Original Research Paper

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Prosthodontics

TO EVALUATE AND COMPARE THE CRESTAL BONE LOSS OF IMPLANT PLACED USING OSSEODENSIFICATION AND CONVENTIONAL DRILLING TECHNIQUE. AN IN-VIVO STUDY.

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ABSTRACT Implant dentistry has fundamentally altered the course of therapy by satisfying patients' needs for the restoration of edentulous sites, with the success of implants largely determined by Bone Implant Contact (BIC). Among various surgical methods, the osteotome approach improves bone density but may exacerbate marginal bone loss. A novel technique, osseodensification, uses specially designed burs to create an autograft layer of condensed bone at the implant bed's edge, while traditional drilling, which removes bone, requires about 12 weeks for healing and can result in elongated and elliptical osteotomies. This study aims to evaluate and compare crestal bone loss (CBL) in implants placed using osseodensification and conventional drilling. In an in-vivo study, 20 implants were placed in the front maxilla of patients divided into two groups: 10 implants using conventional drilling and 10 using osseodensification. Crestal bone levels were assessed at baseline, and at 3, 6, and 9 months post-surgery using clinical analysis and CBCT. Results indicated significant CBL changes at labial and distal sites with osseodensification, while lingual and mesial sites remained stable. Conventional drilling showed marked increases in CBL across most sites, particularly at labial and distal locations. The study concludes that osseodensification, using the new Densah bur, is effective in increasing bone density, reducing the risk of bone dehiscence, and promoting faster healing while preserving marginal bone integrity compared to conventional drilling.

KEYWORDS :

INTRODUCTION

The aim of contemporary dentistry is to restore lost teeth with a prosthesis in order to return the patient to normal in terms of shape, function, comfort, appearance, speech, and health. This objective can be accomplished using implant dentistry, notwithstanding stomatognathic system atrophy, illness, or damage. Due to its high biocompatibility and excellent biomechanical qualities, dental implants are now the treatment of choice for replacing natural dental parts. As a result, patients who need this treatment more frequently accept it.[1]

Among the many surgical methods available is the osteotome approach, which was developed by Summers et al. for low density bone. By compressing the trabecular bone laterally and apically with little damage, this method improves bone density.[3] while the osteotome procedure expands the alveolar ridge, it may also accelerate the marginal bone loss surrounding the implant by applying pressure to the crista bone.[1]

During implant osteotomies, one technique is traditional surgical drilling, which excavates bone and requires around 12 weeks for bone remodelling to heal.[5]

Traditional drilling produces elongated, oval-shaped osteotomies because it is a subtractive procedure that cuts the bone due to the clatter of the drills. Additionally, it is critical to maintain adequate bone mass and density in regions with low bone density, like the maxilla, in order to obtain the necessary bone to produce a biomechanically stable implant and to establish implant contact.

In 2014, Meyer et al. presented a unique concept of additive drilling proto-col called as osseodensification (OD) to address the shortcomings of the traditional drilling approach. Utilising specifically crafted drills with a negative rake angle and an anticlockwise densifying mode are required. The OD method makes sense since it compacts the bone into the osteotomy location that has been created. This promotes successful osseointegration by promoting osteoblastic nucleation on the implant surface and increasing primary stability due to an increase in bone to implant contact (BIC) .[9]

By turning anticlockwise, they compress and autograft the bone inside the socket, decreasing the quantity of lost bone. This is done as opposed to rotating clockwise. Because the bone is condensing and spinning in the noncutting direction, this autografting of bone also contributes to the bone's increased density. In places where the bone is soft, like the maxillary posterior region, this enhances the quantity and quality of bone surrounding the implants. When compared to normal subtractive drilling procedures, implants positioned using the osseodensification protocol demonstrated a superior level of stability and bone preservation after 12 weeks in cases of poor density bone (Lahens et al.). Regarding the osseointegration quality, no noteworthy variations were noted.[10]

This study's main goal is to compare the effectiveness of traditional drilling versus the osseodensification drilling procedure. The purpose of this study is to ascertain the amount of crestal bone loss in implants placed using the osseodensification technique which rotates in the opposite direction as the usual drilling approach and reduce the failure rate of implants due to periimplantites.

MATERIAL AND METHODS

The study was conducted at Shree Bankey Bihari Dental College & Research Centre, Ghaziabad, focusing on comparing two drilling techniques—conventional and Osseodensification—for dental implant placement. Patients were selected randomly, and thorough medical and dental evaluations were conducted. The surgical procedures involved local anaesthesia and flap reflection followed by either standard sequential drilling (conventional technique) or specialized osseodensification drills (Osseodensification technique). Post-surgical care included antibiotics, analgesics, and chlorhexidine

rinses, with regular follow-up visits scheduled to monitor healing and implant stability. The study aimed to assess crestal bone levels via CBCT scans at baseline, 3 months, 6 months, and 9 months post-implantation to evaluate the effectiveness of each technique.

Conventional Drilling Technique: In the conventional drilling technique, local anesthesia was administered, and a crestal incision was made followed by flap reflection. Osteotomy was initiated with a pilot drill, and subsequent drills were used sequentially at 800 rpm to prepare the implant site. Implants were placed using a torque wrench to achieve primary stability (35– 40 N cm torque). Interrupted sutures were used to close the flap around the implant. Post- surgical care included antibiotics, analgesics, and chlorhexidine rinses, with patients scheduled for follow-up visits to assess healing and implant stability.

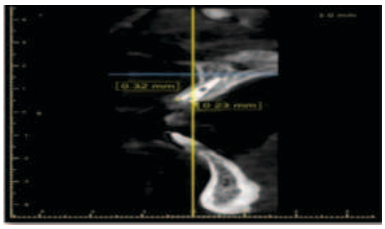
Osseodensification Technique: For the Osseodensification technique, similar pre-operative procedures were followed, including local anesthesia and flap reflection. However, instead of conventional drills, osseodensification drills (densah drills) were used sequentially at varying speeds (800-1500 rpm) and diameters to prepare the osteotomy site. This technique aims to compact and densify bone rather than remove it, potentially enhancing implant stability and bone preservation. Implants were placed using a torque wrench after osseodensification, andsimilar post-surgical care and follow-up protocols were followed as with the conventional technique.

Post-Surgical Care and Prosthetic Reconstruction: Following implant placement, patients were prescribed antibiotics, analgesics, and chlorhexidine rinses for post-operative care. Sutures were removed during the first follow-up visit, typically scheduled seven days after surgery. A comprehensive follow-up schedule was maintained with visits at three, six, and nine months to monitor healing progress and evaluate implant stability. Prosthetic reconstruction commenced after three months, involving the placement of healing caps initially, followed by final impressions and the fabrication of implant prostheses. The final prostheses were installed and torqued to ensure secure fixation. Crestal bone levels around implants were evaluated using CBCT scans at specified intervals (baseline, 3 months, 6 months, and 9 months post-implantation) to assess the success and effectiveness of each drilling technique in maintaining bone levels and implant stability. The study's structured methodology aimed to provide insights into the comparative outcomes of conventional versus Osseodensification techniques in dental implantology, contributing to evidence-based practices in clinical settings.

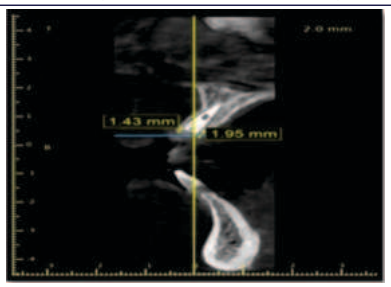
Pre Operative Intra Oral And CBCT

Incision And Osteotomy Site Prepration By Conventional Drilling

Implant Placement Wrt 21 And Cover Screw Placement

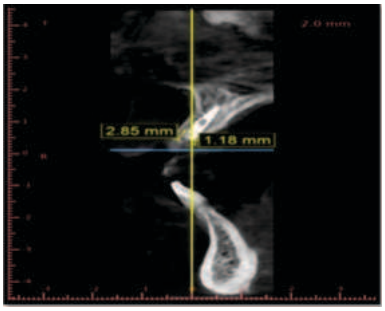


Immediate Post Operative CBCT

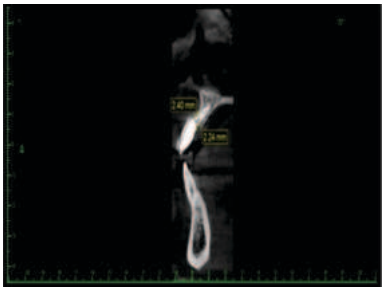


Post Operative CBCT After 3 Months

Prosthesis Insertion



Post Operative CBCT After 6 Months

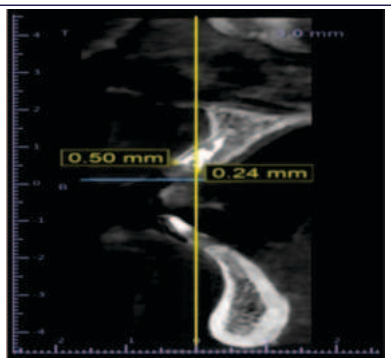


Post Operative CBCT After 9 Months

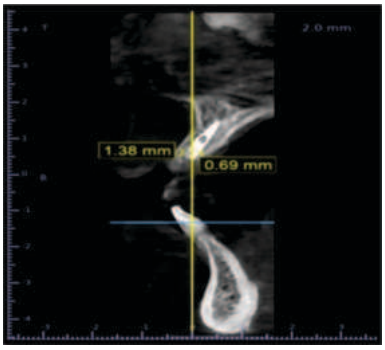
Pre Operative Intra Oral And CBCT

Incision And Osteotomy Site Prepration By Osseodensification Drilling

Implant Placement Wrt 21 And Cover Screw Placement

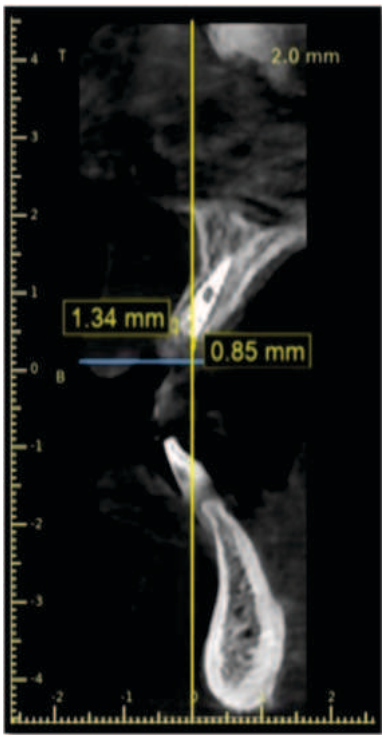


Immediate Post Operative CBCT

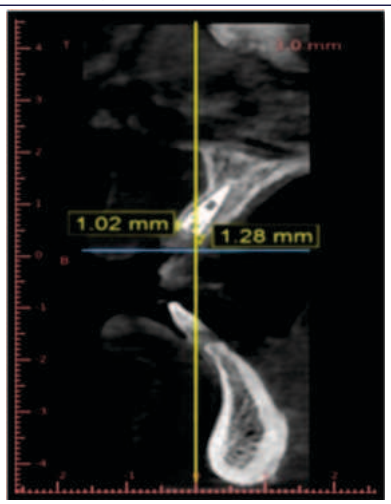


Post Operative CBCT After 3 Months

Prosthesis Insertion



Post Operative CBCT After 6 Months

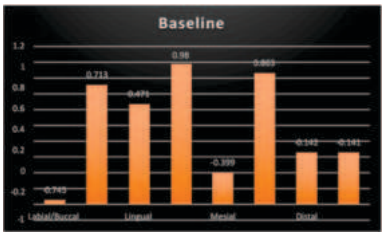


Post Operative CBCT After 9 Months

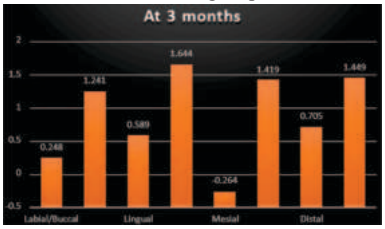
Statistical Analysis

The study employed IBM SPSS Statistics, version 25, for data analysis. Statistical methods included the independent sample t-test to compare between groups and the paired t-test for intra-group comparisons before and after interventions. Statistical significance was set at $p < 0.05$ with a 95% confidence interval, indicating significant relationships between variables. Data were summarized using means and standard deviations. Results were tabulated to compare outcomes between the conventional drilling and Osseodensification techniques, highlighting differences in implant stability and bone preservation.

RESULT

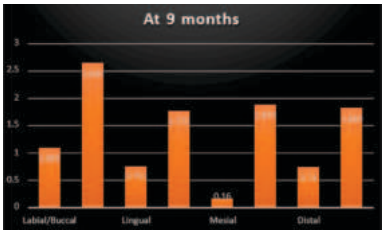


The table compares Osseodensification and Conventional drilling techniques across four groups: Labial/Buccal, Palatal, Mesial, and Distal. Signi5icant differences were found in mean values between Osseodensi5ication (-0.7450) and Conventional drilling (0.7130) in the Labial/Buccal group ($p = 0.019$), indicating superior outcomes for Osseodensification. Similarly, in the Mesial group, Osseodensification (-0.3990) differed signi5icantly from Conventional drilling (0.8630) with a p-value of 0.031. However, no significant differences were observed in the Palatal and Distal groups ($p = 0.104$ and $p = 0.999$ respectively), suggesting comparable results between the two techniques in these groups. Thus, Osseodensification showed distinct advantages over Conventional drilling in specific anatomical groups.



After 3 months, crestal bone levels were compared between Osseodensi5ication and Conventional drilling techniques across four anatomical sites: Labial/Buccal, Lingual, Mesial, and Distal. Osseodensification consistently resulted in lower mean bone levels compared to Conventional drilling: Labial/Buccal (0.24800 vs 1.241, $p = 0.006$), Lingual (0.60500 vs 1.725, $p = 0.006$), Mesial (0.00200 vs 1.426, $p = 0.002$), and Distal (0.23200 vs 1.300, $p = 0.016$). All p-values were below 0.05, indicating statistically significant differences. This suggests that after 3 months, Osseodensification leads to a notably different bone response compared to Conventional drilling across all examined anatomical sites.

After 6 months, a study compared crestal bone levels between Osseodensi5ication and Conventional drilling techniques across fouranatomical sites: Labial/Buccal, Lingual, Mesial, and Distal. The Osseodensification technique consistently resulted in lower mean crestal bone levels compared to Conventional drilling at each site: Labial/Buccal (0.651 vs 2.015, p = 0.029), Lingual (0.5680 vs 2.1500, p < 0.001), Mesial (-0.4720 vs 2.0470, p < 0.001), and Distal (0.709 vs 1.950, p = 0.005). All p-values were below 0.05, indicating statistically significant differences. Therefore, Osseodensi5ication led to generally reduced crestal bone levels across all examined sites compared to Conventional drilling after the 6-month period.



After 9 months, crestal bone levels were compared between Osseodensification and Conventional drilling techniques across Labial/Buccal, Lingual, Mesial, and Distal anatomical sites. Osseodensification consistently resulted in lower mean crestal bone levels compared to Conventional drilling: Labial/Buccal (1.0910 vs 2.6430, p = 0.003), Lingual (0.7530 vs 1.7720, p = 0.031), Mesial (0.1600 vs 1.8730, p = 0.001), and Distal (0.7400 vs 1.8190, p =0.005). All p-values were below 0.05, indicating statistically significant differences. This indicates that after 9 months, Osseodensification consistently led to notably lower crestal bone levels across all examined anatomical sites compared to Conventional drilling.

DISCUSSION

The text discusses the significance of dental implants in restoring missing teeth, emphasizing the importance of treatment planning tailored to patient-specific factors for successful outcomes. Factors affecting osseointegration, such as bone-to-implant contact (BIC) and bone density, are crucial for long-term implant success. Preservation of crestal bone height is critical as it influences implant-tissue interface stability and overall survival. Different bone types require varied healing times, with denser bone types allowing for immediate loading, unlike lower density types.

Various techniques to minimize crestal bone loss during implant insertion include undersizing osteotomies and using osteotomes to condense bone. However, these methods may have limitations, such as inadequate bone compression and potential complications like fractures. Osseodensification (OD) represents a newer approach designed to enhance bone density and stability by compacting bone using Densah burs. This technique aims to optimize the implant site's biomechanical and biological environment, supporting early loading protocols even in low-density bone.

The study compares Osseodensification with conventional drilling techniques using CBCT to evaluate crestal bone levels over 3, 6, and 9 months post-implantation. Results show that Osseodensification consistently led to lower crestal bone levels compared to conventional drilling across all examined anatomical sites and time points. Intragroup comparisons within the Osseodensification group revealed significant changes in crestal bone levels over time at the labial and distal sites, whereas the lingual and mesial sites remained relatively stable.

Conversely, conventional drilling showed significant increases in crestal bone loss at most sites over the study period.

Overall, Osseodensification with Densah burs appears to be effective in reducing crestal bone loss and enhancing bone density compared to conventional drilling. These findings support the use of Osseodensification as a promising approach for improving implant stability and long-term success rates.

CONCLUSION

Despite study limitations, it was concluded that osseodensification using specific burs increases bone density, especially in low-density bone, and reduces the risk of bone dehiscence. This technique promotes healing and preserves marginal bone integrity after functional loading. Therefore, osseodensification appears superior to conventional drilling in altering crestal bone levels around dental implants. In conclusion, the study supports the safe and effective use of osseodensification in clinical practice to enhance long- term success rates of dental implants.

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