

## **Effect of Osseodensification Implant Site Preparation Technique on The Primary Stability of Implant Retained Maxillary Overdentures**

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### **Abstract**

**Objective:** This study was carried out to evaluate the effect of osseodensification implant site preparation technique on the initial stability of implant retained maxillary overdentures using Osstell device

**Materials and methods:** Six patients with completely edentulous arches were selected. After radiographic examination and denture construction, participants in this study were divided into two equal groups, Group I Twelve implants were inserted in completely edentulous maxilla using osseodensification technique, Group II Twelve implants were inserted in completely edentulous maxilla using conventional extractional drilling technique. Implant primary stability was measured using Osstell device for both groups immediately after implant placement. The second stage started after four months , in which ball abutments were secured to the implant fixture, then pick up of metal housings was done All data was collected , tabulated and statistically analysed

**Results:** the mean of primary stability was  $71.50 \pm 2.47$  and  $56.83 \pm 2.44$  for group I and group II respectively. The difference between the two groups was statistically significant  $p < 0.001$

**Conclusion:** Within the limitations of the results obtained from this study, it could be concluded that: Osseodensification technique (Densah burs) showed better effect on implant stability than conventional technique , a situation that may help when immediate loading of implants is planned

**Keywords:** Densah burs, Implant stability, and Osstell

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## Introduction:

There are numerous treatment options for the prosthetic replacement of teeth in partially and completely edentulous patients. Dental implants have been considered the best treatment option amongst them. However management of maxilla could present problems due to atrophy that occurs after extraction of the teeth. This process continues throughout life because of the lack of stimuli (disuse atrophy).(1)

Osseointegration is a direct bone anchorage to an implant body which can give a foundation to support well the prosthesis. There is a direct relation between implant stability and osseointegration. Low implant stability means very bad osseointegration and prognosis and long term success cannot be obtained. Constant analysis in a quantitative and objective way is very important to determine the grade of implant stability. (2)

Primary stability is changed according to bone quality and quantity, surgical technique and implant geometry (length, diameter, surface characteristics). Secondary stability is in direct relation to primary stability.(3)

Basically, the success of dental implant depends mainly on adequate achievement of primary stability which can be directly affected by both quality and quantity of the bone of osteotomy site. (1)

Challenges faced during the restoration of the maxillary edentulous patient with implants are more than those in the mandibular arch because of the anatomic, biomechanical, and esthetic considerations.(1)

Density of maxillary bone is mainly quality 3, as opposed to the mandible, which is more commonly quality 2, using the Lekholm-Zarb classification, which has been associated to primary implant stability.(4)

The drilling technique has a crucial factor in achieving primary stability. The conventional technique, as an example, involves extraction of bone during drilling leading to decrease in the amount of left bone.(5,6)

In 2015, a technique using a specially designed densifying bur was proposed for implant site preparation. This bur was claimed to improve bone density in the drilling site.(7,8)

Densah burs have several lands with negative rake angle that allow a non-cutting motion. They have a cutting chisel edge and a tapered shank so that when entering deep into the bone, they enlarge the osteotomy preparation with well and perfect compacting the bone in the peripheral area. This design allows pushing bone chips and debris inwards the implant bed rather than removing them.(9)

Drills can be utilized in clockwise and also anticlockwise motions at high drilling speeds. The anticlockwise drilling direction is more efficient in the densification process and is utilized in low-density bone, while the clockwise drilling direction is better for higher-density bone.(9)

Periotest, insertion torque measurements and radiographs are methods to assess implant stability. All these methods have the disadvantages of lack of standardization, susceptibility to operator-associated variables and poor sensitivity.(10,11)

Recently, a noninvasive method called resonance frequency analysis has been introduced for the assessment of the stability of implants. The advantages of this method are straightforward, fast, easy to perform and comfort to the patient is guaranteed.(12)

so this study was conducted to answer the question if osseodensification can

improve the primary stability than the conventional technique?

### Material and methods:

This study was accepted by the Prosthodontic Department Board and Ethics Committee of the Faculty of Dentistry, Ain Shams University.

Six patients were selected from the outpatient clinic of the Prosthodontics Department, Faculty of Dentistry, Ain Shams University. The inclusion criteria for this study involved patients who were: (1) Aged range from 45 to 60 years. (2) patients with Completely edentulous upper and lower ridges, with the last tooth extraction done at least 6 months before implant placement.

Exclusion Criteria: (1) Patients suffering from any systemic disease that may affect healing, complicate the surgical procedures or contribute to bone resorption. (2) Patients with para-functional habits (3) Patients receiving radiotherapy or chemotherapy (4) Heavy smokers. Complete denture construction was made in a conventional method and delivered for all patients. The upper complete denture was duplicated into a heat cured acrylic resin to be used as a radiographic stent. Cone beam computed topography (CBCT) scan was taken for the maxillary arch while the patient wearing the radiographic stent to determine bone dimensions at proposed implants site

Patients were randomly divided by into two equal groups three patients for each group: Group I: Twelve implants were inserted in completely edentulous maxilla using osseodensification technique

Group II: Twelve implants were inserted in completely edentulous maxilla using conventional extractional drilling technique Implants with 3.7 mm diameter and 11.5 mm lengths were used in this study.. After administration of infiltration anesthetic solution, a full arch crestal incision with

two realizing vertical incisions was reflected. The stent was used to mark the proposed conventional implant sites using a pilot drill

For group I using osseodensification technique:

A Pilot Drill was reused to reach the desired depth (Clockwise direction, drill speed 800-1500 rpm with profuse irrigation). The drill motor was reversed, the narrowest Densah Bur (VT 1525) 2.0mm was used (Counterclockwise drill speed 800-1500rpm with copious irrigation). Sequential drilling using large drill in diameter (VT 2535) 3.0mm was made to complete drilling of the osteotomy. When the tactile feedback of the bur pushing up out of the osteotomy preparation was encountered, pressure was modulated with a pumping motion until the attainment of the desired depth. Profuse irrigation was carried using internal and external irrigation (the handpiece and a large plastic syringe) with saline.. A sterile vial containing the implant was opened and the implant was inserted in the osteotomy site and rotated clockwise using the finger driver. The technique was repeated for all implants

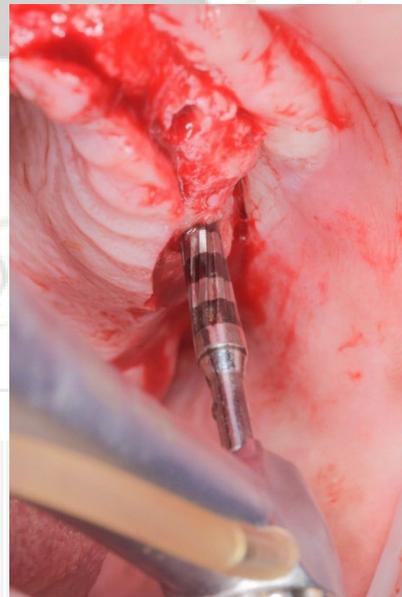


Fig. (1): Sequential drilling with densah bur with diameter (vt2535).

### Group II using conventional technique:

For the group where the osteotomy preparation was made using the conventional drills a round bur was used to mark the implant sites guided by the surgical stent. Preparation of implant sites started with the 2.3 mm diameter pilot drill. The osteotomy preparation was continued using a drill 2.8 mm in diameter followed by finally 3.4 mm drill at 800 rpm speed with copious irrigation. A sterile vial containing the implant was opened and the implant was inserted in the osteotomy site and rotated clockwise using the finger driver. This technique was repeated for all implants fig (2)



Fig. (2): Four implants fully seated in the prepared osteotomies.

### Method of measurement of primary stability:

#### For both groups:

- Implant Stability Quotient (ISQ) were measured using magnetic transducer. Magnetic peg was hand tightened inside the implant. The measurements were made parallel and perpendicular to the bone crest in the bucco-lingual direction, and parallel to the bone crest in mesial-distal direction, as recommended by Osstel (Fig. 3).

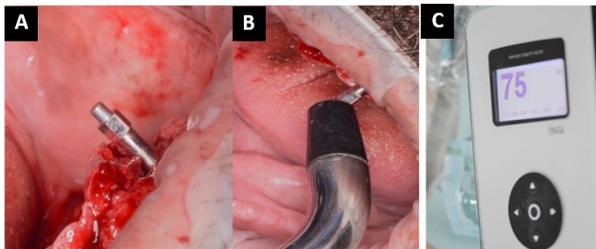


Fig. (3): A-smart peg, B-Osstell probe, C-reading of measurement.

- After assessment, the smart peg is removed and replaced by cover screw (Fig. 4).

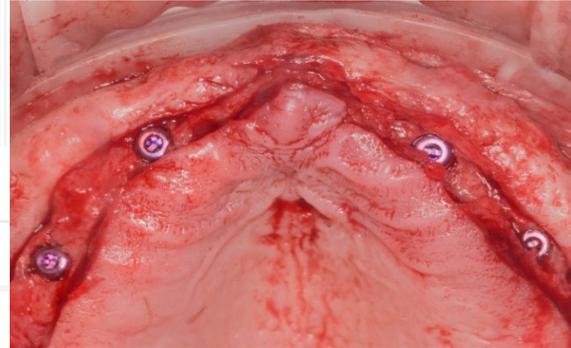


Fig. (4): Implants covered by cover screws

The surgical site was irrigated with saline, and the flap was replaced, adjusted to its former position over the implant. Mucoperiosteal flap sutured in continuous with lock pattern using 4-0 prolene3 suture material using a curved triangular cross-sectional needle.

Seven days after surgery patients were recalled to remove the sutures. Four months later, the second stage started in which exposure of the implant fixtures took place and ball abutments were secured to the implant fixture.

Prior to the pick-up of the metal housings, block-out shim was adapted to each abutment to block out the undercut areas inferior to the ball abutments, then the metal housings were placed in place. A recess was made in the denture base opposite to each ball abutment and hard denture lining material was used for chair-side pick-up of the metal housings. The lining material was applied into the recess of the denture base and the denture was fully settled in the patient's mouth. The patient was guided to close in centric relation till complete curing of the hard denture liner occurred fig 5

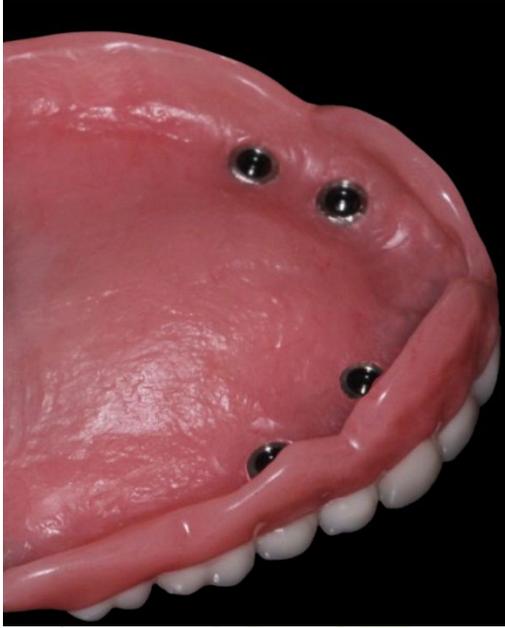


Figure (5): Metal housing & O-ring picked up in the denture

### Statistical analysis

All data was programmed using Microsoft office 365(excel) and Statistical Package for Social Science (SPSS) version 20 unpaired t test was used for the comparison of the same results between groups. Probability value of  $p \leq 0.05$  was considered statistically significant.

### Results:

Comparison between the two groups was performed by using unpaired t-test and the results were presented in table (1) and figure (6).

Table (1): Mean  $\pm$  standard deviation (SD) of primary stability for groups

Primary stability (mean $\pm$ SD)		t-value	p-value
Group I	group II		
71.50 $\pm$ 2.47	56.83 $\pm$ 2.44	14.63	<0.001*

\*, significant ( $p \leq 0.05$ )

Immediately after implant placement, the mean of primary stability was 71.50 $\pm$ 2.47 and 56.83 $\pm$ 2.44 for group I and group II respectively. The difference between the two groups was found statistically significant  $p < 0.001$

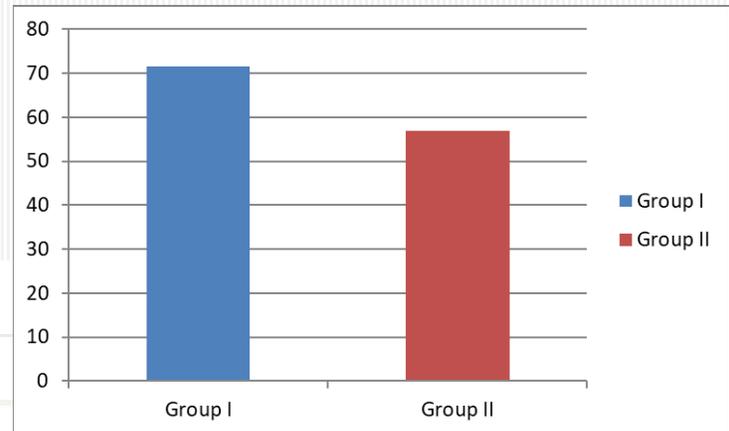


Fig. (6): Bar chart showing average primary stability in different groups

## Discussion

This study examined the effect of osseodensification drilling technique on the primary implant stability

Age range for the selected patients was 45 to 60 years old to avoid effect of age on muscle tone, oral mucosa and residual ridge(13,14)

Patients with systemic diseases that might affect bone quality, increase surgical risk, delay or complicate post-operative healing, cardiovascular diseases, metabolic disorders, history of previous radiotherapy and chemotherapy were excluded to decrease risk of implant failure(16,17) In a study, specially made condensers and expanders were working for compression of low-density bone. In this way, it was expected that the bone is compressed apically and laterally by the use of the osteotomes. Bone density was reported to increase in the periapical area only and not along the lateral walls(18). However, hammering with a mallet is involved in the technique of bone condensation. This way can be hard for the surgeon to control and may result in unplanned displacement(19)

An osseodensification drilling technique that allowed expansion of the drilling site was proposed in 2015. This technique used specially designed burs

operating in a counterclockwise direction instead of hammering with a mallet (10, 20) High temperature during drilling causes bone necrosis in the osteotomy site. so precautions were taken during drilling as using refrigerated saline, sharp drills and sequentional drilling. High temperature during osteotomy site preparation causes bone necrosis and affects implant osseointegration(21)

Drilling was also carried out in anticlockwise and also clockwise (CW) rotation directions. the anticlockwise drilling can be utilized in low density bone as it was reported to be effecient in the densification process(9). During drilling with Densah burs, both clockwise initially and then counterclockwise drilling was employed. However, during drilling with conventional surgical drills, clockwise drilling only was used.

Implant stability quotient was measured in this study using the Osstell device as it is straightforward, rapid and easy to perform and comfort to the patient is guaranteed(12)

Surgical technique is one of the important factors affecting primary stability(22.23). The results of this study match that of another study regarding primary implant stability in which there was statistically significant difference between both techniques of drilling(24). However, another study showed no statistical significant difference although the values attained by using Densah bur for drilling was slightly higher than that attained by using conventional surgical drills(25)

The results of this study revealed that osseodensification technique significantly increased primary implant stability compared to conventional drilling technique. This may be due to the claim that this technique preserve bone by two ways, first by compacting cancellous bone by its plastic deformation second by autografting of bone

chips at the apex and length of osteotomy site(26)

The osseodensification technique utilizes a specially designed drills with several negative rake angles acting as noncutting edges and have four or more lands that smoothly compact the bone along the osteotomy(27).

Densah bur osteotomy diameter was also found to be smaller than conventional osteotomies due to the spring back action of bone and elastic strain. This increased the percentage of available bone at the implant site by about three times.

Histomorphological analysis showed autologous bone chips in the osseodensified osteotomy sites especially in bone of low density relative to conventional drills(27)

The results of this study is confirming those of Lopez et al,(28) which illustrated that the osseodensified implant sites have higher ISQ values than extracting drills. This study proved that ossifying burs have a positive effect on enhancing the initial and biological stability of the implant devices

## Conclusion

**Within the limitations of the results obtained from this study, it could be concluded that:**

Osseodensification technique (Densah burs) showed better effect on implant stability than conventional technique ,a situation that may help when immediate loading of implants is planned

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