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RESEARCH ARTICLE
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CRESTAL BONE LOSS EVALUATION AROUND DENTAL IMPLANTS IN IMPLANT OSTEOTOMY SITE PREPARED BY PIEZOELECTRIC INSERTS: A CASE REPORT.

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Abstract
The process of living bone fusing to a surface of an implanted device that carries a functional load is known as osseointegration. In comparison to rotating instruments, the Piezosurgery device encourages faster wound healing and less frequently forms microfractures and smear layers. The goal of this case study was to look into how employing a piezoelectric device to prepare the osteotomy site affected the amount of crestal bone that was lost around dental implants. The Case involved one individual, who had a single missing tooth in the lower jaw's posterior region. Piezosurgery was employed to prepare the osteotomy site before the implant was inserted. Cone-beam computed tomography (CBCT) was used in an assessment to gauge crestal bone loss nine months after the implant was placed. It was noted that there was less crestal bone loss around the osteotomy site prepared using a piezoelectric device as compared to the literature available in conventional drills. The results of this case study thus support the idea that using piezoelectric inserts to prepare osteotomies can significantly reduce crestal bone loss surrounding implants, improving peri-implant success.

INTRODUCTION:

Implant features and surgical preparation of the implant site are essential components for implant therapeutic success. To date, the research has mostly concentrated on the enhancement of the implant's macro- and microgeometry, with the goal of improving primary stability and accelerating secondary stability.[1,2]

However, the preparation of the implant site and its impact on clinical results have received little attention. The most common surgical procedure calls for the use of handpieces and twist drills that rotate between 700 and 2,000 revolutions per minute (rpm). The drilling process makes use of mechanical macrovibrations, which, despite being quite successful, have some limitations in terms of intraoperatory control. This can make surgery more challenging if there is a reduction in bone volume. Few research have examined the connection between site preparation technique and bone healing response, despite the fact that minimally traumatic preparation of the implant site is known to have a significant impact on osseointegration. The development of piezoelectric bone surgery during the past ten years has opened up new possibilities for osteotomies performed with ultrasonic surgical devices. The micrometric cut of ultrasounds offers a precise, controllable action and has been utilized in a

range of sectors, including neurosurgery, otorhinolaryngology, oral, and maxillofacial surgery and otorhinolaryngology.[3]

Additionally, piezoelectric instruments for osseous surgery only operate on hard tissues preventing any form of damage to the soft tissues present around[4] and histologic and biomolecular observations indicate that ultrasonic osteotomy appears to result in a more favourable bone healing response than bone surgery using conventional rotary instruments.[5]

Therefore, particular piezoelectric inserts were developed for implant site preparation in order to profit from the potential advantages this novel approach to osseous surgery offers.

Thus, the objective of this case report was to use an innovative ultrasonic implant site preparation (UISP) technique and to evaluate outcomes such as crestal bone loss and implant survival by utilizing clinical and CBCT evaluations.

MATERIALS AND METHOD

CASE REPORT

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 Briefly, UI-1 insert was used to prepare cortical access and initial implant osteotomy (**FIG 2**) followed by an UI-2 insert (1.6-mm diameter) to the programmed working length (**FIG 3**), and then Lastly, a UI-7 (1.9 -mm diameter) was used to finalize implant site and bone preparation (**FIG 4**) 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 5**). The procedure was completed with repositioning and suturing the surgical flap (**FIG 6**)

RESULT

Crown was placed after three months and Crestal bone loss was evaluated 9 months after implant placement and it came out to be 0.74 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 crestal bone loss around the dental implants prepared by conventional drills which is stated in the literature as 0.78 , 9 months after implant placement.

DISCUSSION

An early inflammatory reaction occurs in the peri-implant bone during the post-implant healing phase, which causes the growth of vascularized granulation tissue and pluripotent mesenchymal cells with the potential to develop into osteoprogenitors.

Inflammation intensity and surgical trauma are directly correlated, and this effects bone resorption around implants. Any excessive inflammation may result in a major loss of primary stability in the early stages of healing.[6]

The trauma associated with twist drills when performing osteotomies decreased when piezoelectric bone surgery was introduced. Piezoelectric microvibrations use ultrasonic shock waves, which contact the bone with low force and high frequency, to cut through bone.[7]

This case report followed the success criteria defined by **Albrektsson et al.**[8], which stated that changes in the marginal bone level for evaluating implant survival and success within the first year should be less than 1-1.5 mm, and the following annual bone loss should be less than 0.2 mm. An extensive 15-year study that focused on osseointegrated implants that used the Branemark System found that there was 1.2 mm of bone loss in the first year.

The results of this study also align with a study conducted by **Preti et al.**[9] in which they compared UISP to conventional implant site preparation and found that samples collected from the drilled sites included more inflammatory cells. In the implant bone site prepared by the ultrasonic approach, it was shown that there was an early increase in bone morphogenetic-4 and transforming growth factor-2 proteins and a reduction in pro-inflammatory cytokines.

Another human radiographic study compared piezoelectric surgery to rotary protocols in implant site preparation using CBCT evaluation and it was observed that there was a better promotion of bone density and osteogenesis around the implant sites prepared with UISP than in those prepared with rotary protocols, which further supports the result of this case study.[10]

Another study proved that when compared to the conventional drilling technique, ultrasonic implant site preparation causes a limited decrease in implant stability quotient in the early stages of healing and a faster shift from a decreasing to an increasing stability pattern.[11]

The current study is based on a randomized controlled clinical trial done by **Cannulo et al**[12] They compared implant stability throughout osseointegration using RFA, peri-implant radiographic marginal bone loss and implant success after 12 months of follow-up of implants placed with conventional drilling and mixed traditional/piezoelectric osteotomy and concluded that atraumatic preparation of the recipient bed using piezo-surgery could be an important factor to fasten osseointegration and improve peri-implant bone level maintenance Three months after the second stage surgery, the prosthesis was placed. A CBCT evaluation was performed to evaluate crestal bone loss nine months after the procedure. It was seen that there was less crestal bone loss at the osteotomy site that had been prepped using the piezoelectric device.

The results of this investigation are consistent with those of a prior study by **Vercellotti et al.**[13], which shown that osteotomies performed using piezosurgery produced more favourable osseous healing and remodeling than the traditional approach.

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FIG 1

FIG 2

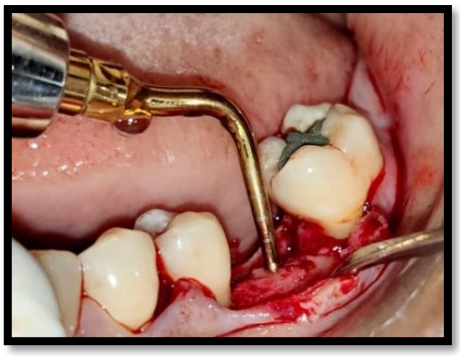

FIG 3

FIG 4

FIG 5

FIG 6

FIG 8

FIG 9

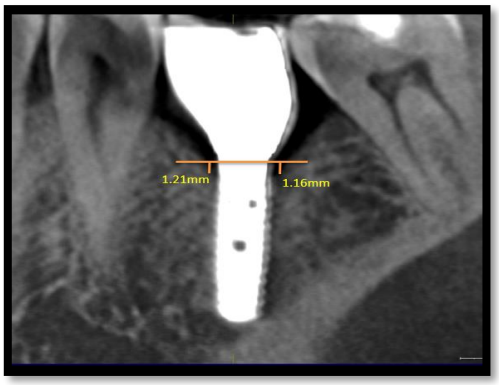

FIG 1 SUB CRESTAL INCISION GIVEN
FIG 2 OSTEOTOMY BY #UI-1
FIG 3 OSTEOTOMY BY #UI-2
FIG 4 OSTEOTOMY BY #UI-7
FIG 5 IMPLANT WITH COVER SCREW PLACED
FIG 6 SUTURES PLACED
FIG 7 CROWN PLACED
FIG 8 CBCT AFTER 9 MONTHS