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Rehabilitation of a maxillary central incisor using symphysis block graft and a CT-only 3D-printed surgical guide

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Abstract

This clinical report presents a two-step protocol for the rehabilitation of a missing maxillary left central incisor using autogenous bone harvested from the mandibular symphysis. Due to insufficient alveolar bone volume, ridge augmentation was performed followed by delayed implant placement. A monocortical block graft was secured with a mini plate, and platelet-rich fibrin (PRF) was used to enhance healing. After osseointegration, a ceramic crown was placed with emphasis on esthetic outcomes, including preservation of the patient's natural diastema. The procedure demonstrated effective bone regeneration, favorable implant stability, and satisfactory esthetics with minimal morbidity.

Keywords: Autogenous bone graft, mandibular symphysis, dental implant placement, ridge augmentation, surgical guide, 3D printed guide

Introduction

For patients who are fully or incompletely edentulous, the development of aesthetically beautiful restorations is essential to their recuperation. Lack of bone volume and quality at the chosen position is one of the main obstacles to getting the possible dental implant placement. The volume of accessible bone can be greatly dropped by alveolar bone loss, which can be brought on by infection, trauma, or natural abnormalities. In order to correct bone deficiency, vertical crest augmentation is constantly carried out either in confluence with implant implantation or as a phased treatment previous to insertion. Bone density to give primary stability, and residual bone volume for correct implant placing are important factors to take into account while choosing the procedure. Other factors including lip line, restoration type, abutment selection, and gingival biotype must also be taken into account in the esthetic zone [1]. This case report describes a twostep implant implantation procedure for the maxillary left central incisor that uses autogenous bone taken from the mandibular symphysis to increase the crest. In this article we also talk briefly about the novel method we used for Implant Surgical Guide fabrication where we use only the CBCT dicom files without the need of a digital intraoral scan.

Case Report

A 26-year-old female patient reported to the Department of Oral and Maxillofacial Surgery at Pacific Dental College and Hospital with the chief complaint of a missing upper anterior tooth. (Fig. 1). Clinical evaluation revealed a thick Gingival biotype with a suitable position and sufficient connected gingival breadth. CBCT showed that there was insufficient bone height and 0.2 cm of accessible bone labio-palatally. An autogenous monocortical graft from the mandibular symphysis region was harvested and used to augment the maxillary left central incisor site, due to the inadequate quantity of bone. The bone augmentation procedure was performed under local anesthesia using 2% lignocaine hydrochloride with epinephrine (1:80,000) as an outpatient surgery. After a clinical examination, the alveolar crest's defect was measured using calipers.

Fig 1: Pre-operative intra-oral image

Harvesting Block graft

After giving vestibular incision in mandibular labial vestibule, the anterior portion of the symphysis was exposed. A piezo surgical device was used to harvest a 10x7mm autogenous monocortical blockgraft from the mandibular symphysis. To fit the graft precisely, the block graft was cut to the proper size and its underpart was slightly prepared. A mini plate screw that went through the graft and into the native residual alveolar bone was used to secure the graft after it was in the correct position (Fig. 2). After filling the defect with bone graft and covering it with

PRF membrane, the incision was closed with interrupted sutures using 3- 0 silk. The patient was prescribed amoxicillin 625 mg twice daily for five days, a combination of Aceclofenac 100 mg, paracetamol 325 mg, and serratiopeptidase 15 mg for postoperative pain and inflammation to be used twice daily for one week. Seven days following surgery, the sutures were removed.

In the second stage, once it was confirmed that the graft has been taken up by the recipient site and there is significant increase in bone volume, implant placement was done.

Fig 2: Symphysis block graft placement in maxillary alveolar ridge defect & fixed by screw

Insertion of Implants

A full-thickness mucoperiosteal flap was raised to expose the alveolar bone following seven months of recovery. The monocortical block graft showed little resorption. 3.75 × 11.5 mm endosseous implant was placed (Fig. 3).

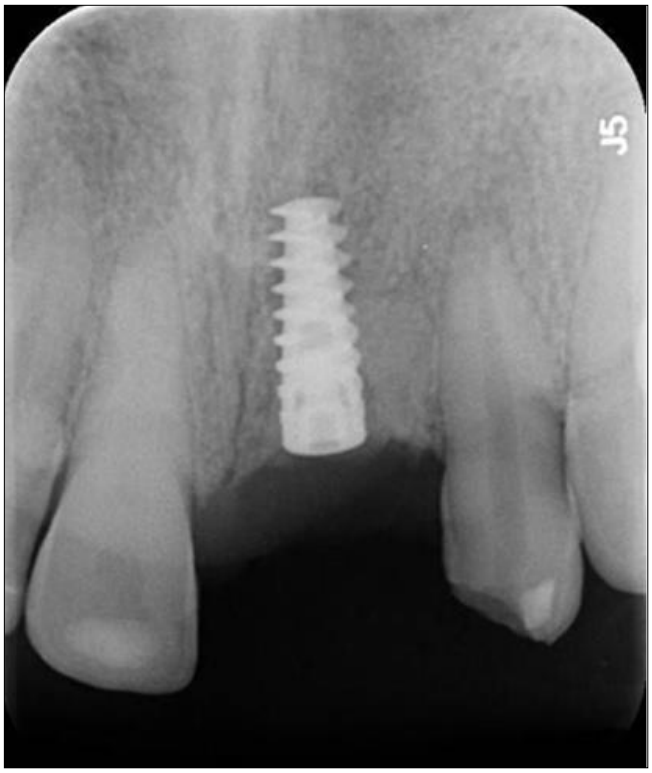

Fig 3: Implant placement

The Patient's CBCT DICOM data was used to construct the tooth- supported implant guide, which was 3D printed (Fig. 4). For guide fabrication only CBCT was used not digital intra oral scanner or any impression were taken so reduces patient's appointment.

For two months, the implant was submerged and allowed to integrate with the body.

Fig 4: Tooth supported implant guide

Implant restoration

After two months of recovery, the implant was revealed. To give a correct gingival collar and aid in soft tissue contouring, a gingival former was first used. A 15- degree prefabricated abutment was chosen and seated to maximize the prosthetic axis. After this, elastomeric material was used to take impression. To maintain aesthetic harmony with the neighboring dentition, tooth shade selection was done using a traditional shade companion in natural illumination. Due to its good wear and tear properties and aesthetics, all ceramic material was used in the fabrication of the final prosthesis. The patient's natural midline diastema was replicated during the crown fabrication process (Fig. 5). In order to maintain facial aesthetics and familiarity with the patient's appearance before to treatment, this case-specific particularity was strictly integrated into the crown design. Fit, aesthetics, and occlusion of the final form were assessed intraorally. Depending on material preference, a resin-modified glass ionomer was used to cement the prosthesis.

Fig 5: Cementation of prosthesis

Discussion

Crucial Factors that affect the clinical outcome of implant surgery are enough bone volume and good stability. Implant insertion may be impossible if the alveolar crest has undergone extensive resorption. The alternatives are either to avoid implant placement or to perform bone grafting to augment the remaining alveolar ridge, either prior to or at the time of implant surgery.

When there wasn't enough bone volume available, implants may be fitted using the technique outlined in this case. Sites to harvest autogenous bone grafts from both intraoral and extraoral location is well established [2, 4]. The calvarium, ilium, mandibular ramus, and symphysis are examples of classical extraoral sites that have been proved in the

literature [5]. In addition, requirement for general anesthesia and hospitalization, extraoral harvesting of a bone graft is generally avoided due to the increased threat of bone resorption [6]. The simplicity of intraoral bone harvesting, it's near propinquity to the site, its ease of surgical access, and its capacity to be carried out under Local anesthesia are its advantages. These lessen patient anxiety and operating time. Similarly, both the donor and recipient sites are made up of bone with the same embryologic origin. Compared to extraoral endochondral grafts, intramembranous mandibular symphysis grafts have demonstrated lower morbidity and delayed resorption [7]. It has been established that implants can be placed in symphysis bone grafted bone [8]. The retromolar region, the ramus, and the tori are mandibular regions where intramembranous bone has been harvested. The fact that only a certain amount of bone can be harvested from an intraoral site is a drawback. Autogenous monocortical mandibular block graft was harvested using a piezo surgical unit. It has been demonstrated that the harvesting system has a major impact on cell survival. Becker *et al*. demonstrated that essential cells that passed *in vitro* osteoblast isolation were present in autogenous bone chips that were uprooted using a piezoelectric unit [9].

Ideally, the fabrication of a tooth-supported surgical guide for accurate implant placement involves the integration of cone-beam computed tomography (CBCT) (or computed tomography) data with a digital intraoral scan. This combination allows for precise planning and alignment of the guide, ensuring optimal positioning of the implant relative to anatomical structures and the final prosthetic outcome. However, in the present case, the guide was fabricated solely using CBCT data without incorporating an intraoral scan.

The CBCT dicom data was imported in to the software Slicer 3D (Version 5.0) and the dicom data was used to create a 3d reconstruction of the maxilla including teeth and the surrounding bone. Enamel, being the hardest tissue in the human body, provides a stable and reliable reference point in CBCT imaging. Even when threshold values in the software are adjusted, enamel maintains its radiodensity, enabling accurate volumetric re-construction of the tooth crown in the software. This 3d reconstruction was then exported into STL file. This STL file was then imported into the software Blender 3D (version 4.0). In Blender 3d, a tooth supported guide was fabricated on top of the 3D reconstructed jaw. Utilizing this guide facilitates precise implant placement at the intended site. This tooth supported guide fabrication reduced pt's discomfort and appointment time as there is no need to take any impression. Which reduces appointment time.

Conclusion

The use of an autogenous monocortical block graft harvested from the mandibular symphysis, combined with a 3D-printed surgical guide based solely on cbct data, proved to be an effective approach for anterior maxillary implant rehabilitation. The protocol provided sufficient bone volume for ideal implant placement, ensured esthetic restoration, and minimized patient morbidity. The enamel's radiodensity served as a reliable reference for guide fabrication, allowing accurate implant positioning without the need for intraoral scan merging. This technique offers a predictable, minimally invasive solution for cases with localized ridge deficiencies in the esthetic zone.

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