International Journal of Dental Research
Online ISSN: 2664-9055, Print ISSN: 2664-9047
Received: 02-11-2019; Accepted: 03-12-2019; Published: 11-01-2020
www.dentaljournal.net
Volume 2; Issue 1; 2020; Page No. 05-12

Assessment of clinical and radiographic outcomes of mandibular implant supported Overdenture with regular and mini dental implants

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Abstract
Purpose: this prospective study was done to evaluate the clinical and radiographic outcomes of mandibular implant supported over denture using two regular implants and two mini-implants.
Methods: Sixteen patients were selected for the study and divided to Group I (control) who received a two conventional implants and group II (test) that received a two mini implants. Retention force of dentures, Bite force and Masticatory efficiency tests were. Evaluation for ridge loss was done using CBCT. The results were statistically analyzed by one-way ANOVA test.
Results: the control group had a statistically significant increment of the clinical features and a statistically significant decrement of ridge resorption than the test group.
Conclusions: Mandibular implant supported overdenture by two mini implant has lower retention, biting force, and masticatory efficacy than the overdenture supported by two conventional implants. Also, it is associated with more radiographic ridge loss than overdenture supported by two conventional implants.

Keywords: mandibular implant supported overdenture, regular implant, mini implant, biting force, masticatory efficacy, flapless approach

1. Introduction

Edentulism is a debilitating and irreversible condition described as the 'final marker of disease burden for oral health'. Although the prevalence of complete tooth loss has been declined over the past decade, it remains a major disease worldwide, especially among the older adults [1].

The complete denture therapy is associated with many problems as, loss of retention, masticatory inefficiency, mucosal irritation, difficulties in speech, appearance, fractured denture, debonding of teeth, swallowing difficulty, loss or alteration of taste sensation, and nausea and gagging [2]. It was demonstrated that more than 56% of conventional mandibular complete dentures have problems with retention and stability [3]. The masticatory function is often poor in the complete denture wearers. Which is 10%to 20% of that of healthy dentate subjects. Consequently, patients with dentures may have a diet deficient in fiber and vitamins [4].

The maximum bite force level in complete denture wearers has been limited to an extent due to the sensitivity or pain of the mucoperiosteum covering the mandibular edentulous ridge which gets sandwiched in between the dentures and bone. Complete denture wearers reported more frequent pain in the mandible than in the maxilla [5].

The alveolar bone supporting the natural teeth receives tensile loads through a large area of periodontal ligament. Whereas the edentulous residual ridge receives vertical, diagonal, and horizontal loads applied by a denture with a surface area much smaller than the total area of the periodontal ligaments of all the natural teeth that had been present [6]. In the past, these problems were approached by the pre-prosthetic surgical initiatives such as vestibuloplasties with skin or mucosal grafts, or in the severe situations by performing ridge augmentation procedures. These techniques have now been virtually eclipsed by the introduction of the implant supported over dentures [7].

A meta-analysis showed that implant overdenture improve retention and stability of the complete denture, which in turn provide greater patient satisfaction and improved quality of life for the general edentate population [8]. A systematic review showed that mandibular implant-supported overdenture and maxillary conventional complete denture provides a statistically significant improvement in the masticatory performance when compared to conventional upper and lower complete denture for a limited population having a persistent functional problems due to severely resorbed mandible [9]. The bite force was improved after the implant overdenture treatment because as a result of more usage and training of the masseter muscle, the muscle thickness was increased. In addition, the muscle activity in the rest decreased because there is no longer tension needed to stabilize the loose denture during rest [10]. A systematic review showed a controversy about the role of implant overdenture in the process of ridge reshaping after loading either destructive due to the anchorage of the denture anteriorly in the symphyseal area which preserves bone

Close and between implants and the free movement posteriorly which causes more resorption. Or preservative due to the best selection for supra-structure attachment with implant over denture and the pre-intervention planning which may reduce implant/ridge load [11].

Implants with a diameter above 3.5mm are termed as a regular diameter implants overdentures. Implants with a diameter ranged between 3.5 mm to 3 mm are termed narrow diameter implants, mini implants are those with a diameter less than 3 mm [12]. Mini dental implants have many benefits such as expanding the bone as they are placed, minimal osteotomy size required, as well as immediate stabilization and loading on the day of placement and so fewer treatment visits. Moreover, flapless placement leads to minimal surgical trauma, and ease of removal in case of failure. Their cost is also significantly less than conventional implants [13]. The cost of 4 mini implants is equal to 1 conventional implant [14]. A meta-analysis showed that mini-implants tend to provide a good patient satisfaction compared to conventional diameter implants in the implant-supported overdentures [15].

The number of implants to be placed for supporting a removable full denture is controversial. Some societies recommend four [16], while other recommend two (McGill and York Conesus) [17]. A new concept of single midline implant overdenture serves as an inexpensive and less invasive treatment [18].

The aim of this study was to evaluate the mandibular implant supported overdenture using two regular implants (Chaorum B & Medi, South Korea 12 mm length x 3.7 mm diameter – Two pieces) and two mini-implants (Slimline Dentium, South Korea 12 mm length x 2.5 mm diameter - One piece) clinically and radiographically.

2. Materials and Methods

2.1. Study Design, Study Setting, Study Population

This was a retrospective study, that was conducted at Faculty of Dental Medicine, Al-Azhar University, Boys, Cairo, Egypt. It included all completely edentulous patients who were managed at the department of Removable Prosthodontics between March 2017 and September 2019.

2.2. The inclusion criteria

Completely edentulous patients who were free from any systemic disease or local factor that contraindicate implant placement and voluntarily agreed to enroll in the study and signed an informed consent.

2.3. Exclusion criteria:

Completely edentulous patients who had local or systemic diseases that contraindicate implant placement and those who refused participation in the study and/or unable to sign an informed consent.

3.4. Ethical Approval

This work was approved by the Institutional Review Board and Ethics Committee and conducted in accordance with the principles of the Declaration of Helsinki (1975) as revised in 2013. All patients agreed to participate in the study and signed a written informed consent.

2.5. Methodology

1. Sixty male patients were selected for the study.
2. All cases were subjected to full history taking, general examination, extra and intra-oral examination, routine investigations and radiographic evaluation. Complete denture was constructed, then the patient was left for 3 months to adapt to his denture.
3. The patients were randomly divided into two equal groups:

Group A (Control group): Each patient received a mandibular implant supported overdenture by two conventional implants

Group B (Study group): Each patient received a mandibular implant supported overdenture by two mini implants

1. Cone Beam Computerized Tomography (CBCT) was done before implant placement to Assess the bone quality and quantity.
2. The DICOM files of CBCT were converted to STL file in to form the 3D model of the patient's mandible. Implant locations were selected according to Misch.[19] The distance between the two mental foramen was divided into five equal distances, namely A, B, C, D, and E from the patient`s right side. The implants were placed in the middle of the B & D locations. The surgical guide was designed in Mimics © software, then the surgical guide was constructed by 3D printing (figure 1)
3. The patients received prophylactic antibiotic orally in the form of (amoxicillin + clavulanic acid and metronidazole). Also, antiseptic mouthwash (chlorhexidine) was prescribed before surgery
4. Surgical procedure (figure 2)

- Bilateral infiltration anesthesia at the site for implant.
- The positions of the prospective implants were marked on the mucosa by a dental probe passing through the sleeves of the surgical guide. Then the radiographic guide was removed, then the mucosa was punched.
- The surgical guide was placed again to guide the pilot drill in the proper position and angulation through its sleeve, the sequence drills were used to prepare the implant site under a copious irrigation, the implants then were screwed in place using ratchet.
- In the regular implant group, the ball attachment was fixed to the implant using the ball head abutment driver. The mini implants in the second group were one piece.
- Metal house pick up was done by self-cured acrylic resin.
- Post-surgical instructions antibiotics, non-steroidal anti-inflammatory drugs and mouthwash were prescribed for all patients.

5. **Assessment of retention**

- Two small rings were attached; one on each side at the first premolar region. Then, an orthodontic wire passing over the occlusal surface was attached to the ring
- The tip of the force gauge was connected to the wire at the midpoint and the force gauge was pulled in an upward direction until denture retention was lost and the prosthesis was felt loose, then the reading was recorded 3 times and the mean value was calculated (figure 3).
- The assessments of retention were done at 1 week, 3 months, 6 months, 9 months, and 12 months.

6. **Assessment of biting force**

- This is done custom-made device composed of Flexiforce A 301® force sensor and Arduino

microcontroller with a crystal display. The sensor is calibrated by known weight object for several times, and the sensor is covered by 3 mm layer of putty rubber base material.

- The device was placed between the upper and lower first molar. The patient then was instructed to bite as hard as possible for a period of 3 seconds, three times in succession, with at least 20 seconds of resting between each bite. The readings were recorded, and the average bite force was calculated (figure 4).

7. **Masticatory efficiency test**

- Masticatory efficiency test was done using three types of food with a different degree of hardness (carrot, peanut, and banana). The tested foods that were cut into standardized cubes (1cm x 1cm).
- Patients assurance was done to reach with them to a relaxed unstrained status and then asked to eat. The following measures were recorded using a stopwatch:

a. The number of chewing strokes up to the first swallow.
b. The number of chewing strokes till the mouth was free of foods.
c. The number of swallows until the mouth was free of foods.
d. The time (in seconds) elapsed until the first swallow.
e. The time (in seconds) until the mouth was free of food.

- The assessments of the masticatory efficiency were done at 1 week, 3 months, 6 months, 9 months, and 12 months.

8. **Radiographic evaluation (figure 5)**

Mandibular alveolar ridge height was measured by the cone beam computerized tomography (CBCT), measurements were carried out in cross sections from the most superior point of the crest of the ridge to the most inferior point of the mandible at five places; zone A: in the midline, zone B: right mental foramen, zone C: left mental foramen, zone D: 16.3 mm distal to the right mental foramen, and zone E: 16.3 mm distal to the left mental foramen.

9. The clinical observations were done at different intervals (one week, three months, six months, nine, and twelve months). The radiographic evaluations were done after 6 and 12 months of implants placement. The difference between the readings and the preoperative CBCT readings was used to express alveolar ridge loss.
10. Statistical analysis: The data were collected, tabulated, and statistically analyzed by SPSS© 20 for windows. One-way ANOVA was used for the statistical analysis.

3. Results

The study included 60 males with age range between 50 and 60 years. The mean age was 54 ± 3.21. The patients were randomly divided into two equal groups:

Group A (Control group): included 30 cases who received a mandibular implant supported overdenture by two conventional implants.

Group B (Study group): included 30 cases who received a mandibular implant supported overdenture by two mini implants.

3.1 Retention test

All values of the retention test showed a statistically significant difference between the two groups during all of the follow-up periods (table 1).

3.2 Masticatory efficiency test

1. Results for carrot and peanuts: The mean values of the chewing cycles till the first swallow, the chewing time till the first swallow, chewing cycles till the mouth is cleared from food, and chewing time till first mouth is cleared from food for the control group showed a statistically significant difference between the two groups during all of the follow-up periods except at 1 week (tables 2 and 3).
2. Results for banana: The mean values of the chewing cycles and times till the first swallow and till the mouth is freed from food showed statistically non- significant differences between the two groups during all of the follow-up periods. The mean numbers of chewing cycles till first cycles and until the mouth is cleared from food are the same which means that there chewing is limited only to one swallow cycle without a second cycle of chewing (table 4).

3.3 Bite force test

For the right and left sides, all values showed a statistically significant difference between the two groups at 6 months, 9 months, and 12 months. For 1 week and 3months, the differences were statistically non-significant (table 5)

3.4 Radiographic Evaluation

All values showed a statistically significant difference between the two groups at 6 months and 12 months at A, B, C, D, and E positions (table 6).

Table 1: Comparison of the retention force in Newtons between the control group and the test group.

Time	Control group	Test group	*P*- Value
1 week	11.1 ± 1.96	7.3 ± 0.79	0.0002*
3 months	10.70 ± 1.82	7.0 ±0.88	0.00014*
6 months	10.2 ± 2.00	6.8 ±1.24	0.0011*
9 months	9.9 ± 1.74	6.45 ±1.38	0.000612*
12 months	9.6 ± 2.17	6.3 ±1.45	0.003*

*Significant difference if (p>0.05), values marked with (*) are significant. Values are presented as mean ± standard deviation.

Table 2: Comparison of the masticatory efficiency between the control group and the test group with the food type carrot.

The measure	Time	Control group	Test group	*P*- value
Number of the chewing cycles till the first swallow	1 Week	58.12 ± 10.78	60.37 ± 4.61	0.71
	3 Months	27.2± 3.23	32.5± 5.52	0.035*
	6 Months	25.0 ± 2.4	30.9 ± 3.7	0.029*
	9 Months	19.9 ± 4.10	29.7 ± 7.561	0.0060*
	12 Months	18.5 ± 4.91	28.68 ± 9.25	0.015*
Chewing time till the first swallow in seconds	1 Week	42.59 ± 8.07	43.26 ± 6.16	0.94
	3 Months	22.9 ± 2.35	27.31± 1.91	0.0010*
	6 Months	14.17 ± 2.89	20.8 ± 3.13	0.0006*
	9 Months	10.78 ± 2.27	18.22 ± 4.71	0.0012*

	12 Months	10.66 ± 1.53	17.45 ± 4.06	0.0057*
Number of the chewing cycles till the mouth is cleared from food	1 Week	69.13 ± 14.11	72.85 ± 11.03	0.54
	3 Months	49.52± 3.49	57.46 ± 7.01	0.012*
	6 Months	40.21 ± 5.86	50.82 ± 4.43	0.0011*
	9 Months	28.3 ± 5.51	37.2 ± 8.35	0.024*
	12 Months	22.67 ± 3.90	34.5 ± 7.41	0.0013*
Chewing time till the mouth is cleared from food in seconds	1 Week	44.63 ± 10.48	46.21 ± 12.02	0.80
	3 Months	33.17± 7.04	42.46± 8.28	0.029*
	6 Months	25.52 ± 4.59	35.18 ± 7.65	0.0084*
	9 Months	15.75 ± 3.24	32.36 ± 8.93	0.00021*
	12 Months	13.99 ± 2.67	26.54 ± 6.89	0.00028*

Significant difference if (p>0.05), values marked with (*) are significant. Values are presented as mean ± standard deviation.

Table 3: Comparison of the masticatory efficiency between the control group and the test group with the food type peanuts.

The measure	Time	Control group	Test group	*P*- value
Number of the chewing cycles till first swallow	1 Week	52.050 ± 11.90	53.79 ± 12.76	0.78
	3 Months	31.9 ± 3.49	39.9 ± 7.01	0.012*
	6 Months	22.9 ± 2.1	28.4 ± 5.46	0.017*
	9 Months	20.5 ± 5.14	25.0 ± 2.03	0.036*
	12 Months	16.7 ± 4.84	23.8 ± 3.15	0.003*
Chewing time till the first swallow in seconds	1 Week	30.24 ± 5.90	33.19 ±7.11	0.38
	3 Months	18.76 ± 2.25	24.42 ± 5.74	0.021*
	6 Months	11.01 ± 1.92	15.11 ± 2.21	0.0014*
	9 Months	9.81 ± 0.85	13.22 ± 3.59	0.024*
	12 Months	7.36 ± 0.94	10.04 ± 1.75	0.001*
Number of the chewing cycles till mouth is cleared from food	1 Week	55.39 ± 12.85	59.11 ± 13.91	0.57
	3 Months	33.77 ± 6.21	42.36 ± 7.97	0.030*
	6 Months	23.5 ± 6.74	34.55 ± 9.26	0.0163*
	9 Months	21.83 ± 4.37	31.47 ± 8.41	0.0121*
	12 Months	18.5 ± 5.84	26.7 ± 7.13	0.024*
Chewing time till mouth is cleared from food in seconds	1 Week	34.09 ± 8.90	36.42 ±6.91	0.56
	3 Months	21.06 ± 3.11	27.58 ± 3.97	0.0025*
	6 Months	12.53 ± 2.36	20.65 ± 4.03	0.00022*
	9 Months	10.87 ± 1.08	18.43 ± 4.12	0.00018*
	12 Months	8.65 ± 2.67	15.79 ± 1.46	0.00011*

*Significant difference if (p>0.05), values marked with (*) are significant. Values are presented as mean ± standard deviation.

Table 4: Comparison of the masticatory efficiency between the control group and the test group with the food type banana.

The measure	Time	Control group	Test group	*P*- value
Number of the chewing cycles till first swallow / and number of the chewing cycles till mouth is cleared from food	1 Week	12.7 ± 1.78	13.5 ± 2.15	0.42
	3 Months	9.8 ± 0.9	10.2 ± 0.61	0.29
	6 Months	10.4 ± 1.23	10.1 ± 0.82	0.56
	9 Months	10.1 ± 0.99	9.6 ± 0.59	0.43
	12 Months	9.9 ± 1.52	8.7 ± 1.08	0.097
Chewing time till the first swallow in seconds	1 Week	14.33 ± 2.45	14.92 ± 3.53	0.70
	3 Months	8.6 ± 0.92	9.15 ± 0.51	0.15
	6 Months	8.21 ± 1.04	9.09 ± 0.7	0.067
	9 Months	9.38 ± 0.65	8.44 ± 1.31	0.09
	12 Months	7.49 ± 0.93	6.97 ± 1.12	0.32
Chewing time till the mouth is cleared from food in seconds	1 Week	15.22 ± 1.88	15.86 ± 2.74	0.49
	3 Months	9.45 ± 0.56	9.93 ± 0.64	0.13
	6 Months	9.05 ± 0.97	9.72 ± 0.62	0.12
	9 Months	9.83 ± 0.76	8.98 ± 0.95	0.06
	12 Months	8.17 ± 1.34	7.53 ± 1.5	0.38

*Significant difference if (p>0.05), values marked with (*) are significant. Values are presented as mean ± standard deviation.

Table 5: Comparison of the bite force in Newtons between the control group and the test group on both sides.

Side	Time	Control group	Test group	*P*- value
Right	1 week	84.98 ± 29.45	65.78 ± 17.03	0.13
	3 months	133.1± 40.81	120.2 ± 32.76	0.55
	6 months	169.12 ± 20.94	132.94 ± 32.68	0.019*
	9 months	204.55 ± 29.36	151.7 ± 17.24	0.002*
	12 months	231.54 ± 19.89	186.23 ± 32.11	0.012*
Left	1 week	99.85± 30.05	72.31± 18.87	0.081
	3 months	139.4 ± 17.05	124.9 ± 34.47	0.3
	6 months	180.57 ± 25.11	145.32 ± 16.51	0.014*

	9 months	219.05 ± 32.82	159.64 ± 52.9	0.037 *
	12 months	243.75 ± 40.13	197.14 ± 20.51	0.011 *

*Significant difference if (p>0.05), values marked with (*) are significant. Values are presented as mean ± standard deviation.

Table 6: Comparison of the loss in the mandibular alveolar ridge height in the control group and the test group.

Time	Zone	Control group	Test group	*P*-value
6 months	A	0.09 ± 0.013	0.25 ± 0.07	0.00001*
	B	0.43 ± 0.098	0.9 ± 0.22	0.00007*
	C	0.61 ± 0.084	0.85 ± 0.17	0.0003*
	D	0.52 ± 0.066	0.85 ± 0.16	0.00009*
	E	0.68 ± 0.05	0.91 ± 0.14	0.0006*
12 months	A	0.34 ± 0.065	0.58 ± 0.084	0.00001*
	B	0.74 ± 0.19	1.06 ± 0.38	0.05*
	C	0.92 ± 0.067	1.37 ± 0.25	0.0002*
	D	0.97 ± 0.12	1.14 ± 0.035	0.001*
	E	1.01 ± 0.096	1.29 ± 0.21	0.004*

*Significant difference if (p>0.05), values marked with (*) are significant. Values are presented as mean ± standard deviation. Zone A: In the midline, zone B: Right mental foramen, zone C: left mental foramen, zone D: 16.3 mm distal to the right mental foramen, and zone E: 16.3 mm distal to the left mental foramen.

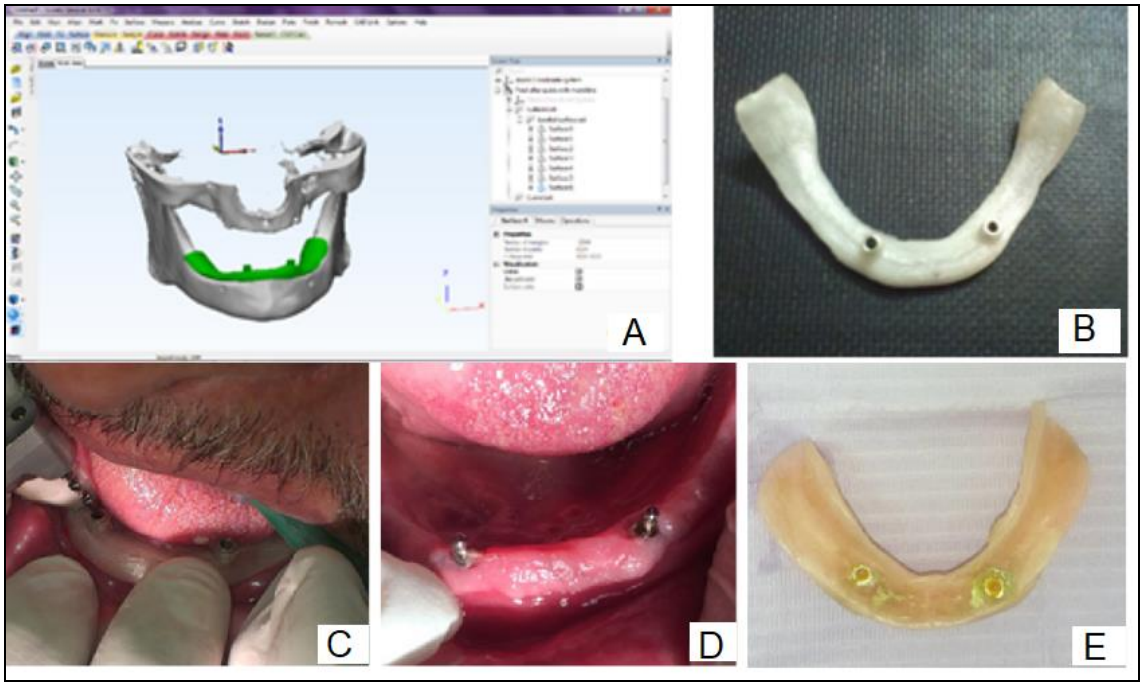

Fig 1: The construction of the surgical guide and the surgical technique

(A) Final guide before 3D Printing. (B) The surgical guide after stereolithograph with a metallic sleeve in place. (C) The surgical guide was placed to guide the pilot drill in the proper position and angulation through its sleeve. (D) The ball attachment was fixed to the implant using the ball head abutment driver. (C) Metal house pick up was done by self-cured acrylic resin.

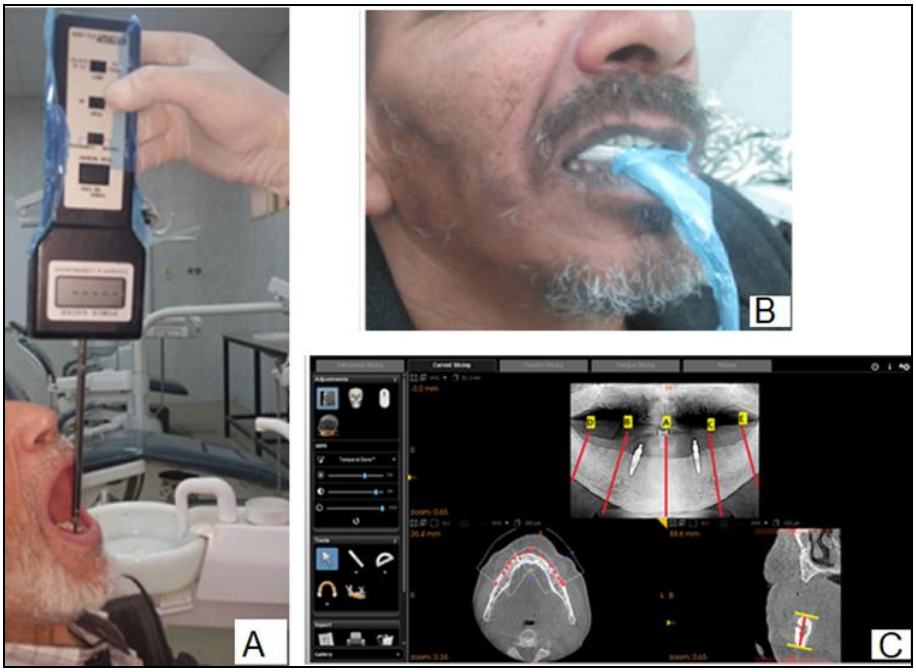

Fig 2: The assessment of results between the two groups

(A) The force gauge measuring retention force. (B) Assessment of retention. The sensor is covered by rubber base putty and the patient is asked to bite on it. (C) Cone beam computerized tomography (CBCT) showing the measurements of the alveolar ridge height at different zones.

4. Discussion

The goal of prosthetic dentistry is to restore the normal function, comfort, and aesthetics of the patient regardless of the atrophy or disease of the stomatognathic system. In an edentulous condition, especially those with resorbed mandibular ridge, it is very difficult to achieve this goal with the conventional complete denture therapy. The recent trend toward the use of dental implants to retain and support mandibular dentures has helped to fulfill the functional requirements of the patient with this challenging condition. Ball attachments were used in this study because its simplicity, ease of handling, minimal chairside time, and relatively low-cost [20].

In this study, the implants were seated between the mental foramen of mandible due to the highest rate of success rate for the implant when placed in this zone [21]. The use of the surgical guide was done in this study, for actual placement of implants parallel to each other since it is difficult to place the two implants parallel without surgical guide. In-addition, the lateral forces arising in the two inclined implants were greater than the vertical one [22]. The surgical guide was used for pilot drill. Complete guide for all of the implant system drills require drill key to adapt each drill, which is not available for the system used in this study [23].

In this study, the implants were immediately loaded through the flapless approach. The immediate and early loading of flapless implants had a high success rate. The literature reported that a high degree of primary stability at implant insertion is a key prerequisite for obtaining a successful osteointegration [24]. The flapless approach leads to reduction in the surgical time, postoperative bleeding, and swelling. Also, it is more comfortable for the patients. We avoided the flap elevation because it leads to bone loss [25].

The force gauge was used in this study because of higher sensitivity, faster response and greater flexibility. It is light, compact and has a higher degree of reliability than its mechanical counterparts. The use of digital display indicates reading directly in decimal numbers and therefore, errors on account of human factors are eliminated [26]. The used sensor has the advantage that the soft bite surfaces are recommended for the measurement of the maximum bite force [27]. However, one of the drawbacks of the commercial piezoresistive force transducer is the possibility of its damage during use, thus a further protection is needed by covering it with a putty rubber base [28].

CBCT was used in this study due to its ability to visualize the bone in coronal sections. It can accurately display the morphology of the alveolar ridge and the height of alveolar bone, thus, showing the bucco-lingual thickness, and the mesio-distal width. Also, it is not associated with the magnification and the distortion encountered in panoramic x-ray even the digital one [29].

This study showed greater values of retention in the conventional group than the mini implant group which was statistically significant. This is because the retentive capacity of O-ring is influenced by many factors such as the elasticity of the rubber ring, and undercut conformation of the retainer which is higher in the conventional group due to the larger size of ball attachment [30]. Loss of the retention values was found to be progressive over the time; this may be due to the wear of rubber O-ring during insertion and removal.

A statistically significant difference of all of the masticatory efficiency readings of both carrots and the peanuts food during the follow-up periods were found between the conventional implant group values and the mini implant group values. However, for the first week, the results were not statistically significant, this may be due to the post-operative pain and discomfort, which limited the efficient chewing causing prolongation of the chewing time and increasing the number of chewing cycles of the first swallow and until the mouth is cleared from food. For banana food there were no significant statistical differences between the two groups during all of the follow-up periods,

this may be due to its soft consistency that allowed for easier mastication. Although the mastication was limited to one cycle, the duration of chewing cycles till mouth is cleared from food was longer than the chewing time till first swallow by only a fractions of second which corresponds to the transportation stage of oral phase of deglutition [31].

The results of bite force were low and statistically non-significant for both groups at 1 week, which may be explained by the limitation of mastication by the postoperative pain. The results at 3 months were higher in the conventional implant group but were statistically non-significant from the results of the mini-implant group, which may be explained by limitation of complete biting because there is increased number of the prosthetic adjustments in the early weeks after pick up, and the patients may not close maximally due to fear of prosthesis break. Progressive increase of the bite force is observed in the later periods with statistically significant higher values in the conventional implant group which is possibly attributed to the higher retention value that gives the patient the feeling of comfort and confidence during chewing. Improved retention leads to the improvement of both bite force and masticatory efficiency, retention is extremely important criteria for patient's satisfaction with dentures [32]. Loss of retention and stability with mandibular usually causes discomfort and functional limitation, which consequently impact the oral health-related quality of life in a negative way [33].

The radiographic results of this study showed that there is an increased amount of the bone resorption as far as we go posteriorly on both groups, this may be due to the anchorage of the denture anteriorly in the symphyseal area and the free movement posteriorly which may exert more resorption posteriorly than anteriorly [34]. Another explanation for the increased amount of bone resorption posteriorly is that the mucosa under the implant supported overdenture may exhibit a high hydrostatic stress magnitude and a more concentrated distribution on the residual ridge in the molar and premolar regions [35]. Higher values of ridge loss in the mini implants group anteriorly and posteriorly may be explained by the increased flexion in both directions due to the low values of retention, which causes a significant higher loss than the conventional implant group. Frequent relining of the denture is necessary since it was shown that this resorption might cause high stress concentration on the implants if relining is not done [36].

5. Conclusion

Mandibular implant supported overdenture by two mini implant has shown lower retention, biting force, and masticatory efficacy than the overdenture supported by two conventional implants. Also, it is associated with more radiographic ridge loss than the overdenture supported by two conventional implants. It is advisable to restrict the support of mandibular overdenture by two mini implant to their original use as provisional restoration until definitive prosthesis is fabricated with conventional implants or increasing the number of mini implant as a definitive prosthesis.

6. Disclosure

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest: there is no conflict of interest.

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