I			Group II			P value
			M	SD	P value	M	SD	P value	
Hard food	Masseter	At delivery	115.87 $_{a}$	4.79	0.01*	114.01 ^{a}	5.96	0.008**	0.42 ns
		After 1 month	121.54 $_{b}$	4.86		121.11 ^{b}	6.01		0.85 ns
		After 3 months	121.65 $_{b}$	4.85		121.47 ^{b}	6.06		0.93 ns
		After 6 months	122.45 $_{b}$	4.90		122.39 ^{b}	6.14		0.98 ns
	Temporalis	At delivery	96.78 $_{a}$	3.99	<0.0001**	95.14 ^{a}	4.96	<0.0001**	0.41 ns
		After 1 month	102.25 $_{b}$	4.01		101.78 ^{b}	5.04		0.81 ns
		After 3 months	103.51 ^{b}	4.14		103.42 ^{b}	5.17		0.96 ns
		After 6 months	105.89 ^{b}	4.24		106.34 ^{b}	5.32		0.82 ns
Soft food	Masseter	At delivery	45.59 ^{a}	2.02	<0.0001**	44.29 ^{a}	2.05	<0.0001**	0.14 ns
		After 1 month	51.78 ^{b}	2.07		52.35 ^{b}	2.09		0.52 ns
		After 3 months	52.37 ^{b}	2.09		53.68 ^{b}	2.15		0.16 ns
		After 6 months	53.54 ^{b}	2.14		54.11 ^{b}	2.16		0.54 ns
	Temporalis	At delivery	34.11 ^{a}	1.56	<0.0001**	33.41 ^{a}	1.58	<0.0001**	0.31 ns
		After 1 month	40.89 ^{b}	1.64		40.42 ^{b}	1.66		0.51 ns
		After 3 months	41.25 ^{b}	1.65		40.89 ^{b}	1.72		0.62 ns
		After 6 months	42.57 ^{b}	1.82		41.78 ^{b}	1.87		0.32 ns

M: Mean **SD:** standard deviation **Ns:** non-significant difference as P>0.05
*Significant difference as P<0.05 **Highly significant difference as P<0.001
Means with the same superscript letters were insignificantly different as P>0.05
Means with different superscript letters were significantly different as P<0.05

III. Evaluation of Chewing Efficiency

Group I (MRPD) demonstrated insignificant higher scores of chewing efficiency (lower chewing efficiency) than group II (PRPD) as P>0.05 at delivery, after 1, 3, and 6 months. In group I (MRPD), there was a significant decrease in scores of chewing efficiency (improvement of chewing efficiency) from (3.13 ± 0.33) at delivery to (1.55 ± 0.36) after 1 month, then there was insignificant gradual decrease to (1.23 ± 0.25) after 6 months. In group II (PRPD), comparison among follow-up intervals to estimate the time impact revealed significant decrease in scores from (3.28 ± 0.28) at delivery to (1.61 ± 0.33) after 1 month, then there was insignificant gradual decrease to (1.29 ± 0.34) after 6 months, as presented in table (3).

Table 3 Chewing efficiency using the Chewing Function Quality questionnaire of both groups at different follow up intervals

Follow up	G I (MRPD)		G II (PRPD)		Comparison between group I & II (Independent t test)			
					MD	95% CI		P value
	M	SD	M	SD		L	U	
At delivery	3.13 ^{a}	0.33	3.28 ^{a}	0.28	0.15	-0.42	0.12	0.26 ns
After 1 month	1.55 ^{b}	0.36	1.61 ^{b}	0.33	0.06	-0.36	0.24	0.68 ns
After 3 months	1.30 ^{b}	0.14	1.37 ^{b}	0.15	0.07	-0.19	0.05	0.27 ns
After 6 months	1.23 ^{b}	0.25	1.29 ^{b}	0.34	0.06	-0.32	0.21	0.64 ns
P value	<0.0001**		<0.0001**					

M: Mean **SD:** standard deviation **Ns:** non-significant difference as P>0.05
**Highly significant difference as P<0.001
Means with the same superscript letters were insignificantly different as P>0.05
Means with different superscript letters were significantly different as P<0.05

DISCUSSION

The mean retention values for MRPD partial dentures surpassed those observed in PRPD partial dentures, and this difference was statistically significant between the two groups. This observation finds support in a recent in vitro study which evaluated the fit of RPDs manufactured thru CAD/CAM technology, concluding that their fit surpassed that of traditional RPDs. These findings align with another recent research which conducted that RPD frameworks made from a sacrificial pattern employing SLA technology exhibited an excellent quality of fit upon examination. Additionally, the outcomes of this study resonate with other findings which demonstrated that prostheses created through CAD/CAM technology tightly adhere to the tissue, enhancing retention, stability, and even load distribution on the tissue. This, in turn, minimizes the oral mucosa interference (Waleed et al., 2019, Malara et al., 2015, Ye et al., 2018).

Furthermore, the fabrication of flexible partial dentures involves more manual steps; including master cast duplication and wax pattern construction. These manual procedures necessitate significant human intervention and material manipulation, which could introduce inherent processing shrinkage or expansion. Such factors might contribute to increased processing errors and inaccuracies, potentially explaining the lower retention values observed in flexible dentures compared to their digital counterparts. Moreover, the depth of undercut and thickness of the clasp are limited to 0.5 mm and 1.0 mm respectively which adversely affect superior retention (Ziglam., 2017, Macura et al., 2016, Keplan., 2008).

In both groups there was a significant improvement in retention after 1 month which may be attributed to neuromuscular adaptation. As patients wear the denture regularly, their oral muscles and proprioceptive senses adjust and optimize muscle coordination and stability. This adaptive process ensures a more secure fit, enhancing patient comfort and overall denture retention during various oral activities (Benso et al.,2013). On the other hand, group I (MRPD) retention declined significantly after 6 months as retention in milled partial dentures can diminish over time due to wear, material degradation, or changes in oral tissues and bone resorption. Moreover, surface roughness increase with time, reduces the grip on tissues. Additionally, unlike traditional dentures, milled ones cannot be easily modified, potentially causing discomfort and reduced stability for the wearer. The lack of adjustability and relining can lead to retention issues over time (El-Khamisy., 2017, Snosi ., 2021).

While in group II (PRPD) retention diminished significantly after 6 months as nylon has higher polymerization shrinkage compared to PMMA. While water absorption can cause some expansion in nylon, this does not fully make up for the initial shrinkage during polymerization. The water absorption property also leads to dimensional instability, which can negatively impact the fit of removable partial dentures made from nylon that directly affect prosthesis retention. Moreover, polyamide material in retentive surfaces are softer, has low flexural strength and modulus of elasticity, which is easily damaged by time under function, that was clear via scratch test when compared with PMMA (Campbell et al.,2017), Vojdani et al., 2015). The detrimental effect by time was emphasized in this study due to forces exerted and accentuated by the opposing fixed implant retained prostheses during function.

Masticatory muscle activity was assessed utilizing the masseter and temporalis muscles because they are not only the largest and strongest muscles but also accessible for recording. Moreover, these muscles play a significant role in mandibular movement. To ensure consistency in recorded muscle activity, the collected data were averaged bilaterally at each follow-up interval. Surface electromyography (EMG) provided a noninvasive method to record muscle activity in these elevator muscles. Furthermore, advancements in signal detection and processing through this technology have enhanced the quality of data obtained from surface EMG (Abd-Elhameed et ., 2018 , Khoury et al ., 2019)

In the muscle activity test, the analysis results showed that the masseter and temporalis muscle efficiency averages were quite similar between milled and flexible partial dentures during different visits. Initially, muscle activity was low as mastication with new dentures posed a challenge for patients, especially due to the higher risk of denture displacement during function especially when opposing implant retained fixed prostheses, then muscle activity increased with time as adaptation progressed. This aligns with previous studies which suggested that muscle fibers require a minimum adaptation period of two weeks after new prosthesis installation. Interestingly, our study corroborates with this timeframe, as patients and dentures started adapting and chewing improved after 1 month of delivery (Ramadan et al., 2018, Nishi et al., 2017).

Regarding food consistency, muscle efficiency decreased notably when chewing soft food compared to chewing harder textures regarding both milled and flexible partial dentures. EMG readings in response to hard foods typically show more intense muscle activity, as the jaw muscles exert greater force to break down the tough food types. These increased EMG values indicate strong muscle contractions that improved with time. In contrast, soft foods like banana require less force to be chewed and swallowed. When RPD wearers consume soft foods, EMG readings tend to show reduced muscle activity compared to hard foods. The muscles work with lesser intensity, resulting in lower EMG values. This reduction in muscle activity signifies a more relaxed state during mastication of soft food (Campbell et al.,2017, Fueki et al., 2014).

In chewing efficiency, both groups revealed a significant improvement after 1 month with insignificant difference between them referring to development of favorable cognitive responses by time opposing to implant retained fixed prostheses. In group I (MRPD), chewing efficiency may be improved due to precise fit and adaptation. In accordance with this results, previous studies demonstrated that milled RPD improved chewing efficiency compared to conventional RPDs. Optimal fit resulting from digital impressions and designed pathways for force distribution are advantages of milled RPDs that enhance chewing function. Moreover, Milled RPDs better preserve occlusal contacts and chewing patterns resulting in increased bite force and chewing performance (Goodacre et al., 2016).

The improved chewing efficiency seen in group II utilizing polyamide resin base removable partial dentures (PRPDs) can be attributed to the physical and mechanical properties of polyamide. In agreement with this study, previous research has shown polyamide RPDs providing comparable masticatory performance to types of RPDs (Sheng et al., 2018). Polyamide demonstrates high fatigue resistance and minimal deformation under chewing stresses. The flexible, resilient material of RPD absorbs shocks during mastication and allows normal chewing patterns and efficiency on both sides of the dental arch when opposing implant retained fixed prostheses. To summarize, the chewing efficiency favorable results observed with the polyamide RPDs in this study align with previous findings showing polyamide providing satisfactory masticatory function due to its beneficial properties as a RPD base material (Mousa et al., 2021, Alqutaibi., 2023).

CONCLUSION

Withing limitations of this study, it has been concluded that CAD/CAM milled PMMA RPD (MRPD) is superior in retention than the flexible Polyamide RPD (PRPD), although both almost had the same impact regarding muscle activity and chewing efficiency. Both RPDs employed demonstrated improvement in retention, muscle activity, and chewing efficiency after one month.

LIST OF ABBREVIATIONS

RPD: Removable partial denture
CAD/CAM: Computer aided design and computer aided manufacturing
PMMA: Poly methyl methacrylate
MRPD: Milled PMMA RPD
PRPD: Polyamide RPD
EMG: Electro myography
MREC: Medical Research Ethical Committee
MSCE: Medical and Scientific Centre of Excellent
NRC: National Research Centre

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DECLARATION OF CONFLICT

All authors have declared no conflict of interests.

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