

# The success of immediate implant placement with Zero insertion torque

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## Research article

**Keywords:** orque implant insertion, implant primary stability, loose implant, immediate implant survival, immediate implant placement

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# Abstract

**Background** The primary stability in immediate implant placement was considered one of the prerequisites for the achievement of good osseointegration. The insertion torque varies between cases depending on many factors and may go down to Zero that may affect the prognosis of the implant especially in the soft maxillary bone. The aim of the study was to assess clinically the success and/or failure of immediate flapless implant placement in the maxilla with Zero insertion torque measurement with a follow up time ranging 2-4 years.

**Results:** out of 780 analyzed, fourteen implants were placed in fresh extraction sockets for single rooted teeth in the maxilla and did not get primary stability (zero insertion torque). Their survival rate was 85.7%.

**Conclusions:** The loss of torque during immediate implant placement to Zero may jeopardize the survival of the implants, but it may not be statistically significant with their failure and loss. The lack of certain conditions that are absent during their surgical installation and healing have the major effects on success. The implant primary stability is not an absolute prerequisite to osseointegration; however, it may affect the implant survival rate. **Key words:** 0 torque implant insertion, implant primary stability, loose implant, immediate implant survival, immediate implant placement.

## Introduction

The immediate dental implants has become a daily common dental procedure in oral rehabilitation. Implant stability is a clinically valuable measurement of the strength of implant anchorage in the bone during placement and in the post-osseointegration period. Its insertion torque varies between cases depending on the local bone quality and quantity, design of implant surface, time elapsed since extraction, and drilling surgical protocol (1; 2; 3).

The primary implant stability was considered one of the main pillars to get the osteointegration. Although, it is a biomechanical stability, the stability mainly depends on the mechanical engagement with bone. Secondary implant stability occurs due to bone formation and remodeling creating a biological anchorage. The implant stability and osseointegration can be clinically measured by both the cutting resistance (CR) during implant placement and removal torque after osseointegration (4; 5; 6). Resonance frequency analysis (RFA) and periotest are the most popular digital techniques, but both are not accurate enough to measure the stability or describe the success after implant placement.

The implant primary stability was clinically classified by Rodrigo et al as the following: (7)

- (A) No rotation at all.
- (B) When there is a light rotation with a feeling of resistance;
- (C) When the implant rotates without resistance;

(D) When there is both rotation and lateral oscillation of the implant.

The osseointegration is a direct structural connection between the vital bone and the surface of an implant and is considered a biological response occurs with the functional load. It occurs by osteoblasts activation then peri-implant osteoid tissue. Bone necrosis from overheating during drilling or a micromotion passing the threshold (50–150 nm) will lead to implant failure where the fibrous encapsulation will overcome the osseointegration (8)

The factors that affects the stability of implants have been conventionally analyzed, but there are few studies that evaluate the success of dental implants with the absence of primary stability (9) (10) (11). Clinical studies that evaluated osseointegration of implants with no primary stability at the time of placement are scarce and are mostly conducted on animal model. (12) (13)

## Methods

Out of 780 implants, fourteen patients (6 males and 8 females) were included in the study as there was a loss of primary stability that reached finally zero insertion torque. All patients have unrestorable remaining root in the maxilla that need extraction and immediate implant placement. (Fig. 1) No apical cortical plate perforation or infection. (Fig. 2) They never done previously apical root surgery or bone augmentation. The cases were selected with adequate buccopalatal bone width and about 4 mm of native bone height over the root apex for implant primary stability. The size of the implants ranged between 3.2 and 4.3 mm in diameter and between 11.5–16 mm in length. Patients do not have any systemic disease or a local factor that may jeopardize osseointegration.

In all cases, a Cone Beam Computerized Tomography (CBCT) was performed prior to implant surgery. (Fig. 3) All patients signed an informed written consent prior to the surgery, providing their approval to use the information obtained in the implant procedures. Preoperative prophylactic antibiotic medication was prescribed. The pharmacological regimen in all cases was amoxicillin at a dose of 500mg three times daily for 4 days and ibuprofen at a dose of 600 is given with the same regimen as amoxicillin. The patients were instructed to use Chlorhexidine Gluconate 0.2 % as a mouth wash preoperatively as well as postoperatively for a week. All the procedures were conducted under local anesthesia. The conventional technique of flapless, post-extraction implant placement was followed as atraumatic extraction, enucleating and cleaning of the socket from any granulation tissue or the remnants of periodontal ligaments. Before drilling, the surgical motor parameters were set to place the implant with handpiece at a speed 15 rpm and a torque 50 Ncm. All the patient's data were displayed as a graph documented through a USB port in the surgical motor that showed the torque curve until complete implant insertion. (Fig. 4)

Drilling sequence was done as recommended by the manufacturer. In no case of zero insertion torque a healing abutment was used as well as no immediate crown was placed. The implants were left submerged about 4 months in the fresh extraction socket to allow osseointegration before uncovering. Patients were recalled 7 days after implant placement, and bi-monthly thereafter to evaluate the

osseointegration. In all cases, the prosthodontics phase commenced with gingival former (Fig. 5,6) after about 4 months from the time of implant insertion to assure an undisturbed bone apposition onto the implant surface. The delivery of the temporary prosthesis (Fig. 7) was done with adjusted free of occlusion for 2 months. The oral hygiene instructions were reinforced with the patients. Radiographic controls were performed upon implant placement, at the time of prosthetic loading, and every 3 months thereafter in order to evaluate the bone level around implants as well as the status of the prosthetic work.

According to Rodrigo (7), Primary stability of all cases was divided into 2 categories, depending on the degree of implant rotation when tightening the cover screw: C (rotation without resistance that was found in 11 implants) and D (rotation and lateral oscillation, that was in 3 implants). The primary stability value was clear on the digital screen of the motor and the printed pdf file.

## Results

Implants were placed immediately in fresh extraction socket. The actual cases that were with almost final 0 torque of insertion were 14 (Table 1). All cases were placed with the same surgical motor, under the same criteria. The surgical motor was used to determine and measure the implant insertion torque. The torque was displayed and documented as a graph (Fig. 4) for every patient that was expressed as pdf file on a USB port. (14; 15)

All patients tolerated the procedure without major complications. Minor complications in one case included postoperative swelling, edema, and pain due to difficult atraumatic removal of the remaining root. Twelve implants were successfully osseointegrated and loaded after about 4 months with temporary crown.

There was failure for 2 implants. One during exposure of the implant for fixation of the gingival former where the implant was removed out during cover screw unscrewing. The other implant was found with movement after a week of temporary loading. Both implants lost their primary stability to zero and had unstable lateral movement in the socket.

Although all the 14 implants have final Zero insertion torque, only two failed that could be due to traumatic extraction, unseen apical granulation tissue or eccentric movement during insertion. Follow ups were minimum 26 months for all cases by periapical x-ray films that showed a good osseointegration of implants with no bone resorption or infection around the implant. The follow up time was up to 4 years to evaluate clinically the outcome and survival of immediately placed dental implants in the maxilla that lost its primary stability to zero torque during insertion. The results showed that all the remaining 12 cases have a good osseointegration. Moreover, under certain conditions, implant primary stability could be not an absolute prerequisite to osseointegration even with very low primary stability only if the socket is clean, healthy, intact, without apical perforation and no major eccentric implant movement during insertion.

## Discussion

At present, there are no standards for the measurement of primary stability. However, the most used objective simple methods are resonance frequency analysis (RFA) and the Periotest, but both frequently debated for their limitations and risks. (16; 17; 18). Insertion torque (IT) and resonance frequency analysis (RFA) are the most widely used methods to measure primary stability and they are independent and incomparable methods so their relationship has been extensively analyzed by numerous researchers and yet remains controversial. (19)

Regarding clinical evaluation, the inserted implants were left about 4 months and judged clinically by follow up to see the fate of zero inserted torque implants in comparison with others who made tests aggressive and invasive tests as histologic or microscopic analysis which was considered the gold standard method to evaluate implant stability, but it has ethical issues. Non-aggressive methods as perio test, resonance frequency test and the cutting torque resistance is not accurate enough to judge the predictability of implant success (2). The found similarities with Fu *et al.*, who warns of the limitations of primary stability measurement instruments in bone densities. Therefore, clinical assessment of implant stability is generally subjective, observational and experience-based (20). However, it has been reported in the literature that implants that lacked or had low primary stability have comparable survival rates to those with high primary stability. (21; 22; 23; 24)

The primary stability can be measured at the time of implant placement but never after that time. An increased value of insertion torque could be due to direct friction of the implant with the dense cortical plate and not enough bone to implant contact and this can be deceiving in the giving a rock primary stability. (25)

Although the insertion torque was zero, the biological response lead to a structural direct connection between the vital bone and the surface of an implant. Successful osseointegration that comes from secondary implant stability is the main required criteria for functional dental implants where the low values of insertion torque tended to increase, in the transition to secondary stability (1).

The early osseointegration can be accelerated with the surgical protocol and the new developed implant surfaces. This can reduce the required time for healing, even to a point of immediate/early loading. (26) It is reported from the literature that machined surface implants have a low survival rate (27; 28); however, osseointegration of rough surface implants with no primary stability at placement is predictable. (22; 7; 29) Orenstein and colleagues done a study with 2770 implants that have 6 different designs. They found that the survival after 3 years for mobile implants was 79.8% while it was 93.4% for the stable implants. They concluded that the survival rate for implants could increase for those with modified implant surfaces even with low primary implant stability. (28)

There were some argue about the removal of any implant from the osteotomy site if there was any loss of primary stability and replacing its size with a bigger one. Based on the clinical findings of the small limited sample, very low or even zero insertion torque in immediate implant placement may not

statistically significant in the loss of implants if the surrounding sterile socket biology, intact socket walls, thick gingival phenotype, atraumatic extraction, hand skills and absence of lateral eccentric implant movement are guaranteed. (30)

In a study by Veradi and colleagues for 11 implants with insertion torque less than 10 N-cm, he found that the survival rate was 100% and concluded that primary stability is not a prerequisite for osseointegration although there was a slight mobility to lateral force of 250 g at the time of placement. (31)

## Conclusions

The primary stability may be very low or even lost to zero torque during immediate implant insertion. The atraumatic extraction, clean socket, sterile biology as well as Mother Nature will aid enhancement of the osseointegration and therefore lead to highly successful implants. Thus, the implant primary stability is not the principal prerequisite to osseointegration. Although predictable outcomes for implant anchorage may be unknown in zero insertion torque of implants; the meticulous hand skills and the experienced surgeon's perception have a major role in the success of the immediate implant placement. More studies with larger sample sizes and with different implant systems are warranted to develop a standard management protocol for implants that have no primary stability or are mobile at the time of placement.

## Abbreviations

BTI: Bone to implant.

CBCT: Cone beam computed tomography.

CR: cutting resistance.

IT: Insertion torque.

Nm: Nanometer

N-cm: Newton centimeter.

RFA: Resonance frequency analysis.

USB: Universal Serial Bus

## Declarations

**Ethics approval and consent to participate:** The 'ethics committee' Sohag University Hospitals, Faculty of Medicine, Sohag University approved the research and study. All patients gave the written informed consent to participate in the surgery.

**Consent for publication:** Not applicable.

**Availability of data and materials:** The data supporting my findings can be requested from me for free at any time.

**Competing interests:** The author Samy Elian declare that he has no competing interests.

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**Author contribution:** SE carried out all the surgical procedure, implant placement and the restoration. He read and approved the final manuscript.

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## Tables

Table 1: Insertion torque during implantation surgery

No. of immediate implants	Failed	Maximum torque during insertion	Final reached insertion torque	Mean (N/Cm)
14	2	32 N/cm	0 N/cm	12.3

# Figures



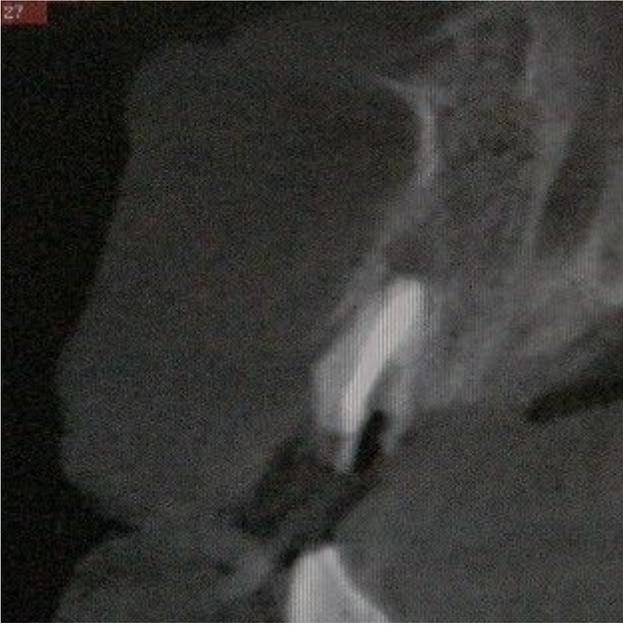
**Figure 1**

Unrestorable remaining root.



**Figure 2**

Preoperative x.ray film.



**Figure 3**

Preoperative cross-section CBCT.



## Set parameters:

Transmission	WI-75
Speed	15 rpm
Torque (forward operation)	50 Ncm
Torque (reverse operation)	50 Ncm
Coolant volume	0 %
Program	Implantation

## Torque curve:



Figure 4

Insertion torque showed as curve reached 6 Ncm then dropped to 0.



**Figure 5**

periapical x-ray shows implant with gingival former



**Figure 6**

Gingival former fixed after about 4 months of implant placement



**Figure 7**

Delivery of the crown.