

Perceived masticatory ability evaluation in completely edentulous patients with thermoplastic complete denture versus single implant-retained mandibular overdenture (#97425)

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Perceived masticatory ability evaluation in completely edentulous patients with thermoplastic complete denture versus single implant-retained mandibular overdenture

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Background: This study was carried out to compare the perceived masticatory ability in completely edentulous patients with thermoplastic conventional complete dentures versus single implant-retained mandibular overdentures. **Methods:** This study was conducted in the outpatient Prosthodontic Clinic, Faculty of Dental Medicine, Al-Azhar University, Cairo, Egypt. The perceived masticatory ability (PrMA) was evaluated in 45 completely edentulous patients. Each patient received a thermoplastic PMMA complete denture (Polyan IC TM Bredent GmbH & Co.KG, Germany). The PrMA was evaluated at one month and after six months of denture use. For each patient, an immediate loading single implant was placed in the mid-symphyseal area, and the denture was modified; then, the PrMA was evaluated again after one month and after six months. Data were collected and statistically analyzed with SPSS® V25 to assess the changes in perceived masticatory ability. **Results:** The PrMA improved after six months of thermoplastic conventional denture use but was not statistically significant ($p = 0.405$). PrMA increased significantly after a single implant placement after one and six months ($p < 0.001$) of the overdenture use compared to the conventional denture. The PrMA insignificantly improved ($p = 0.397$) after six months of the single implant retained overdenture use. **Discussion:** The overall results of this study showed that using immediate loading single implant-retained mandibular overdentures significantly improved perceived masticatory ability in completely edentulous patients.

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Abstract

Background: This study was carried out to compare the perceived masticatory ability in completely edentulous patients with thermoplastic conventional complete dentures versus single implant-retained mandibular overdentures.

Methods: This study was conducted in the outpatient Prosthodontic Clinic, Faculty of Dental Medicine, Al-Azhar University, Cairo, Egypt. The perceived masticatory ability (PrMA) was evaluated in 45 completely edentulous patients. Each patient received a thermoplastic PMMA complete denture (Polyan IC TM Bredent GmbH & Co. KG, Germany). The PrMA was evaluated at one month and after six months of denture use. For each patient, an immediate loading single implant was placed in the mid-symphyseal area, and the denture was modified; then, the PrMA was evaluated again after one month and after six months. Data were collected and statistically analyzed with SPSS® V25 to assess the changes in perceived masticatory ability.

Results: The PrMA improved after six months of thermoplastic conventional denture use but was not statistically significant ($p = 0.405$). PrMA increased significantly after a single implant placement after one and six months ($p < 0.001$) of the overdenture use compared to the conventional denture. The PrMA insignificantly improved ($p = 0.397$) after six months of the single implant retained overdenture use.

Discussion: The overall results of this study showed that using immediate loading single implant-retained mandibular overdentures significantly improved perceived masticatory ability in completely edentulous patients.

Keywords: Perceived masticatory ability, Single implant, Overdenture, Complete denture, Thermoplastic denture base, Edentulous Patients

Introduction:

One of the main objectives of prosthodontic rehabilitation is to restore and maintain oral function especially the effective masticatory function (Liang et al. 2015). Edentulous individuals wearing conventional dentures often experience a significant decrease in their ability to chew well, which is a big concern for them. Furthermore, the intricate neuromuscular abilities needed to overcome the limitation of dentures decline with age. Depending on the biomechanical properties of exclusively mucosa-supported dentures, the patient's age and type of food chewed of the individual, the ability of complete denture wearers to comminute food during mastication is diminished in comparison to adults with natural dentition (Goiato et al. 2008).

Denture prosthesis with inadequate masticatory efficiency hinder wearers from effectively consuming high-fiber diets. Therefore, dentures that have a great ability to chew food effectively are necessary(van der Bilt 2011; van der Bilt & Fontijn-Tekamp 2004).

The chewing forces used by denture wearers may be limited by the discomfort and the pain that occurs when one or both of the dentures lose their retention or even by the fear of such pain (Goiato et al. 2010).

The individuals' perception of chewing ability is significantly related to Oral health-related quality of life (OHRQoL), the patients with higher OHIP scores were more likely to report having chewing problems and perceived difficulty.(Khalifa et al. 2013) . The improvement of masticatory performance in patients with complete dentures will have a positive impact on their general health and thus their quality of life.(Elmoula et al. 2018)

Masticatory function can be addressed from two perspectives:: firstly, as the capacity to objectively fragment solid food; and secondly, as an individual's subjective response when queried about their food-chewing technique. Masticatory performance, which is the objective measure of masticatory function, has frequently been assessed by determining an individual's ability to pulverize or grind a designated food item within a predetermined number of chewing cycles. Subjects' self-assessed masticatory function (defined as masticatory ability) was investigated through oral function interviews. (Feizi et al. 2016; van der Bilt 2011).

Several objective techniques for assessing masticatory performance have been tried, but they **necessitate** specialized tools, materials, or intricate procedures. Experiments investigating

masticatory performance have utilized both natural foods, such as almonds, peanuts, and carrots, as well as synthetic materials as test substances. (Cunha et al. 2013; Goiato et al. 2008; Liedberg & Owall 1995; van der Bilt & Fontijn-Tekamp 2004).

Another commonly employed approach to assess masticatory performance involves evaluating the capacity to thoroughly blend and manipulate a meal bolus. The masticatory performance has been quantified using two-colored chewing gum and paraffin wax as test meals. (Salleh et al. 2007; van der Bilt 2011).

Both subjective and objective methods can be used effectively in measuring masticatory performance. Elmoula et al , (Elmoula et al. 2018) found a correlation between the subjectively evaluated perceived masticatory ability and the objectively assessed masticatory efficiency.

The masticatory function of the complete-denture wearers is relatively poor compared to that of healthy dentate subjects . Complete-denture wearers need up to 7 times more chewing strokes than subjects with a complete natural dentition to reduce the food to half of the original particle size(Emami et al. 2013; Kumari et al. 2022) . The significantly lower masticatory functions in patients rehabilitated with complete dentures have been reported in other studies.(Slagter et al. 1992; Wayler & Chauncey 1983)

To improve the masticatory efficiency of complete denture wearers, treatment alternatives that aid in increasing retention and stability for improving denture function should be considered when conventional denture therapy is inadequate. One of these alternatives using the injection molded thermoplastic denture base (Fayad et al. 2023).

The injection molding technique of the thermoplastic PMMA enhanced denture base properties such as flexural strength, transparency, flexibility, and water absorption, as well as having less residual monomer and fewer pores, resulting in more dimensional stability. The injection-molded PMMA has a micro-crystalline structure that eventually makes the finishing and polishing much easier. Dentures fabricated by the injection molding method reported improved quality and durability due to the increased microhardness and decreased surface roughness compared to conventional denture bases. (Moslehi et al. 2022)

The thermoplastic denture bases have greater aesthetics and are more readily accepted by patients when compared to conventional dentures. They can serve as a substitute for individuals

who have an allergic reaction to poly methyl methacrylate. Because of their low weight and pliable characteristics, they can be efficiently applied to individuals with skeletal protuberances. The material's flexibility provided a targeted level of stress reduction, eliminated denture-related problems that were causing oral discomfort (Singh et al. 2011).

Other alternative to improve the masticatory functions for completely edentulous patients is using implant placement to improve denture retention and stability which subsequently results in improvement in masticatory performance (Bae et al. 2015; Fayad et al. 2016; Mohamed 2008).

Although the utilization of **Osseo integrated** implants for rehabilitation has increased, the most common method of therapy for those without teeth, especially in underdeveloped countries, remains conventional complete dentures (Carlsson & Omar 2010).

The use of implant-supported or retained prostheses for rehabilitating the mandible in individuals without teeth has been proven to be a highly effective and gratifying treatment, as indicated by numerous clinical investigations.(Kourtis et al. 2018) Nevertheless, there is ongoing debate regarding the minimal number of implants necessary for this restoration. **The Single Implant Retained Overdenture (SIROD)** has become increasingly popular due to it is a simple technique.(Mahoorkar et al. 2016)

It has been hypothesized that placing a single implant in the middle of the symphyseal region can effectively support an overdenture, with a high success rate based on Albrektsson's success criterion. (Albrektsson & Wennerberg 2019; Gjølvd et al. 2020). Also, this line of treatment can be used as an economical therapeutic option to the conventional complete denture (Krennmair & Ulm 2001; Passia & Kern 2023).

A finite element method study by Liu et al.(Liu et al. 2013) on the implant number required to retain mandibular implant-retained overdenture, found that single implants were able to bear and dissipate the load to the bone well.

Up to our knowledge , there was no study evaluating the perceived masticatory ability (assessed subjectively) among completely edentulous patients rehabilitated with a thermoplastic acrylic denture before and after the single implant placement for each patient to assess the changes in the perceived masticatory ability with single implant placement. Thus, the null

hypothesis was that placing a single implant to retain a complete mandibular thermoplastic denture would not affect the perceived masticatory ability.

MATERIALS AND METHODS

This study was conducted at the Faculty of Dental Medicine, Al-Azhar University, Egypt, using a prospective study design. The study was conducted for a duration of 18 months, spanning from April 2022 to August 2023. The ethics committee at Al-Azhar University has approved the study protocol (Ethical Application Ref: AUAREC2002204-12). Before enrolling in the study, all participants were provided with an explanation of the methodology and gave their informed consent. E.G. written consent was obtained from all participants .

Patients' selection

All patients included in the study were free of any psychiatric problems or movement disorders. Patients who have previously had temporomandibular problems, including Myofascial Pain Dysfunction Syndrome (MPDS), trismus, trauma, TMJ dislocation, and ankylosis, were not included in the study. Furthermore, those with compromised oral diseases , local lesions, xerostomia and resorbed or flabby ridges were not included.

Previous studies have determined that a sample size of 40 cases is sufficient to conduct the research with a statistical power of 0.80, a confidence interval of 0.95, and an alpha level. 0.05.(Albert et al. 2003; Goiato et al. 2010; Mohamed 2008; Tatematsu et al. 2004) A higher sample size calculation was considered (n=50). To allow for the possibility of edentulous participants dropping out due to illness, death, or difficulty with the research protocol.

A total of 50 patients who had lost all of their teeth were chosen randomly from those who sought treatment at the outpatient clinic of the Department of Prosthodontics. Five patients withdrew from the study , so only 45 patients were evaluated. The group consisted of 21 males and 24 females, with an average age range of 44-59 years (mean age 50.4 ± 4.77 years)

All patients received a new thermoplastic PMMA conventional complete denture (Polyan IC TM bredent GmbH & Co.KG, Germany), with even occlusion, and free from discomfort.

The new complete dentures were delivered, and the perceived masticatory ability (**PrMA**) was evaluated after one month of denture placement without pain or discomfort.(Mathew et al. 2024; Rocha et al. 2023)

First stage-measurement of the PrMA

The subjective approach of evaluating masticatory ability was assessing the **PrMA**. The measurement was conducted using a perceived difficulty of chewing (PDC) index score devised by Khalifa et al,(Khalifa et al. 2013) in which respondents were queried about the level of difficulty they had while chewing fifteen commonly consumed hard and soft foods. The scoring of this index is based on (PDC) scale, with a range of scores from 0 (indicating very easy chewing) to 5 (indicating very difficult chewing that is actively avoided). A total number of zero signifies a very easy chewing and satisfactory conditions, whereas a total score of 75 signifies adverse conditions and the most difficult chewing.

For each patient, The **PrMA** was measured after one month of conventional thermoplastic denture placement. The second measurement was conducted six months following the conventional thermoplastic denture placement, as recommended by Goiato (Goiato et al. 2010; Goiato et al. 2008) It was proposed that a minimum of five months was required to adequately assess patient adaptability and functional capacity with new complete dentures.

Mid-symphyseal single Implant Placement

Cone-beam computed tomography (CBCT) scans of the mandible were performed for each patient using the Kodak 9500 cone-beam 3D System scanner, manufactured by Carestream Dental/Kodak in the United States. For each patient a mid-symphyseal dental implants was placed (Dentis, Dalseo-gu, Daegu, Korea) . Following a two-days period of implant placement, the mandibular denture was prepared for insertion. The locator attachment (Dentis, Dalseo-gu, Daegu, Korea) was affixed to the fixture and secured with a screwdriver.

The resilient cap was placed over the male part of the attachment and transferred to the base of the denture using marker past that was placed on the cap, and the lower denture was inserted in the patient mouth, so the corresponding area of the cap would be marked on the fitting surface of the denture. A housing for the resilient cap (female part) was created on the fitting surface of the denture in the marked area using a round bur at a low speed.

The denture was examined in the patient's mouth to ensure the absence of interference.. Auto-polymerizing acrylic resin was placed in the space created in the denture base, and a small amount of resin was injected intraorally into the dry metallic cap.

The denture was placed in the patient's mouth, and the patient was advised to close their mouth, causing the metal cap to be fitted into the base of the denture. After the acrylic resin had solidified, the denture was removed from the mouth then examined, and any surplus material was eliminated using an appropriate bur.

Second stage-measurement of the PrMA

For each patient, The **PrMA** was measured after after one month of single implat-retained mandibular overdenture placement. The final measurment was conducted after six months of single implat-retained mandibular overdenture placement.

Statistical analysis

The data were collected, and the statistical analysis was conducted using IBM SPSS Statistics V25 software (Armonk, NY: IBM Corp) with a significant level of 0.05 for all tests. For continuous data, they were tested for normality by the Shapiro-Wilk test. Quantitative data were expressed as range (minimum and maximum), mean, standard deviation and median. Descriptive statistics of mean and standard deviation were reported. Mann Whitney test was used to compare two groups for not normally distributed quantitative variables while Kruskal Wallis test was used to compare different groups for not normally distributed quantitative variables. while Friedman test For abnormally distributed quantitative variables, to compare between more than two periods or stages. The post-hoc paired comparison was done using the Wilcoxon signed rank test. Significance of the obtained results was judged at the 5% level.

The null hypothesis is rejected and there is strong evidence that there is a difference between the groups. When the null hypothesis has been rejected, it is possible to test which groups are different. The est (pairwise comparison) is output for this purpose.

Results

The PrMA was evaluated among completely edentulous patients with a thermoplastic PMMA denture base at one month and six months of complete denture insertion. Again, for each patient, after single implant retained mandibular overdenture placement, the perceived masticatory ability was measured after one month and six months .

The sample included 50 completely edentulous patients who were randomly selected, only 45 patients were evaluated (one patient was released for health reasons, four patients declined to continue with the research). There were 21 male and 24 female patients Table (1). The mean age of the selected patients was 50.46 years ranging from 44 years to 59 years.

The mean and standard deviation of the perceived masticatory ability measurements at different intervals were shown in Table (2). The perceived masticatory ability for each participant was obtained by collecting the perceived masticatory ability score (from 0 to 5) of each food. The mean value for perceived masticatory ability was 37.8 ± 10.5 at the time of one month after the new denture placement. After six months of denture placement, the mean value of perceived masticatory ability was 36.3 ± 10.3 . The mean value for perceived masticatory ability was 28.6 ± 8.4 at the time of one month after the single implant placement. After six months of single implant placement, the mean value of perceived masticatory ability was 26.9 ± 8.5 . (Table 2) .

The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to test data normal distributaion. (Kim 2012; Kim 2013). The results of the two tests showed that the data were not normally distributed. Table (3)

The nonparametric Friedman test was used for within-subject design as the data is not normally distributed. The post-hoc paired comparison was done using the Wilcoxon signed rank test [30, 31]. The Friedman test, (Table 4) showed that there was a statistical significance difference between different measurements of PrMA at different intervals.

The multiple comparison between different mean measurements of PrMA at different intervals (Table 5) showed that there was no statistical difference in perceived masticatory ability recorded after one month of denture insertion and perceived masticatory ability recorded after six months of denture insertion. [$P > 0.05$]. The perceived masticatory ability increased considerably

with mid-symphyseal single Implant placement and there was a highly statistically significant difference between the perceived masticatory ability recorded before and after single implant placement.[$P < 0.05$].

Regarding the age, the study sample was further allocated based on age range into three subgroups: (1) less than 47 (n=13), (2) from 47 - 52 (n=14), and (3) more than 52 (n=18).

The Mann Whitney test (Table 6) was used to test the effect of gender on the perceived masticatory ability at different intervals. The results showed no statistically significant effect of gender on the PrMA at different intervals. The Kruskal Wallis test (Table 7) was used to test the effect of different age groups on the perceived masticatory ability at different intervals. The results showed no statistically significant effect of gender on the PrMA at different intervals.

Discussion

The results of the current study reported that the placement of a single mid-symphyseal implant significantly affected the perceived masticatory ability of the study groups. Thus, the null hypothesis has been rejected.

Patients with oral diseases that may compromise the masticatory function were excluded from the study. As xerostomia has a significant negative effect on the quality of life and is associated with reduced masticatory function(Moriya et al. 2012) so, the patients with xerostomia were also excluded from the study.

The masticatory ability was evaluated in this study via questionnaires, although this method lacks the necessary objectivity for repeatability, and it is more reasonable to assess masticatory function from the aspects of questionnaires and clinical assessments. However, previous studies indicated that subjective assessments of a self-perceived chewing ability were as valid as objectively assessed masticatory efficiency, and both methods were similarly effective in clinical practice (Limuangthip et al. 2021).

In addition, in the case of a completely edentulous wearer, the subjective criteria may be more important than the chewing tests; thus, the questionnaires are considered an effective tool (Boretti et al. 1995). Also in complete denture wearers, the subjective criteria may be additionally explanatory as the complete denture quality has been significantly related to patient s' satisfaction and perceived chewing ability (Yamaga et al. 2013) .

The perceived masticatory index for each participant was obtained by collecting the perceived masticatory ability score (from 0 to 5) of each food; the natural test foods may be considered advantageous because of their consumption in daily life and familiarity with patients [32].

The thermoplastic denture base material was chosen in this study as it is processed using the injection molding technique for a controlled polymerization process. The flask design allows a continuous flow of material through the sprue channel, compensating for the polymerization shrinkage and resulting in better dimensionally accuracy than compression molding produces (Khan et al. 2022). It shows also significantly better flexural strength, and higher flexural modulus, which lead to minimal-to-no deformation before fracture(Patankar et al. 2022).

As many clinical studies have confirmed, the process of adaptation to both new CDs or to new mini-implant overdentures opposing maxillary CDs is completed within a month. The perceived masticatory ability was evaluated after one month of denture placement (Hayakawa et al. 2000; Poljak-Guberina et al. 2022; Topic et al. 2022). The Second measurement was conducted after six months, as recommended by Goiato et al, [2, 5] who suggested that more than five months was needed to evaluate patient adaptation and functional capacity with new complete dentures.

The immediate loading implant procedure has been proven to be reliable and successful in various clinical contexts. It offers a reduction in the treatment time by the possibility of immediate functionality of the implant by positioning within 48–72 hours after fixture placement (Mangano et al. 2017; Raes et al. 2018). Loading single implants immediately appears to be a highly successful treatment approach.(Raes et al. 2018)

The concept of a single implant placement has been suggested to address some of the upcoming limitations of using two or more implants. The two-implant overdenture has proven successful and was proposed as the minimum standard of treatment that should be offered to a completely edentulous mandible. However, the current increase in dental initial and maintenance expenses renders the two-implant overdenture unaffordable for many financially challenged elderly individuals. Studies anticipated the chair side time and the cost of fabricating the two-implant overdenture to be 1.75 times more than single-implant overdenture. Yet both reported satisfactory clinical performance and patient satisfaction. (Mahoorkar et al. 2016) The novelty of the current study is that the treatment provided to the study group comprised the advantages of the

resilient thermoplastic resin and its cushioning effect improving the support together with the enhanced retention offered by the dental implant.

The results showed that, an improvement was observed in the masticatory function with a conventional complete thermoplastic denture after six months of denture placement, also regarding single implant placement, an improvement was observed after six months of single implant retained mandibular overdenture but there was no statistically significant difference (table 5). The improvement may be attributed to increasing adaptation and subsequent stability of the denture after six months of denture use.

This result is opposite to the findings of Hazari et al.(Hazari et al. 2015). They found a statistically significant difference after six months, which may be attributed to the different assessments and different thermoplastic materials used in their study. This improvement is extremely important since complete thermoplastic dentures offer a simpler and cheaper treatment option when compared with other treatment options, such as implant-supported dentures. Furthermore, they provide a significant improvement in terms of stability and retention for patients with severe adaptation problems to conventional mandibular dentures. These results were in accordance with the study conducted by Berretin-Felix et al.(Berretin-Felix et al. 2008) who stated that the type of dental treatment used has a direct relationship with masticatory efficiency.

This study showed a highly significant difference in perceived masticatory ability evaluated after six months of conventional denture placement when compared to the perceived masticatory ability evaluated after six months of single implant-retained mandibular overdenture. This in accordance with the results of Rocha, et al, (Rocha et al. 2023), who found that the treatment with mandibular overdentures supported by a single implant in the mandibular symphysis region improved masticatory efficiency over conventional complete dentures.

Even when the comparison is made between perceived masticatory ability evaluated after six months of conventional denture use with that assessed one month after a single implant retained mandibular over denture, there was a highly significant difference. (Table 3) This finding demonstrates the considerable enhancement following the insertion of a single implant. Also the masticatory function significantly improves after mandibular implant overdenture treatment. Most

studies on implant treatment and oral function showed a significant improvement of the objective masticatory performance in the mandibular overdenture. (Fontijn-Tekamp et al. 2004)

The study of Rocha et al. (Rocha et al. 2023), evaluated the masticatory function objectively also confirmed the importance of using a single implant to improve the masticatory function for a completely edentulous patient.

The results showed that gender had an insignificant effect on the perceived masticatory ability. (Table 6) The study's results are in accordance with the results of Elmoula et al. [7]

The results showed that the different age group of the study sample had an insignificant effect on the perceived masticatory ability. (Table 7) this results is in disagreement to the results of Haiari et al.(Hirai et al. 1994) who investigated the age-related changes in masticatory function in complete denture wearers. He found that in relationship to aging, both the masticatory performance and the chewing score decreased significantly. This may be attributed to different age range of patients selected in this study.

The limitation of this study includes that the alveolar ridge height and denture retention, which could influence the results, were not investigated. Also, the association between self-assessed masticatory ability (SAMA) and psychological status should be considered as the results of Roohafza et al (Roohafza et al. 2016) study provide evidence that participants with a higher score of depression, anxiety, and stress suffer lower masticatory ability.

It is also important to emphasize the diagnostic factor and previous planning before denture construction. The human factors in planning and technical performance are decisive for the success of rehabilitation.

Future investigations should, therefore, focus on an approach that involves many aspects and the incorporation of dental care with other treatments, such as nutritional counseling to improve eating habits and physiotherapy to improve patients' quality of life.

Conclusion

Within the limitations of the present study, a significant improvement in perceived masticatory ability was observed in completely edentulous patients rehabilitated with single implant-retained mandibular overdentures.

Competing interests

The authors declare that they have no competing interests.

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Table 1(on next page)

Gender Frequency

1
Table (1): Gender Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	21	46.7	46.7	46.7
	Female	24	53.3	53.3	100.0
	Total	45	100.0	100.0	

2

Table 2(on next page)

The mean and standard deviation of the perceived masticatory ability measurements at different intervals.

Table (2) The mean and standard deviation of the perceived masticatory ability measurements at different intervals.

Evaluation intervals	Gender	Mean	SD	Std. Error	Minimum	Maximum
Con1	Male	38.90	10.95	2.39	15.00	55.00
	Female	37.00	10.40	2.12	15.00	50.00
	Total	37.88	10.58	1.57	15.00	55.00
Con6	Male	37.19	10.26	2.23	15.00	53.00
	Female	35.62	10.66	2.17	15.00	50.00
	Total	36.35	10.39	1.54	15.00	53.00
impl1	Male	29.33	8.39	1.83	15.00	50.00
	Female	28.08	8.58	1.75	10.00	39.00
	Total	28.66	8.42	1.25	10.00	50.00
imp6	Male	27.52	9.00	1.96	13.00	43.00
	Female	26.45	8.21	1.67	9.00	38.00
	Total	26.95	8.50	1.26	9.00	43.00

Con1: The PrMA recorded after one month of thermoplastic complete denture placement.

Con6: The PrMA recorded after six months of thermoplastic complete denture placement.

Impl1: The PrMA recorded after one month of single implant-retained mandibular overdenture placement.

Imp6: The PrMA recorded after six months of single implant-retained mandibular overdenture placement.

Table 3(on next page)

Tests of Normality.

Table (3) Tests of Normality.

Table (3) Tests of Normality.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Mast	.092	178	.001	.974	178	.002

a. Lilliefors Significance Correction

1

2

Table 4(on next page)

Friedman Test

1 **Table (4) Friedman Test**

Ranks		Test Statistics			
	Mean Rank	N	Chi-Square	df	Asymp. Sig.
Con1	3.53	45	96.60	3.00	0.000
Con6	3.23				
impl1	1.72				
imp6	1.51				

- 2 Con1: The PrMA recorded after one month of thermoplastic complete denture placement.
3 Con6: The PrMA y recorded after six months of thermoplastic complete denture placement.
4 Impl1: The PrMA recorded after one month of single implant-retained mandibular overdenture placement.
5 Imp6: The PrMA recorded after six months of single implant-retained mandibular overdenture placement.
6

Table 5(on next page)

Perceived masticatory ability means comparison at different intervals

Table (5): Perceived masticatory ability means comparison at different intervals .

(I) test	(J) test	Mean Difference		Sig.	95% Confidence Interval	
		(I-J)	Std. Error		Lower Bound	Upper Bound
Con1	Con6	1.702	2.039	.405	-2.32	5.72
	Impl1	9.222*	2.015	.000*	5.24	13.20
	Impl6	10.933*	2.015	.000*	6.95	14.91
Con6	Con1	-1.702	2.039	.405	-5.72	2.32
	Impl1	7.519*	2.039	.000*	3.49	11.54
	Impl6	9.230*	2.039	.000*	5.20	13.25
Impl1	Con1	-9.222*	2.015	.000*	-13.20	-5.24
	Con6	-7.519*	2.039	.000*	-11.54	-3.49
	Impl6	1.711	2.015	.397	-2.26	5.68
Impl6	Con1	-10.933*	2.015	.000*	-14.91	-6.95
	Con6	-9.230*	2.039	.000*	-13.25	-5.20
	Impl1	-1.711	2.015	.397	-5.68	2.26

*. The mean difference is significant at the 0.05 level.

Con1: The PrMA recorded after one month of thermoplastic complete denture placement.

Con6: The PrMA recorded after six months of thermoplastic complete denture placement.

Impl1: The PrMA recorded after one month of single implant-retained mandibular overdenture placement.

Impl6: The PrMA recorded after six months of single implant-retained mandibular overdenture placement.

Table 6(on next page)

Relation between gender and PrMA

1 **Table (6): Relation between gender and PrMA**

	Sex			
	Male (n=21)	Female (n=24)	U	p
Con1				
Mean ± SD.	38.9 ± 11	37 ± 10.4	238.0	0.747
Median (Min. – Max.)	40 (15 – 55)	40 (15 – 50)		
Con6				
Mean ± SD.	37.2 ± 10.3	35.6 ± 10.7	233.0	0.658
Median (Min. – Max.)	40 (15 – 53)	40 (15 – 50)		
Impl1				
Mean ± SD.	29.3 ± 8.4	28.1 ± 8.6	249.50	0.954
Median (Min. – Max.)	30 (15 – 50)	30 (10 – 39)		
Impl6				
Mean ± SD.	27.5 ± 9	26.5 ± 8.2	238.0	0.746
Median (Min. – Max.)	28 (13 – 43)	28 (9 – 38)		

2 SD: Standard deviation U: Mann Whitney test
3 p: p value for comparing between Male and Female
4

Table 7 (on next page)

Relation between different age group and PrMA

Table (7): Relation between different age group and PrMA

	Less than 47 (n = 13)	Age 47 to 52 (n = 14)	More than 52 (n = 18)	H	p
Con1					
Mean ± SD.	36.9 ± 10.7	34.1 ± 11.9	41.6 ± 8.6	4.377	0.112
Median (Min. – Max.)	40 (15 – 55)	39 (15 – 54)	45 (20 – 55)		
Con6					
Mean ± SD.	35.6 ± 11.1	32.1 ± 11.9	40.2 ± 7.4	4.396	0.111
Median (Min. – Max.)	35 (15 – 53)	37.5 (15 – 50)	40 (15 – 50)		
Impl1					
Mean ± SD.	27.4 ± 7.3	26.4 ± 9.4	31.3 ± 8.1	2.110	0.348
Median (Min. – Max.)	30 (15 – 40)	30 (12 – 35)	30 (10 – 50)		
Impl6					
Mean ± SD.	25.6 ± 9.3	24.6 ± 8.9	29.7 ± 7.3	3.623	0.163
Median (Min. – Max.)	23 (13 – 43)	28 (11 – 38)	29 (9 – 43)		

SD: Standard deviation H: H for Kruskal Wallis test
p: p value for comparison between the studied categories