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# EVALUATION OF IMMEDIATE LOADING MINI-IMPLANT VERSUS TRADITIONAL IMPLANT (CLINICAL AND RADIOGRAPHIC STUDY)

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***KEYWORDS***

*Clinical examination, Conventional implants, Immediately loaded mini-implants, Radiographic examination*

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## *ABSTRACT*

**Introduction:** Replacing lost teeth by employing dental implants has represented a challenge since ancient times. Using mini-implants is more favorable than conventional ones, not only for surgeons but also for patients. **Aim:** The current study aimed to compare the conventional and mini dental implants regarding primary stability, vertical bone loss after three- and nine-month post-surgery, plaque index, gingival index, and pocket depth in three- and nine-month. **Materials and Methods:** The current study used two types of dental implants, conventional dental implants (Dentium super line) and mini dental implants (Dentium slim line). Accordingly, two examination groups were defined, Group I and Group II. Each group included eight dental implants in healthy patients aged 31-48. All implants were subjected to clinical and radiographic examinations either before surgery or after surgery. Both conventional and mini-implants were checked based on primary stability, vertical bone loss after three- and nine- months post-surgery, plaque index, gingival index, and pocket depth in three- and nine- months. **Results:** The results showed no significant differences between the conventional and mini dental implants regarding the primary stability and vertical bone loss in three- and nine months. Also, clinically there is no significant difference in plaque index, gingival index, and pocket depth. **Conclusion:** The mini-implant can be a promising alternative when the ridge width does not accommodate the conventional type.

## INTRODUCTION

Replacing missing teeth, and employing the best way, always has been a challenge to come up since ancient times. Formerly, dentures were the standard way of replacing missed teeth [(1)]. However, for the time being, science, technology, and the appearance of dental implants have made it possible to improve the choice for better care of teeth and understanding of oral health, leading to a perfect deal with most oral problems [(2)]. Dental implants have changed the treatment plan for the patient with an insufficient number of remaining abutments teeth or for entirely edentulous patients to have a fixed prosthesis [(3)]. A dental implant can be defined as a prosthetic device or alloplastic material implanted into the oral tissues within the bone to provide retention and support to a removable and fixed prosthesis [(4)]. Mini dental implants are more favorable than conventional implants, not only for the surgeons but also for the patients [(5)].

Moreover, the surgical protocol required for introducing mini-implants is less invasive. Besides, less bone is needed to place them. In addition, they are less expensive compared to conventional ones[6]. The implant stability is measured through successful osseointegration, which occurs after the integration of the implant. Implant therapy is related to two phenomena: primary and secondary implant stability. Primary stability is associated with the mechanical engagement of an implant with the surrounding bone, whereas bone regeneration and remodeling phenomena determine the implant's secondary (biological) stability[7,8]. The primary stability of the implant is undoubtedly associated with secondary stability. In addition, it is affected by many factors, such as the situation of surrounding tissues, bone quantity and quality, implant geometry, and surgical technique assumed [7–9]. The present study aimed to compare the conventional and mini dental implants regarding primary stability, vertical bone loss after three- and nine-month post-surgery, plaque index, gingival index, and pocket depth in three- and nine-month.

## MATERIALS AND METHODS

### Ethics approval and consent to participate:

The present study adhered to the principles of the "Declaration of Helsinki" (64th WMA General assembly, Fortaleza, Brazil, October 2013). The study was carried out in the out clinic, Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Suez Canal University after the approval of the Research Ethical Committee (REC) Faculty of Dentistry Suez Canal University.

### Consent for publication

All patients and volunteers in the present study were carefully informed about the aims of the trial, the nature of the procedure, and any possible side effects of the drugs/materials and interventions.

### Sample size:

The current study was carried out in the out clinic, Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Suez Canal University. The study involved six patients, one male and five females, who visited the out clinic, their ages ranged from 31 and 48 years old. The study included 16 implants, divided into two patient groups. Group I included eight conventional implants, and group II involved eight mini-implants.

### Sample selection:

The patients were selected to have single root teeth for further replacement with dental implants. In addition, all patients were physically healthy with no medical history of any systemic diseases that would contraindicate implant surgery or might complicate the healing process. Also, they had adequately soft tissue, bone height, and width and had good oral hygiene conditions for implant insertion.

All the patients were given the necessary information about the procedure, including its prognosis, potential hazards, and complications, and they gave their approval to participate in written informed consent.

### Implant types:

Two types of implants were used, conventional dental implants (DENTIUM super line) (**Fig. 1a**) and mini dental implants (DENTIUM slim line) (**Fig. 1b**).

### Preoperative preparation:

All patients received strict oral hygiene instructions to maintain periodontal health through oral

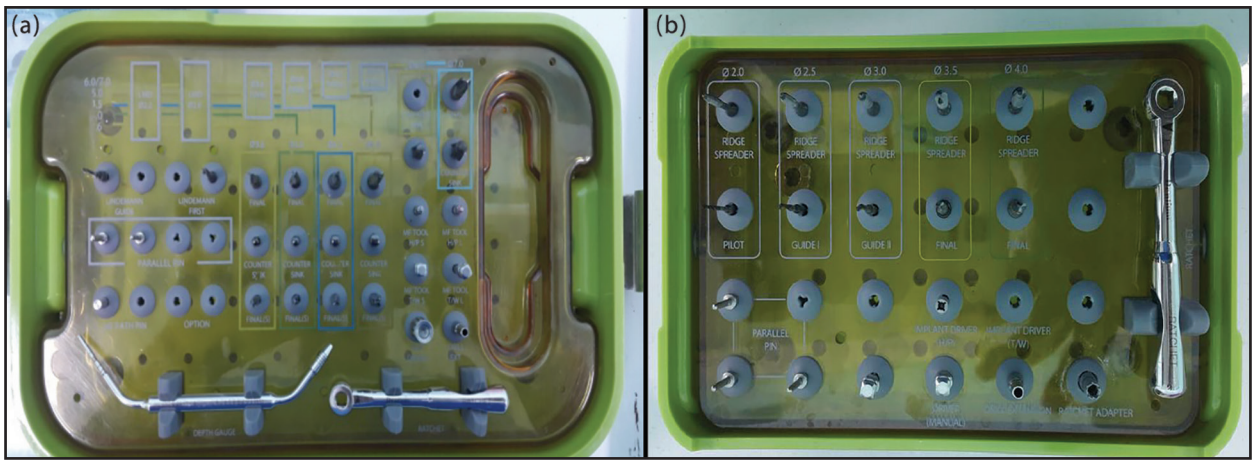


Fig. (1) a) DENTIUM conventional implant surgical kit, b) DENTIUM mini implant surgical kit

rinses with Antiseptol (mouth wash) (Chlorohexidine 1%, Kahira Pharma, Egypt) three times/day. Each patient was instructed to administer oral prophylactic antibiotic Augmentin (GlaxoSmithKline (Amoxicillin trihydrate 825 mg + Clavulanic acid 125mg) (tablets) twice daily one day before surgery.

**Radiographic examination:**

Each patient underwent preoperative Cone beam CT scanning to evaluate the absence of any pathology in the implant area. In addition, the radiographic examination was carried out to measure the proximity of the tooth to be replaced by the immediate implant to the maxillary sinus or nasal cavity, besides the width and depth of the edentulous areas.

**Preoperative examination:**

Detailed preoperative data about each patient were collected. Collected data comprised of each patient's name, age, gender, occupation, and address. The medical history, dental history, and previous or current habits were also recorded.

All patients were subjected to clinical examination to evaluate the existing alveolar contour, height, width, and soft tissue attachments for any signs of inflammation, ulceration, or scar formation and the possible existence of any pathological symptoms. In addition, the intermaxillary space and the type of occlusion were evaluated.

**Operative stage:**

The surgical procedures were performed under local anesthesia using Septanest SP (Septodont, France) (Articaine hydrochloride 4% with 1:100000 epinephrine). The patients were administered Augmentin 1 gm tablets one-hour before surgery. All patients were asked to thoroughly rinse with an antiseptic mouthwash solution before the surgical procedure. Anesthesia was administered to the patient a few minutes before surgery. The oral cavity was then scrubbed with Betadine antiseptic solution, and the patient was draped using sterile towels according to the standard technique of intraoral surgery. A gingival incision was made using bard parker No. 3 with blade #15 to expose the bone. The pilot hole was drilled to the chosen depth using a twist drill (2 mm diameter).

Gradually increased drills were then used until the planned selected implants were reached. Drilling was done on speed 900 RPM torque 40 Ncm; for mini-implants, just the pilot drill was used, and the Wrench was inserted into the implants. The used implants were self-tapping, so it was inserted to 2/3 of its length under finger pressure, followed by using a wrench, so the implant was screwed into bone till the implant was below the alveolar bone crest by 1mm (submerged implant). Then, the cover screw was screwed instead. Interdental papillae mesial and distal to each implant were sutured in an interrupted matter suture using resorbable suture material (Assucryl braided videt coated 3.0 UPS-Assut Sutures, Switzerland and Diclofenac-potassium manufactured by Novartis) (Fig. 2).

**Post-operative care:**

All patients were instructed to apply ice packs over the surgical area for 15 min. each hour for six hours. They were supplied by the oral regimen of Augmentin 1 gm every 12 hours for five days. In addition, they have prescribed Cataflam 50mg tablet twice a day for five days. Also, they were supplied with Antispeptol 0.12% mouthwash four times daily. The prosthesis had been adjusted and refitted two weeks post-surgery.

**Post-operative follow-up:**

All patients were subjected to clinical and radiographic examinations after surgery. The patients were clinically examined 24 hours post-surgery for possible complications such as delayed bleeding, redness, edema, swelling at the surgical site, wound dehiscence, pain, discomfort, or implant looseness. Patients were offered regular weekly check-ups after three- and nine months post-surgery. For the detection of possible bone loss, CBCT was carried out at a regular intervals after three- and nine-months post-operation (Figure 3).

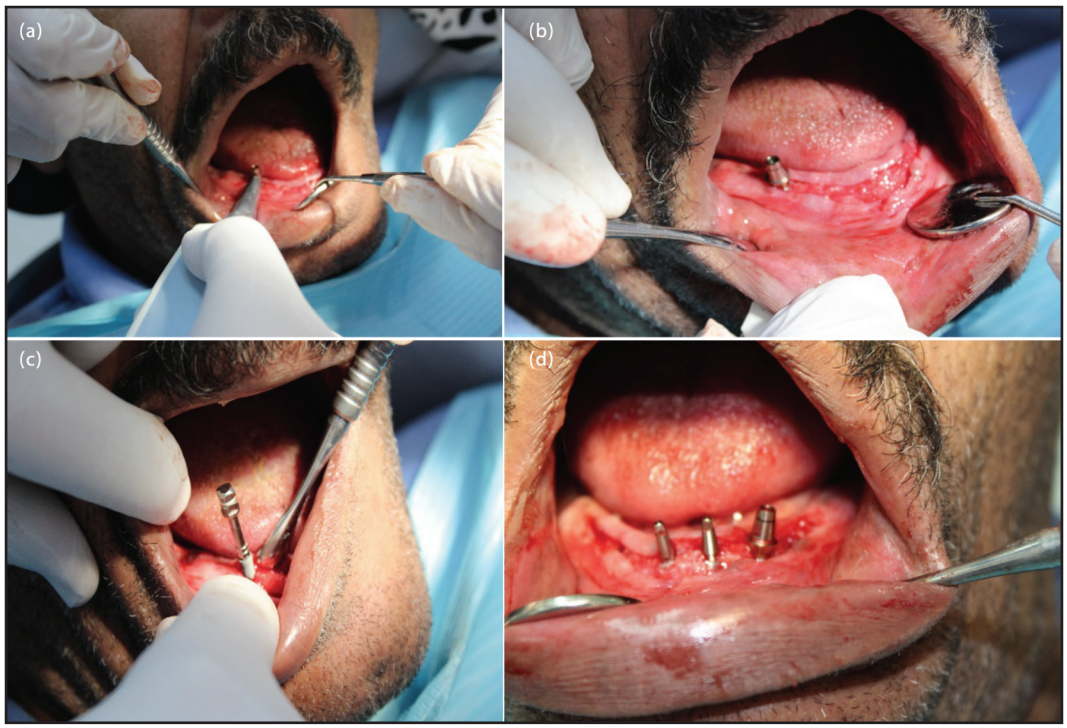


Fig. (2) Preoperative (a, b) and intraoperative sequence (c, d)

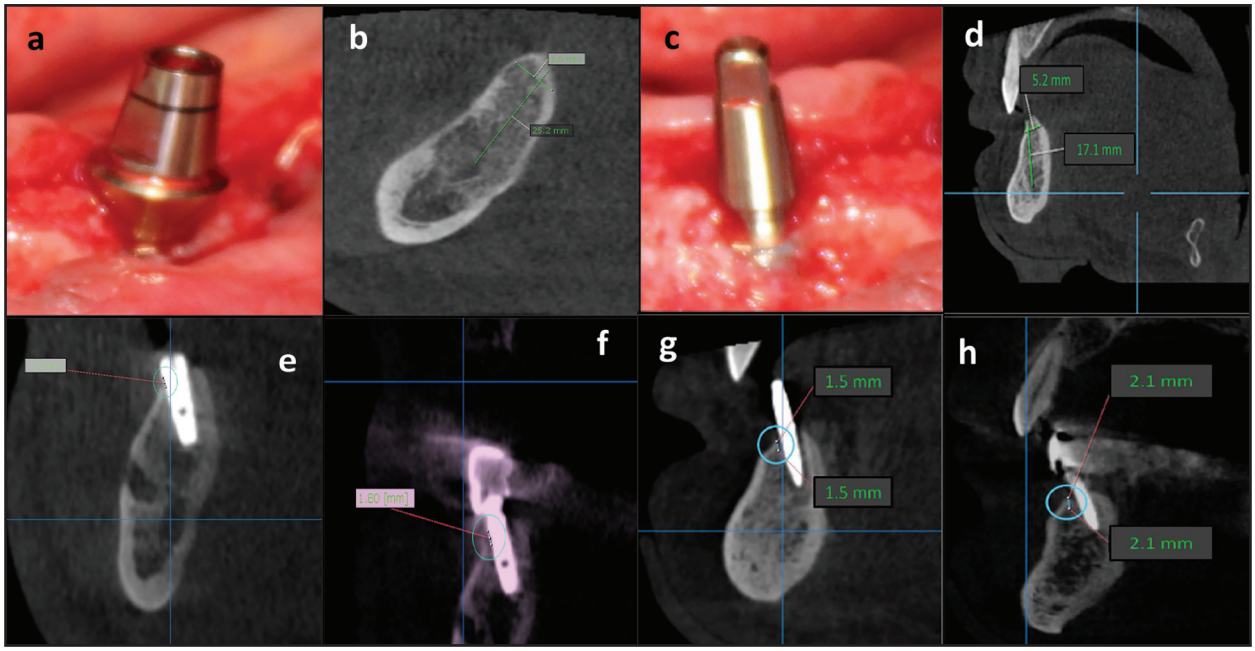


Fig. (3) Photograph showing: a) the conventional implant at the lower right first premolar, b) the ridge at the implant area showing the length and width measurements, c) the mini-implant of the lower right central incisor, d) the ridge at the implant area showing the length and width measurements, e) the measurement of the vertical bone loss around the conventional implant after three months, f) the measurement of the vertical bone loss around the conventional implant after nine months, g) the measurement of the vertical bone loss around the mini-implant after three months, and h) the measurement of the vertical bone loss around the conventional implant after nine months.

## RESULTS

### Periotest measurements:

The current study included the implanting of 16 dental implants divided into two groups: group I, patients with conventional dental implants, and group II, with mini-implants. Results showed a high negative value in group II for the periotest measurements. In addition, there was no significant difference between group I and Group II. During the surgical operations, no complications were observed, and the primary implant stability was achieved as confirmed by the Periotest measurement obtained immediately after the implant insertion (**Table 1**).

On the first day post-surgery, results showed no bleeding, erythema, or wound dehiscence was observed. Furthermore, two patients in group I and four in group II experienced mild pain or discomfort, and mild edema resolved after 48h of following the medication regimen. In addition, all the patients in both groups continued the follow-up period without any signs of infection. The implants, either the conventional or the mini-implants, were stable, with no clinical complications, and were supported with fixed ceramic crowns.

Moreover, the results in table (1) showed the clinical measurement of the gingival and plaque index immediately after surgery. Results showed no significant difference in the gingival and plaque index measurement between group I and group II. Further, the same mean value was recorded in both groups. Moreover, group II showed a higher mean value of plaque index than group I, but no significant difference was observed between both groups.

**Table (1)** *Different parameter measurements immediately after surgery*

| Measurements | Patient groups (Mean ± S.D.) | | *P*-value | t-value |
|---|---|---|---|---|
| | Group I | Group II | | |
| **Periotest** | -2.56 ± 0.65$^{ns}$ | -2.71 ± 0.74$^{ns}$ | 0.673 | 0.4308 |
| **Gingival index** | 1.00 ± 0.76$^{ns}$ | 1.00 ± 0.76$^{ns}$ | 1.000 | 0.000 |
| **Plaque index** | 1.13 ± 0.83$^{ns}$ | 1.25 ± 0.71$^{ns}$ | 0.761 | 0.311 |

*ns: not significant (unpaired t-test)*

**post-operational measurements:**

***Pocket depth at the mesial side:***

The measurement of pocket depth on the mesial side in group I and group II after three- and nine-months post-surgery was presented in table (2). Results showed that the pocket depth at the mesial side in group I after three-month post-surgery was 1.33 mm, while in group II, it was 1.39 mm. Results also showed an increase in the pocket depth after nine months post-surgery in group I, while there was a decrease in the pocket depth after nine months post-surgery in group II. However, in both groups, there was no significant difference in the pocket depth at the mesial side after three- and nine- months post-operation. Results revealed a significantly great change percentage in pocket depth at the mesial side in group II between three- and nine- months post-operation. However, the change percentage in group I was not high.

**Pocket depth at the distal side:**

The measurement of pocket depth on the distal side in group I and group II after three- and nine-months post-surgery was presented table (3). Results revealed a high pocket depth at the distal side in group II compared to group I after three months post-operation, and no significant difference was obtained. A greater percent decrease was noted in group II (-27.96±9.21), with an exceptionally statistically significant difference between groups.

**Table (2)** *The pocket depth at the mesial side in Group I and II after three- and nine- months post-surgery*

| Patient groups | Pocket depth at the mesial side (Mean ± S.D.) (mm) | | % Change |
|---|---|---|---|
| | After three months | After nine months | |
| **Group I** | 1.33 ± 0.66$^{ns}$ | 1.39 ± 0.56$^{ns}$ | 2.22 ± 0.73$^{*}$ |
| **Group II** | 1.78 ± 0.62$^{ns}$ | 0.94 ± 0.39$^{ns}$ | 47.04 ± 11.48$^{*}$ |
| **t-value** | 1.406 | 1.865 | 12.113 |
| ***P*-value** | 0.182 | 0.083 | 0.0001 |

*ns: not significant *: significant at P ≤ 0.05 (unpaired t-test)*

**Table (3)** *The pocket depth at the distal side in Group I and II after three- and nine- months post-surgery*

| Patient groups | Pocket depth at the distal side (Mean ± S.D.) (mm) | | % Change |
|---|---|---|---|
| | After three months | After nine months | |
| **Group I** | 1.33 ± 0.50$^{ns}$ | 1.50 ± 0.71$^{ns}$ | 13.89 ± 4.32$^{*}$ |
| **Group II** | 1.78 ± 0.67$^{ns}$ | 1.06 ± 0.30$^{ns}$ | -27.96 ± 9.21$^{*}$ |
| **t-value** | 0.296 | 1.615 | 11.636 |
| ***P*-value** | 0.1502 | 0.1287 | 0.0001 |

*ns: not significant *: significant at P ≤ 0.05 (unpaired t-test)*

**Vertical bone loss measurement at the buccal side:**

Data in table (4) showed the vertical bone loss at the buccal side in group I and group II three- and nine- months after surgery. Results showed no significant difference in the vertical bone loss between the examined groups after three- and nine-months post-surgery. Group I recorded a significant change percentage compared to Group II, which was significantly different.

**Table (4)** *The vertical bone loss measurement at the buccal side in Group I and II after three- and nine-months post-surgery*

| Patient groups | Vertical bone loss at the buccal side (Mean ± S.D.) (mm) | | % Change |
|---|---|---|---|
| | After three months | After nine months | |
| **Group I** | $1.18 \pm 0.25^{ns}$ | $1.68 \pm 0.24^{ns}$ | $47.40 \pm 14.88^{*}$ |
| **Group II** | $1.78 \pm 0.87^{ns}$ | $2.07 \pm 0.76^{ns}$ | $21.88 \pm 7.59^{*}$ |
| **t-value** | 0.320 | 1.3841 | 4.3212 |
| ***P*-value** | 0.082 | 0.188 | 0.0007 |

*ns: not significant *: significant at P ≤ 0.05 (unpaired t-test)*

**Vertical bone loss measurement at the lingual side:**

Data in the table (5) showed the vertical bone loss at the lingual side in groups I and II three and nine months after surgery. Results revealed a significantly higher change percentage in group I than in group II. The vertical bone loss at the lingual side was higher in group I than in group II after three months with no significant difference between them. In addition, the vertical bone loss at the lingual side in group II was higher than in group I after nine months, and no significant difference was detected.

**Table (5)** *The vertical bone loss measurement at the lingual side in Group I and II after three- and nine-months post-surgery*

| Patient groups | Vertical bone loss at the lingual side (Mean ± S.D.) (mm) | | % Change |
|---|---|---|---|
| | After three months | After nine months | |
| **Group I** | $1.32 \pm 0.79^{ns}$ | $1.38 \pm 0.48^{ns}$ | $36.20 \pm 12.77^{*}$ |
| **Group II** | $1.28 \pm 0.49^{ns}$ | $1.54 \pm 0.50^{ns}$ | $24.07 \pm 8.60^{*}$ |
| **t-value** | 0.122 | 0.653 | 2.228 |
| ***P*-value** | 0.905 | 0.524 | 0.043 |

*ns: not significant *: significant at P ≤ 0.05 (unpaired t-test)*

## DISCUSSION

The current study examined comparatively the immediately loaded mini-implants versus the traditional ones through two patient groups. All implants were inserted at the rooted teeth and underwent CBCT. The study included 16 implants divided into two patient groups. Group I included eight conventional implants, and group II involved eight mini-implants. Primary stability was measured immediately after each implant's insertion using the Periotest device. After three and nine months, the vertical bone loss was assessed by measuring the bone surrounding each implant using the CBCT. During the follow-up visits, the periodontal status related to each implant was evaluated by measuring their pocket depth and analyzing their gingival and plaque indices. The obtained results were consistent with the previously obtained data by *Romeo et al*. [10] and *Dhaliwal et al*. [11] They found that there was no significant difference in primary stability between MDIs and conventional implants. According to the obtained results, the marginal bone loss in group I (conventional implant) was

less than in group II (Mini implants) after three- and nine- months post-operation. These results agreed with formerly published studies that used mini-implants or narrow-diameter implants as an implant treatment [12–17]. The single-piece mini-implants provide a gap-free connection (bacteria-proof) and therefore get the optimal effect of the barrier and protection functions of the peri-implant soft tissue. Mini-implants also establish a tissue collar overlapping the bone-implant interface [18–20]. *Karoussis et al*. [21] assessed the long-term success rate of many implants. They showed that implants' marginal bone level, pocket depth, and probing attachment level were significantly associated with smoking, general health, implant location, and full mouth probing depth. As a result, the clinician must consider the patient's general health, smoking habit, and oral hygiene for successful treatment. In the present study, the two groups showed a statistically insignificant difference in gingival index throughout the study period, which shows a mean of 1.00, and this was consistent with the study of *Omran et al*. [13] They found its mean of 0.637 in conventional implant while it was 0.673 in Mini Implants [22]. Moreover, in the present study, there were no significant differences in the pocket depth in both mini-implant and conventional implants.

## CONCLUSION

According to obtained results, we can conclude that the outcome of the mini dental implant and the conventional implant is almost the same in terms of primary stability, plaque index, and gingival index. Although there was no significant difference in both implant types, the vertical bone loss around both implants after nine months was comparable. The mini-implant can be a promising alternative when the ridge width does not accommodate the conventional type.

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