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(RESEARCH ARTICLE)

# Radiographic evaluation of immediate placement implant in fresh extraction socket with bone graft (HYPRO-OSS)

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## Abstract

Introduction: Xenograft play role in osseointegration of immediate placement dental implant. The study's objective is to assess the effectiveness of xenograft (Hypro-oss) in radiographically documenting the osseointegration of immediate dental implants. Patients and methods: This study, which involved 8 patients aged 18 to 48, was carried out. divided into two equal groups, 12 immediate dental implants; (Control Group): Immediate placement of a dental implant after atraumatic extraction of a single-rooted tooth or remaining root, (Study Group): Single-rooted teeth in the maxillary arch's anterior region should beextracted without trauma, and any remaining roots should be immediately replaced with dental implants and sealed with Hypro-Oss bone graft material. Clinical examinations done for all patients prior to surgery include examination of oral and para oral tissues and evaluation the intermaxillary space and the type of occlusion. In order to measure the density of the formed bone between living bone and the implant surface,radio- graphic evaluations using CBCT were performed at intervals of 15, 90, 180, and 270 days after surgery. Result: None of the patients displayed any indications or symptoms of soft tissue pain, tenderness, redness, or inflammation around the implant site. The soft tissue and bone around the implant should heal normally. The follow-up period was continued by all patients. Radiographic evaluation showed significant higherbone density in study group than control group after 15, 90, 180 and 270 days. Conclusion: The bone density around the implant increased when the Hypro-Oss bone graft was used.

**Keywords:** Immediate placement; Xenograft bone grafts; CBCT

## 1. Introduction

Immediate implant placement, defined as the immediate placement of a dental implant into a fresh extraction socket following tooth extraction, has been regarded as a predictable and acceptable procedure for replacing missing teeth [1]

The immediate placement of an endosseous implant following tooth extraction has several advantages. It shortens treatment time, maintains bone horizontal and vertical dimensions, and keeps the implant in the same angulations as the previous natural tooth [2].

The most significant aspect of any implant surgery regarding the successfulness of the procedure is implant primary stability and bone to implant contact (BIC) [3]. Furthermore, to achieve a good oseo-integrated dental implant with a high degree of predictability, the implant must be sterile, made of a highly bio-compatible material, such as titanium, inserted with an atraumatic surgical procedure that avoids overheating, placed with an initial stability, and functionally loaded after a 4–6 month healing period [4].

Although the clinical results of the implant are affected by factors including the oral environment, the skill of the surgeon and the body of the implant, the primary stability at the implant placement is the most important factor for success. Initial stability can be increased with adequate bone quality then the osseointegration improved and the likelihood of the dental implant increased consequently [5]. The basic stability associated with mechanical involvement of the

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implant with the surrounding bone after the implant is inserted, while bone regeneration and remodeling provide secondary osteointegration (biological stability) to the implant [6]. The primary stability of immediately placed implants, biological fixation, and then the osseointegration process will all be improved using bone substitutes between the titanium implant surface and the interior walls of the sockets [7]. There are still difficulties for the oral surgeon to determine the appropriate bone substitute around the inserted immediate implant to achieve a successful osseointegration and increase the success rate of dental implants.

## 2. Material and method

This research was approved by the ethical committee of Faculty of Dentistry Suez Canal University. The study was conducted on twelve immediate placement dental implants fixed in eight patients. The implants divided into two equal groups: (Control Group): Atraumatic extraction of single rooted tooth or remaining root and immediate placement of dental implant into fresh extracted socket in anterior maxillary region, while in (Study Group): Atraumatic extraction of single rooted tooth or remaining root and immediate placement of dental implant into fresh extracted socket and sealed (with Hypro-Oss) Xenograft material. The patients selected from the outpatient clinic, oral and maxillo- facial surgery department, Faculty of Dentistry, Suez Canal University. All patients have good oral hygiene condition and physically healthy and given the necessary information about the procedure and they gave their consent to participate in a written informed consent. A natural bovine bone substitute called Hypro-Oss is used to permanently fill and reconstruct bone defects. AteloCollagen Type I makes up 30% of each granule, and hydroxyapatite 70%. Patented atelopeptidation and lyophilization techniques are used to create HyproOss.

### 2.1. Preoperative phase

Detailed preoperative data collected from all patients through a printed questionnaire and discussion. Examination of oral and Para oral tissues done. Evaluation the intermaxillary space and the type of occlusion. CBCT radiographs taken for each patient to evaluate the absence of any pathology related to the tooth to be extracted, the length and width of the tooth for proper selection of the implant required for the surgery and Mesio-Distal and Bucco-Palatal Dimensions. Diagnostic casts construction done and all patients undergo scaling and root planning prior to the surgical procedure to ensure and preserve good oral health. All patients received strict oral hygiene instruction to preserve periodontal health in the form tooth brushing and oral rinses mouth wash with “Antiseptol”* three times per day. Each patient was directed to administer oral prophylactic antibiotic Augmentin** twice daily one day before surgery.

### 2.2. Operative phase

Prior to surgery, patients were instructed to thoroughly rinse with an antiseptic solution (Antiseptol) and take an antibiotic tablet an hour before the procedure. All the surgical procedures done under local anesthesia (Supraperiosteal injection-infiltration) using Ubistesin Forte 1:100.000 (Articane HCL 4% by ESPE). Local anesthesia administered to the patient just before surgery.

The oral cavity purified using Betadine antiseptic solution and the patient draped using sterile towels reference to the standard technique of intraoral surgery. A gingival incision made using bard parker No3 with blade #15 exposing the tooth or remaining root to be extracted. The tooth was extracted a traumatically using the periotome. The periotome applied around the tooth to be extracted to cut and tear the periodontal ligaments. The facial and palatal walls of the socket should be maintained almost intact by using the right forceps with a light twisting motion. By carefully curettage using a small curette and appropriate irrigation with saline solution to remove any connective tissue tags or periodontal ligament remnants, the socket was thoroughly degranulated.

The root diameter measured by using caliber to determine the diameter (buccopalatal and mesio- distal) and the implant should be as wide as permissible to allow maximum bone engagement with minimum thickness of facial and palatal walls not less than 1 mm. The depth gauge to determine the depth of the fresh extracted bony socket to select the appropriate implant. To achieve primary stability of the fixture, the implant should protrude 3 to 5 mm past the extracted root’s apex.

(New biotech-type IS-II active) implant system was used.

The pilot hole drilled using a twist drill of 2mm diameter to the planed depth, which extended to 3-5mm apical to the depth of fresh extracted bony socket, sequential drills of gradual increased diameter were used under copious irrigation with saline until reach the suitable dimensions for the selected implant. As the implant is a self-tapping, it inserted to

2/3 of its length under finger pressure, followed by slight tapping. The implant screwed into bone until the implant was below the alveolar bone crest by 1mm (submerged implant). The cover screw screwed in place.

Group 1 (control) did not receive a bone graft. In-group 2 will investigate the placement of a bone graft in the area surrounding the implant and the socket wall (Hypro-oss). Interdental papillae mesial and distal to each implant sutured in an interrupted matters suture using resorbable suture material.

### 2.3. Postoperative care and follow up

Patients instructed to apply cold packs over the surgical area extra-orally 15 min/hr. for the first six hours postoperatively. Oral regimen of Augmentin1gm/ 12hr continued for five days post-operatively. Cataflam 50mg (Diclofenac potassium-Novartis pharma) tablet was given two times/day for five days post operatively. After the first twenty-four hours patients were instructed to use Antiseptol mouthwash 4 times per day.

### 2.4. Radiographic evaluation

GALAXIS GALILEOS viewer software of Sirona cone-beam volumetric imaging gray scale value was used, intervals of 15 days, 90, 180 and 270 days postoperatively. The bone density of the formed bone between living bone and the surface of an implant is measured using CBCT. Readings were recorded as following: Mesial and distal to every implant from coronal view at 3 points: the 1st point 3 mm, the 2nd point 6mm & the 3rd point 9 mm away from implant crystal module respectively. Labial and palatal to every implant from cross sectional view at 3 points: the 1st point 3 mm, the 2nd point 6 mm & the 3rd point 9mm away from implant crystal module respectively.

### 2.5. Statistical analysis

Version 20.0 of the Statistical Program for Social Science (SPSS) was used to analyze the data. ANOVA and the T-test were used to analyze quantitative data, which were expressed as mean and standard deviation (SD). When comparing two means, Independent Samples (t-test) of significance was applied. When comparing more than two means, a repeated analysis of variance (ANOVA) was employed. $< 0.05$ was a significant p-value.

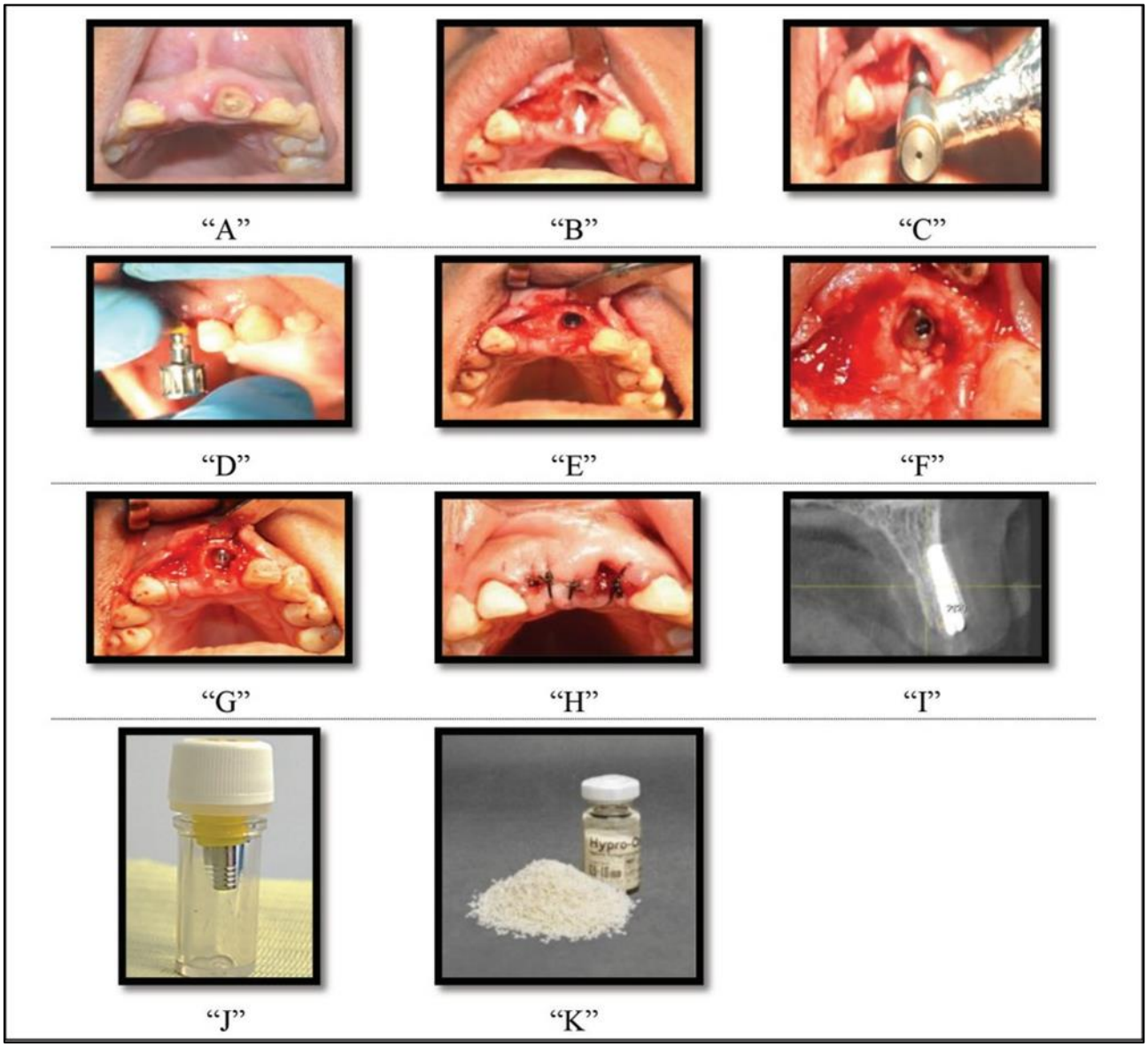


**Figure 1** (1) Study group showing: (A) Showing non-restorable remaining root upper left central before extraction. (B) Showing fresh empty bony sockets after extraction and degranulation of the walls of the socket (White arrow). (C) Showing osteotomy preparation of extracted bony socket for immediate implant placement. (D) Showing-using screwdriver for immediate dental implant. (E) Showing the dental implant after insertion. (F) Showing cover screw of dental implant. (G) Showing the bone graft after packing into the gap space. (H) Showing the surgical field after suturing. (I) CBCT cross- Sectional showing bone density reading around inserted implant after 270 days. (J) Showing Neo Biotech implant. (K) Showing Hypro -Oss bone graft bottle granules

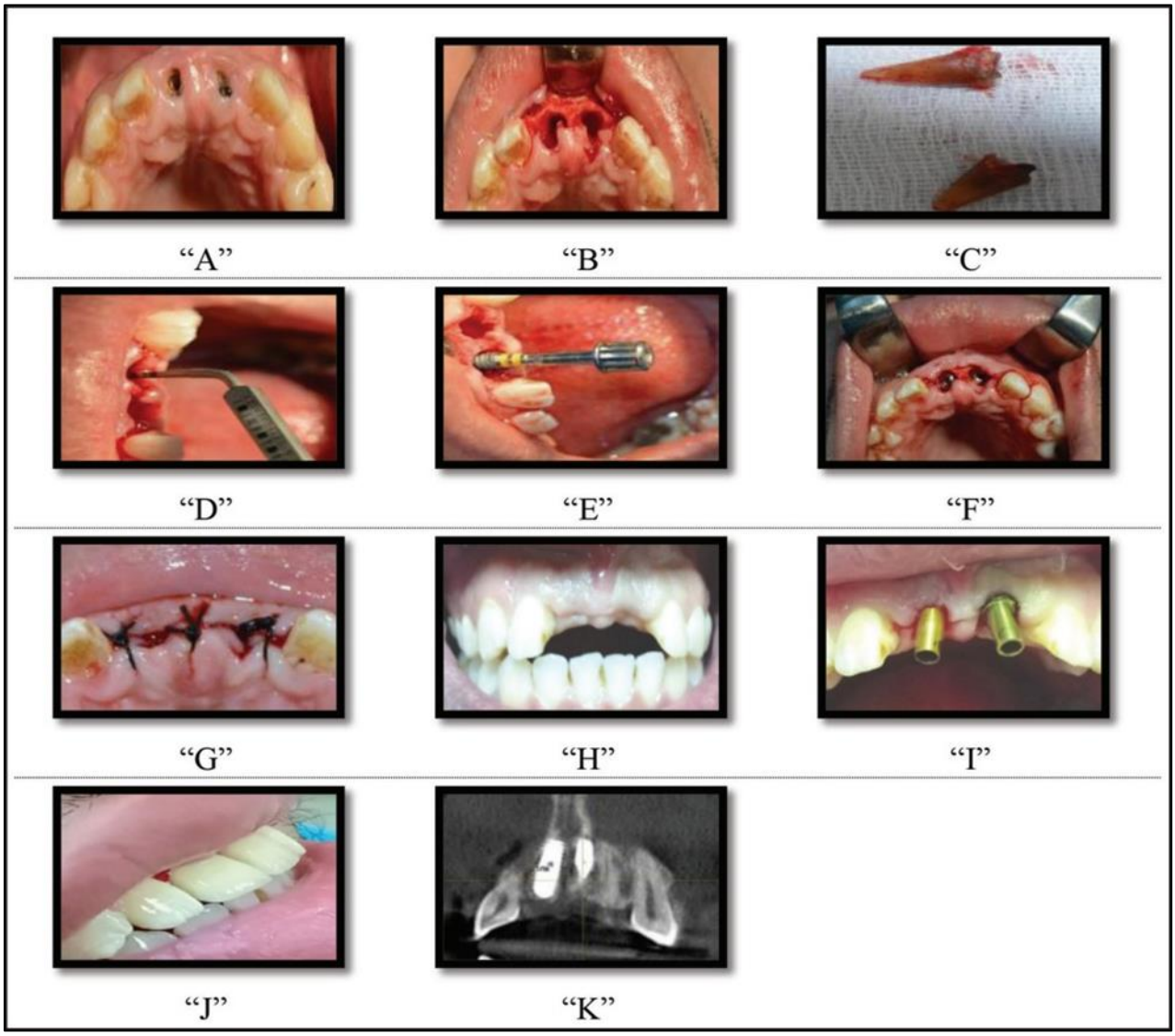


**Figure 2** (2) Control group showing: (A) Showing non-restorable reaming root upper right-left central teeth and before extraction. (B) Showing fresh empty bony sockets after extraction and de- granulation of the walls of the socket. (C) Showing the remaining teeth after extraction. (D) Showing the use of depth gauge for measuring the depth of the fresh extracted bony socket. (E) Showing screw- driver for dental implant. (F) Showing cover screw of dental implant. (G) Showing the surgical field after suturing. (H) Showing normal tissue healing over the implant site after 3 months. (I) Showing abutment connected to the fixture. (J) Showing the final restoration of implants that replacing missing bilateral upper two incisors. (K) CBCT cross-sectional showing bone density reading around inserted implant after 270 days

## 3. Results

### 3.1. Bone Density Measurements

In the control group; the first post operatively CBCT was done 15 days after implant insertion and considered base line for the following examinations done at 90, 180, and 270 days post operatively. The mean value stander deviation after 15 days postoperatively was (1114.00 222.98) while the mean value and stander deviation after 90 days was (1509.67

94.72) while the bone density after 180 days was (1685.83 101.72) and after 270 days was (1903.17 117.28). Showing a high significant increase in the three records. P-value < 0.001∗. In the study group, bone density measurements increased steadily throughout the study period showing statistical significant different mean value and stander deviation. After 15 days was (1458.17 117.60) postoperatively and after 90 days was (1754.50 75.81) while the

mean value after 180 days reach to (1958.50 84.42) and the mean value and stander deviation reach (2295.67 115.21) after 270 days was showing high significant increase in the three records as was p value < 0.001.

**Table 1** Statistical analysis of bone density measurements around implants between control and study groups through the whole study intervals

| | | **Range** | **Mean ± S. D** | **t. study** | **p. value** |
|---|---|---|---|---|---|
| 15 day | Control group | 727 – 1321 | 1114.00 ± 222.98 | 3.344 | 0.007* |
| | Study group | 1296 – 1658 | 1458.17 ± 117.60 | | |
| 90 day | Control group | 1347 – 1591 | 1509.67 ± 94.72 | 4.943 | 0.001* |
| | Study group | 1664 – 1844 | 1754.50 ± 75.81 | | |
| 180 day | Control group | 1565 – 1798 | 1685.83 ± 101.72 | 5.052 | 0.001* |
| | Study group | 1856 – 2090 | 1958.50 ± 84.42 | | |
| 270 day | Control group | 1704 – 2012 | 1903.17 ± 117.28 | 5.848 | 0.001* |
| | Study group | 2146 – 2459 | 2295.67 ± 115.21 | | |

Both groups' bone densities are steadily increasing. The measurements of bone density from 15 postoperative days to 270 were higher in the study group. Gray scale readings of the bone density around the implant in study group showed significant increase more than control group according to statistical data analysis (t-study)

## 4. Discussion

Cavallaro et al [8], stated that when immediate implant placement therapy and tooth extraction are planned treatments, teeth should be removed as painlessly as possible. To prevent damage to nearby hard tissues, forces should be applied slowly and for a long period of time. Multi-rooted teeth should also be used, especially for molars, to protect the facial plate and the furcal bone.

This agrees with the surgical protocol that was applied in the current study and confirmed by the clinical evaluations: There were no visible signs or symptoms of pain, tenderness, redness, inflammation of the soft tissue surrounding the implant's insertion site, or implant looseness.

Rojas-Vizcaya [9] concluded that the fixture's position and angulation should be determined primarily by factors like the need to achieve sufficient primary stability and to be consistent with a properly acknowledged restoratively driven plan. While Han and Jung [10], mentioned that flaps should not be raised from the facial bone -if it can be avoided- because doing so severs the significant source of vascularization to the delicate facial plate, which might be as thin as less than 1mm in the maxillary anterior teeth.

As a result of the development of immediate implant dentistry, implant fixtures are now frequently inserted into recently created extraction sockets that, at their most coronal aspects, can be significantly larger than the diameter of the implants being used. The immediate implant's circumferential aspect typically has a small gap between it and the extraction socket wall. The size of the space, also known as the "jumping distance," will vary depending on a number of variables, including the type of tooth, the specific morphology of the extraction socket, and the diameter of the implant being used [11, 12]. The immediate peri-implant gap, according to a recent analysis of gap management concepts and procedures, has two dimensions: the horizontal defect width (between the implant circumference and socket wall) and the vertical defect height [the distance between the most coronal aspect of the socket wall and the most coronal point of macroscopic contact between the fixture and the socket wall] [12]. Ferrus et al [13], recommended that following implant placement, peri-implant gaps into which graft may be freely introduced (greater than 1mm in dimension) should be grafted to prevent ridge width deficiency and promote greater bone-to-implant contact.

Autologous bone grafting is still regarded as the gold standard for grafting, and this has been studied by Ewers [14], who used an alternative graft material and monitored the input/output statistics of im- plants to determine whether this material (marine derived HA) produced results that were comparable to those of the autologous bone graft. Evaluations of graft materials using histomorphometry reveal how much new bone is created and whether the graft

material is resorbed. This study demonstrated that the marine-derived HA material ACA can enhance enough new bone in 6 months to enable im- plant osseointegration in 6 more months with a high implant survival rate. The mixture also contains about 10% autogenous collector bone. Allografts are currently the next-best option, but there are still problems with minor immunogenic rejection and the risk of disease transmission [15].

Excellent clinical results were achieved in the current study when xenogeneic bone graft was placed right away in the fresh post-extraction implant placement. This clinical procedure can be regarded as a safe, effective, and predictable treatment option for the immediate rehabilitation of fresh post- extraction sockets due to the high success rate preservation of soft and hard tissue as well as the overall high patient satisfaction with the esthetic and functional outcomes [16].

Today, it is widely accepted that implants should be positioned more palatally when being im- planted. This results in the so-called bucca "gap" between the exposed implant surface and the buccal bone during immediate implant placement. Then, a variety of biomaterials with the ability to promote bone formation may be used to fill this gap [17].

In the current study, we proposed that a Xenograft containing atelo collagen would serve the purpose of promoting more ideal bone regeneration more effectively. It has recently been demonstrated that Xenografts with atelo-collagen present a number of benefits over those with collagen-free Xenografts. Atelo-collagen has demonstrated that it favors improved growth factor adsorption, enhances cellular adhesion, encourages quicker cell proliferation, and increases osteoblast differentiation [17].

An effective inductive bone grafting material for guided bone regeneration sinus augmentation is xenograft (Hypro-Oss), which combines native osteoinductive elements with osteoconductive bovine hydroxyapatite components.

This research demonstrates that the production of this Xenograft preserves the organic components, such as bone growth factors, which speed up the bone regeneration process and produce bone of the best quality and volume for implant placement. High implant insertion torque and a significant amount of calcified tissue in histological slides were indicators of good bone density. The new bone has similar clinical and radiographic characteristics to type II natural bone. In addition to these benefits, this case was concluded to have good preoperative care, good healing, and few postoperative complications.

Antonin et al [16] conducted research to determine the efficacy of phylogenic bone substitute hydroxyapatite in an augmented sinus. The graft healing, bone remodeling, and biomaterial replacement processes were investigated. They concluded that the density of trabecula in grafted bone corresponded to cancellous bone after 15 months; however, the bone substitute was not completely resorbed during this period, indicating the graft's affinity to induce more bone remodeling and density increase. These findings are consistent with the current study's findings, as the bone density curve increases after 6 months.

Neugebauer et al [18], performed a study to assess the effect of immediate loading of dental implants in conjunction with grafting procedures. The study concluded that if primary stability was achieved, local grafting did not disrupt the course of osseointegration for immediately loaded im- plants. Apical defect regeneration went smoothly, but crestal defects required membrane fixation.

Regarding the previous study, immediate loading was avoided and delayed immediate loading was done showing a significant statistical improvement in both implant stability and bone density of the grafted group. All implants were loaded after six months after implant insertion.

## 5. Conclusion

With the use of (Hypro-Oss) Xenograft the bone density around the dental implant display increase in values especially after the implant was in function (post-loading of the dental implant in the maxillary anterior teeth).

## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest.

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