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Comparative evaluation of crestal bone loss around dental implants in implant osteotomy sites prepared by piezoelectric inserts versus conventional twist drills: Two case reports

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Abstract
Osseointegration refers to the connection between living bone and the surface of an implanted device that bears functional load. The Piezosurgery device, as compared to rotating instruments, promotes improved wound healing and reduces the occurrence of microfractures and smear layer. In this case report, the objective was to investigate the impact of using a piezoelectric device for preparing the osteotomy site on the loss of crestal bone around dental implants. Two patients, both having a single missing tooth in the posterior region of the lower jaw, were chosen for the study. In one patient, the osteotomy site was prepared using Piezosurgery, while in the other patient, the conventional physiodispenser was used, followed by the placement of ani-Fix® implant. After a period of 6 months following the implant placement, an evaluation was conducted using cone-beam computed tomography (CBCT) to measure crestal bone loss. It was observed that the osteotomy site prepared with the piezoelectric device exhibited a reduced amount of crestal bone loss. Therefore, the findings of this study suggest that the utilization of Piezoelectric inserts for osteotomy preparation can effectively decrease crestal bone loss around implants, thereby enhancing peri-implant success.

Keywords: Elastic modulus, flexural strength, provisional restorative materials

Introduction
Dentists commonly employ dental implants as a form of prosthetic to substitute for teeth that have been lost or damaged. These implants, made of titanium cylinders, create connections with the jawbone and form a strong bond [1]. Studies have consistently demonstrated that dental implants are an effective and reliable method for replacing missing teeth [2].
Implant dentistry aims to reinstate teeth that have been lost or extracted by strategically positioning implants in a manner that is both anatomically and aesthetically optimal, ensuring long-term functionality. This approach prioritizes preserving the health of adjacent teeth while enabling the placement of a dental prosthesis [3]. Numerous factors have been identified as influential in determining the survival and success of dental implants.
Osseointegration is the term used to describe the process by which the implant securely fuses and attaches to the bone [4]. Several factors, such as the quality and quantity of the bone, the initial stability of the implant, and the surface characteristics of the implant, play a significant role in determining the successful osseointegration of the implant [5].
Osseointegration, which is considered the foundation of implant dentistry, has always been the primary objective for dentists to accomplish [6]. Achieving faster osseointegration may rely on addressing unfavorable tissue conditions or optimizing the biomaterial used, rather than simply speeding up the bone's natural response rate [7].
Crestal bone loss represents a significant long-term risk associated with dental implants [8]. The stability of marginal bone, or the bone surrounding the implant, serves as a crucial indicator for evaluating the success of the implant. In the past, osseous surgery has been conducted using either manual or motor-driven instruments. Manual instruments provide better control when dealing with less dense mineralization.

However, they are challenging to handle in cortical bone, especially in cases where precise osteotomies are necessary [9]. The piezosurgery device is an ultrasonic device that operates at a modulated frequency and has a controlled range of tip vibrations. The tip of the piezosurgery device vibrates between 60-200 mm, enabling precise incisions and clean cutting. The power of the device can be adjusted between 2.8 to 16W, and there are pre-set power settings available for different bone densities [10].

Piezoelectric surgery (PS) has emerged as a beneficial alternative to overcome the drawbacks associated with conventional rotating instruments. Piezosurgery is recommended for its ability to perform precise and safe cuts while minimizing trauma. This technique enhances the osteogenic potential, reduces edema, promotes improved wound healing, and decreases the occurrence of microfractures and smear layer compared to rotating instruments [11].

Therefore, the objective of this case report was to assess and compare the impact of Piezoelectric inserts and conventional twist drills on Crestal bone loss by utilizing clinical and CBCT evaluations.

Materials and Method

Case 1

A patient with a chief complaint of missing tooth in the lower left tooth region came to the outpatient department of Subharti Dental College and Hospital. Patient was systemically well. Implant placement using Piezosurgery was planned.

Surgical Procedure

Before starting the procedure, a written consent was taken from the patient and the entire procedure was explained to the patient. Routine Oral hygiene procedure was done and oral hygiene instructions were given. Local anaesthesia containing Articaine 4% with Adrenaline 1:100000 was administered and the Piezosurgery unit was used. After assessing the pre-treatment records and identifying vital anatomic landmarks, the selected implant site was surgically exposed by raising mucoperiosteal flap (FIG 1). A Piezosurgery device (DTE Woodpecker) and inserts of increasing diameter (UI-1, UI-2, UI-7, UI-8, UI-9) were used with a power setting in Bone mode (FIG 2) Then paralleling pins were used to verify the desired angulation of the implant. Implant was placed into the prepared site with gentle digital pressure until resistance and seated into final position with a torque ratchet followed by the attachment of cover screw (FIG 3). The procedure was completed with repositioning and suturing the surgical flap (FIG 4).

Fig 1: Sub crestal incision given

Fig 2: Osteotomy by #ui-1

Fig 3: Implant with cover screw placed

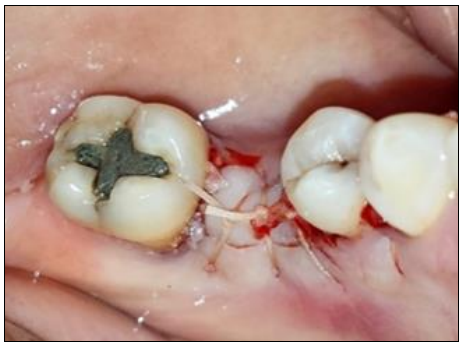

Fig 4: Sutures placed

Fig 5: Post operative CBCT

Fig 6: Crown placed

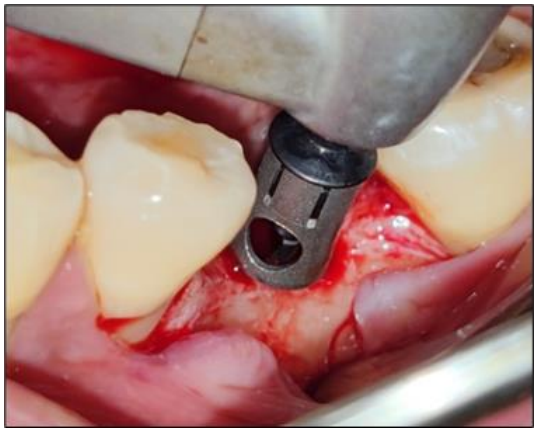

Fig 7: Osteotomy being done

Fig 8: Implant placed

Fig 9: Crown placed

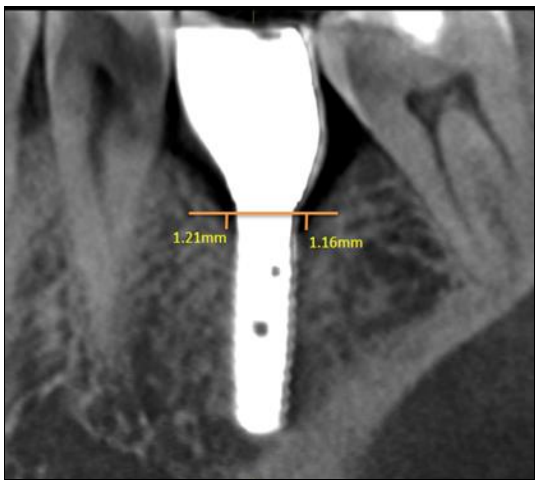

Fig 10: CBCT after 9 months

Case 2

A patient with a chief complaint of missing tooth in the lower left tooth region came to the department. Implant placement by conventional osteotomy preparation using Physiodispenser was planned.

Surgical Procedure

A written consent was taken from the patient before planning the procedure. Routine Oral hygiene procedure was done and oral hygiene instructions were given. Conventional osteotomy was prepared using i-Fix implant kit in the second patient with similar methodology without using Piezosurgery.

Result

Crown was placed after three months and Crestal bone loss was evaluated after 9 months by CBCT. It was observed that less amount of crestal bone loss was seen in the osteotomy site prepared by Piezosurgery as compared to the osteotomy site prepared conventionally.

Discussion

It was noted that the success of dental implants greatly relies on the process of osseointegration. As described by Adell *et al.* [12], osseointegration refers to a strong, direct, and long-lasting bond between the screw-shaped titanium implants, with specific surface characteristics and design, and the surrounding vital bone. It signifies the absence of any intervening tissue between the implant fixture and the bone.

The study adhered to the success criteria established by Albrektsson *et al.* [13], which outlined that changes in the marginal bone level for assessing implant survival and success within the initial year should be less than 1-1.5 mm, and the subsequent annual bone loss should be less than 0.2 mm. A long-term investigation spanning 15 years, focusing on Osseo integrated implants utilizing the Branemark System, reported a bone loss of 1.2 mm during the first year.

The manner in which occlusal forces are transferred to the bone-implant interface is a significant factor influencing the success of implant therapy, as mentioned by Misch *et al.* [14] The transmission of these forces relies on various factors, including the implant's design, type of implant-abutment connection, the presence or absence of threads, microarchitecture, and the chemical composition of the implant surface. The objective of implant design is to distribute the occlusal load in a favorable manner, thereby optimizing the functionality of the prosthesis supported by the implant.

Following the second stage surgery, the prosthesis was placed three months later. After a total of nine months, a CBCT evaluation was conducted to assess crestal bone loss. It was observed that the osteotomy site prepared using the piezoelectric device exhibited a reduced amount of crestal bone loss.

The findings of the current study align with those of a previous study conducted by Vercellotti *et al.* [15], which showed that the osteotomy performed using Piezosurgery resulted in more favorable osseous repair and remodeling compared to the conventional method.

Conflict of Interest

Not available

Financial Support

Not available

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