

# To Evaluate and Compare Bone Density After Using Two Commercially Available Bone Graft Materials During Immediate Implant Placement: An In Vivo Study

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**Abstract:** ***Background:** Tooth extraction leads to alveolar bone loss, affecting implant outcomes. Bone grafting during immediate implant placement helps maintain bone volume and density. **Aim:** To evaluate and compare peri-implant bone density using two bone graft materials during immediate implant placement. **Materials and Methods:** An in vivo study was conducted on 36 patients divided into three groups: Group A (Control), Group B (Bio-Oss xenograft), Group C (NovaBone putty). CBCT scans were taken pre-operatively, and at 6 and 12 months. Bone density was measured in Hounsfield units. **Results:** All implants showed 100% survival. Grafted groups showed significantly higher bone density at 6 and 12 months. Bio-Oss showed highest values, followed by NovaBone. **Conclusion:** Bone grafting improves peri-implant bone density. Bio-Oss performed better, while NovaBone also showed satisfactory results.*

**Keywords:** Immediate implant, Bone graft, Bio-Oss, NovaBone, CBCT, Bone density

## 1. Introduction

Tooth loss due to caries, trauma, periodontal disease, or failed endodontic therapy leads to progressive resorption of the alveolar ridge, which adversely affects implant positioning and compromises esthetic and functional outcomes. Immediate implant placement into fresh extraction sockets has gained acceptance because it shortens treatment time, preserves alveolar bone, and improves prosthetic positioning compared with delayed protocols. However, the gap between the implant surface and socket wall ("jumping distance") can exceed 2-3 mm, and when left ungrafted it is associated with buccal bone loss and contour collapse. Bone grafting with or without barrier membranes has therefore been advocated to enhance bone regeneration and maintain ridge architecture through osteogenesis, osteoinduction and osteoconduction. Among available grafts, bovine-derived xenografts such as Bio-Oss offer good biocompatibility, osteoconductive behavior and slow resorption, whereas alloplastic materials such as Nova Bone putty provide synthetic, bioactive and easily handled alternatives. Bone density is a critical determinant of primary stability and long-term implant success, and cone beam computed tomography (CBCT) enables three-dimensional evaluation of peri-implant bone quality in terms of Hounsfield units with relatively low radiation. Despite routine clinical use of grafts in immediate implant sites, limited evidence is available directly comparing peri-implant bone density changes around different graft materials after functional loading, creating a need for systematic in vivo evaluation

## 2. Materials and Methods

This in vivo interventional study was conducted in the Department of Prosthodontics and Crown & Bridge and included 36 patients aged 20-50 years requiring extraction and immediate implant placement in the anterior or premolar

region. Patients were systemically healthy and fulfilled predefined inclusion and exclusion criteria; informed consent and institutional ethical clearance were obtained prior to recruitment. Following atraumatic extraction and socket debridement, implants were placed according to a standardized surgical protocol and patients were randomly allocated to three groups:

Group A – immediate implant placement without bone graft (control);

Group B – immediate implant placement with Bio-Oss xenograft and barrier membrane placed to fill the jumping distance;

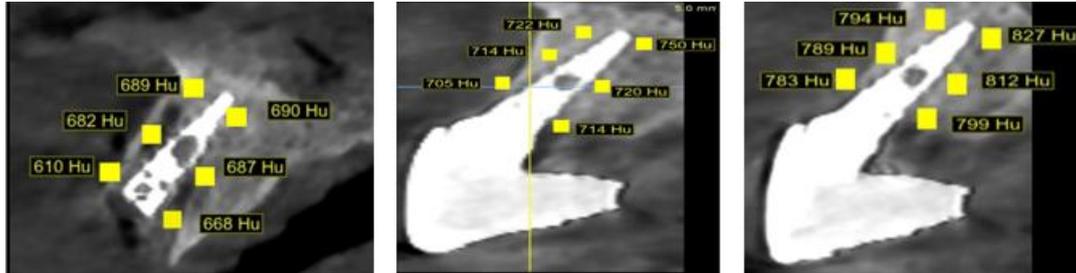
Group C – immediate implant placement with Nova Bone putty alloplastic graft and barrier membrane.

CBCT scans were obtained pre-operatively and post-operatively, and repeated at 6 and 12 months after functional loading to assess peri-implant bone density. Bone density was measured in Hounsfield units at standardized regions of interest on the buccal and palatal aspects, typically at crestal, middle and apical levels around each implant. The same CBCT machine and exposure parameters were used for all scans to minimize variability, and measurements were recorded using dedicated software tools. The collected data were compiled in a master chart and subjected to statistical analysis. Descriptive statistics (mean and standard deviation) were used to summarize bone density values within each group at each time interval. Intergroup comparisons among the three treatment groups were performed using appropriate parametric tests (such as one-way ANOVA with post-hoc analysis) for continuous variables, while intragroup comparisons between 3 different time points were carried out using paired tests. A probability value of less than 0.05 was considered statistically significant.

### Case 1 – Immediate Implant Placement Without Bone Graft



Pre Operative CBCT and intraoral image

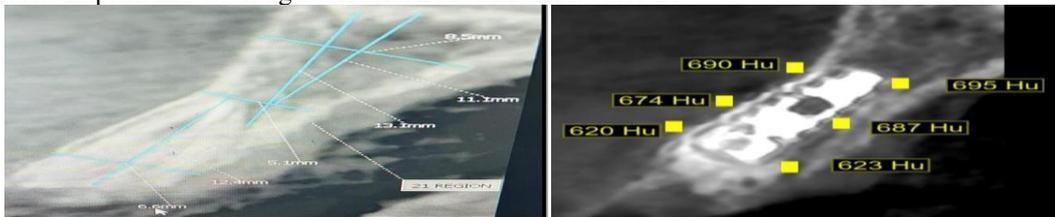


Pre operative CBCT

CBCT at 6 Months

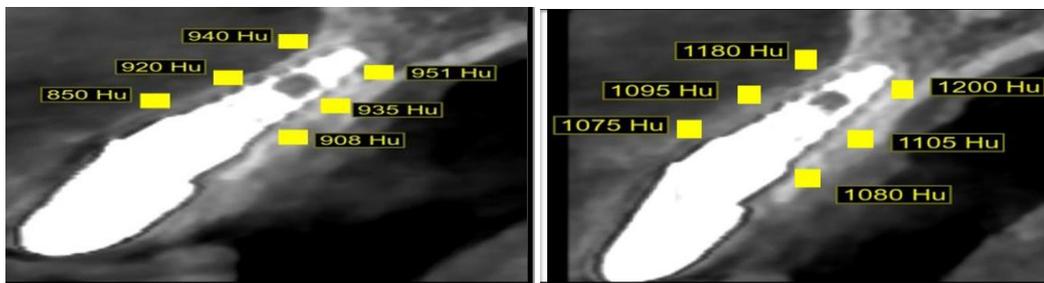
CBCT at 12 Months

Case 2: Immediate Implant and Grafting Done with BIO OSS Graft WRT 21



Pre operative CBCT

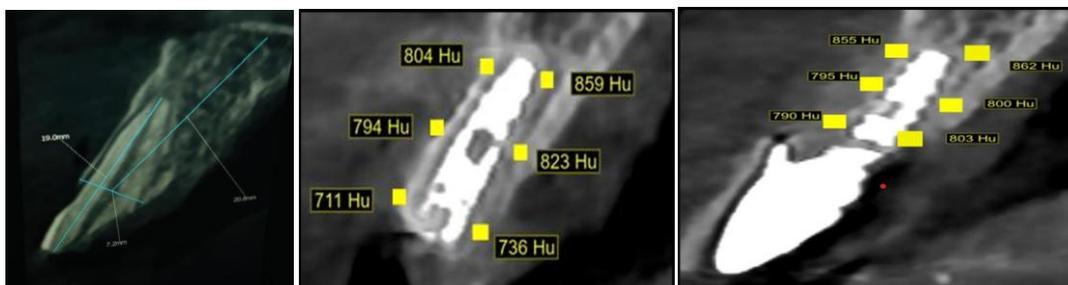
Post Operative CBCT



CBCT at 6 Months

CBCT at 12 Months

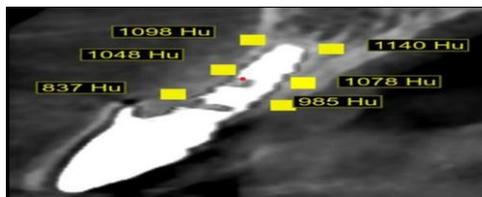
Case 3: Immediate Implant and Grafting done with Nova Bone Putty and Barrier Membrane Placed WRT 11



Pre Operative CBCT

Post Operative CBCT

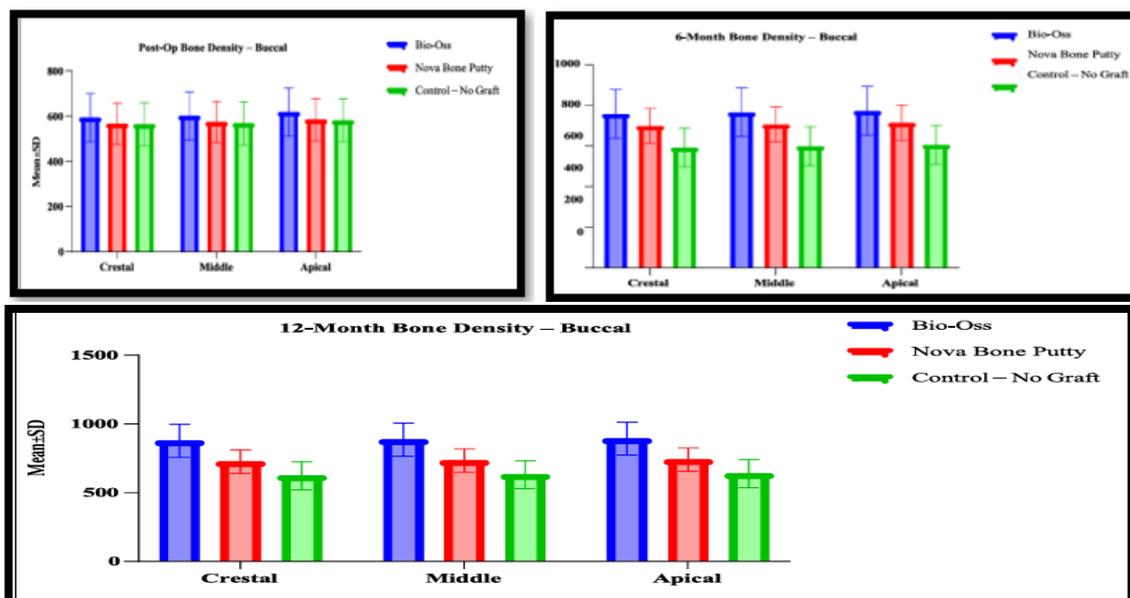
CBCT at 6 Months



CBCT at 12 Months

### 3. Results

All implants showed 100% survival in all groups. Grafted groups showed higher bone density. Bio-Oss showed highest values followed by NovaBone and Control. Significant difference observed at 6 and 12 months.



Comparison between groups at post operative, at 6 months and at 12 months

### 4. Discussion

Bone grafting significantly enhances peri-implant bone quality. Bio-Oss provides slow resorption and better scaffold, while NovaBone shows moderate regeneration. Ungrafted sites show more bone loss. These findings align with existing literature. Grafting the jumping distance around immediately placed implants results in improved peri-implant bone density compared to ungrafted sites. Among the materials used, Bio-Oss demonstrates superior performance due to its slowly resorbing, highly osteoconductive nature, which supports stable and long-term bone formation. NovaBone putty, although slightly less effective than Bio-Oss, still provides favorable and clinically acceptable outcomes, likely due to its different resorption and remodeling characteristics. Ungrafted sites show lower bone density and greater physiologic bone resorption, indicating that immediate implant placement alone cannot completely prevent post-extraction ridge loss. Clinically, higher peri-implant bone density contributes to better primary stability, improved stress distribution, and potentially enhanced long-term implant success. However, despite the benefits of grafting, overall implant survival also depends significantly on proper surgical technique and prosthetic planning.

### 5. Conclusion

Grafting improves bone density. Bio-Oss is superior, while NovaBone is also clinically effective. Implant survival is not dependent on graft but bone quality is improved.

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