10.5005/JP-Journals-10012-1054

CASE REPORT

Restoration of Maxillary Anterior Defect using Autogenous Block Graft and Optimizing the Esthetics using Zirconia Restoration

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ABSTRACT

The placement of dental implants in the anterior maxilla is a challenge for clinicians because of patients' exacting esthetic demands and difficult pre-existing anatomy. An atrophic alveolar ridge frequently causes functional, esthetic and prosthodontic problems. New approaches to implant therapy are available for patients with insufficient bone volume, like bone grafts, which may be autografts, xenografts, allografts or alloplasts. In maxillofacial reconstruction, the autogenous bone graft is still the "gold standard" for bone augmentation procedures. All ceramic crown emerging from a healthy peri-implant mucosa would fulfil the ultimate goal of a life-like restoration. This article describes a method for harvesting intramembranous monocortical bone from the symphysial region for horizontal alveolar ridge augmentation followed by implant placement in the anterior maxilla. This method provided enough bone volume for insertion of an implant in an optimal position with total bony coverage and esthetics.

Keywords: Autogenous, Augmentation, Esthetics, CAD/CAM, Zirconia abutment.

INTRODUCTION

Fabrication of esthetically pleasing restoration is a vital part in rehabilitation of completely edentulous and partially edentulous patients. A major problem in optimal placement of dental implants is inadequate volume and integrity of bone at the chosen site. Collapse of the alveolar bone after extraction, infection, trauma or aplasia may result in reduced bone volume. For patients needing single tooth replacement by implant, the width of bone should exceed 4 mm and the height 7 mm for placement of an endosseous implant.[1] Horizontal ridge augmentation of a deficient alveolar bone site is performed either simultaneously with implant placement, or with a staged approach prior to implant insertion.[2,3] The main criteria to consider when choosing the procedure are the residual bone volume needed to allow correct implant positioning, the bone density needed to achieve primary implant stability, and the defect morphology of the per implant bone defect. In the esthetic zone, additional factors, such as the gingival biotype, lip line, abutment type and type of restoration should be taken into account.[4]

This article describes the placement of an implant in a two-stage protocol at the site of the maxillary left central incisor with ridge augmentation using bone harvested from the symphysis region of the mandible to allow optimal placement of implant and the use of all ceramic abutment and crown for best possible esthetics.

CASE REPORT

A 40-year-old male with no relevant medical history reported with the chief complaint of missing left maxillary central incisor (Fig. 1). On clinical examination, the gingival biotype was thick with adequate width of attached gingiva and favorable arch position. The smile line was normal. Computed tomography revealed that the available bone thickness was 2.5 cm at the implant site with adequate bone height. Since the amount of bone was deficient, so an autogenous monocortical graft from the mandibular symphysis region followed by implant placement was done.

Site Preparation

The bone augmentation was performed as an outpatient procedure under local anesthesia [2% lignocaine hydrochloride with epinephrine (1:2,00,000)]. A crestal incision was given in the left maxillary central incisor area with vertical releasing incisions. A mucoperiosteal flap was

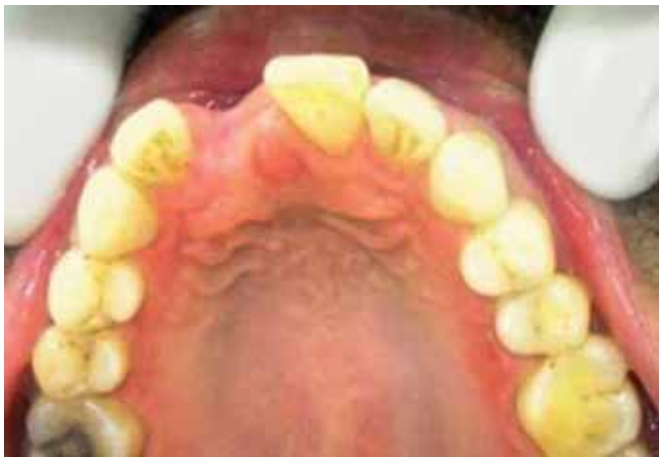

Fig. 1: 40-year-old male patient with missing left central incisor

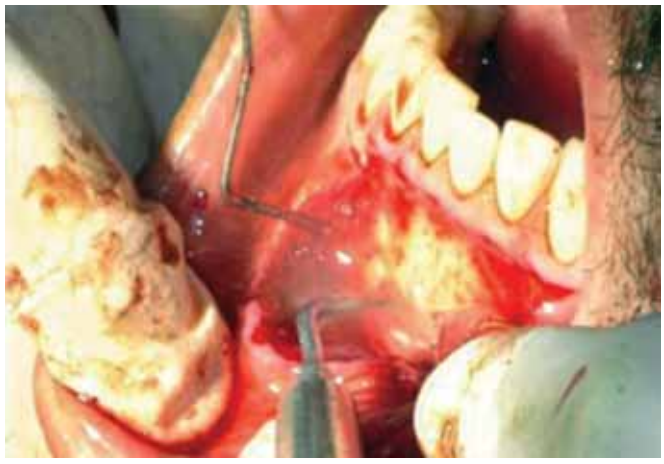

Fig. 3: Monocortical block graft obtained using piezosurgery

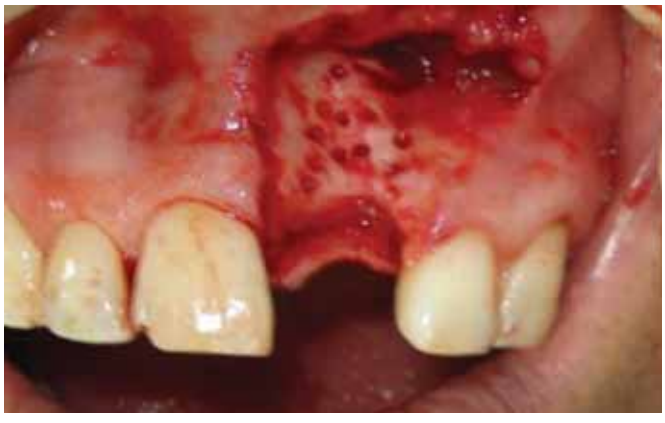

Fig. 2: Intraoral view of the edentulous area showing a prominent bony defect

Fig. 4: Outline of the graft marked

raised buccally and palatally. The alveolar ridge was clinically examined, and the width was measured with a probe and alveolar ridge calipers. Cortical perforations were made on the buccal cortex (Fig. 2).

Block Graft Harvesting

A horizontal incision was made in the vestibule of the anterior mandible. The mental muscles and periosteum were dissected, and the anterior part of the symphysis was exposed. A 2 × 1 cm autogenous monocortical block graft was harvested from the mandibular symphysis using a piezosurgical unit. The lingual cortex was left intact (Figs 3 and 4).

Ridge Augmentation

The block graft was cut to an appropriate size and under surface was slightly grinded to fit the recipient site intimately. Once properly positioned, the graft was fixed with a bone fixation screw that passed through the graft into the native remaining alveolar bone (Fig. 5). Cavity was filled with bone graft and nonresorbable membrane was placed over it, wound was closed with interrupted sutures using 3-0 silk. Primary closure was obtained without any tension in the grafted areas.

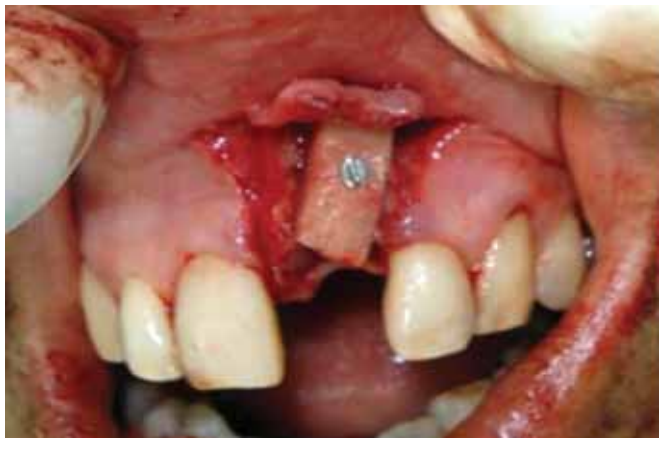

Fig. 5: Block graft placed at the recipient site and fixed with a bone screw

Medication and Follow-up

The postoperative care consisted of 10 ml of 0.2% chlorhexidine gluconate rinses twice daily for 4 weeks and the patient was prescribed ibuprofen 400 mg for post-operative discomfort and amoxicillin 500 mg thrice a day for 7 days. Sutures were removed 10 days after surgery. Panoramic and intraoral radiographs were taken at the same visit.

Implant Insertion

After 6 months of healing (Fig. 6), a full thickness mucoperiosteal flap was elevated to expose the alveolar bone at site 9. Minimal resorption of the monocortical block graft was evident. The fixation screw was removed and the site was prepared for placement of an endosseous implant (3.75 × 11.5 mm Hi Tech) (Fig. 7). The implant was submerged and left for 5 months to osseointegrate.

Restoration of Implant

The implant was subsequently uncovered after 5 months and a modified healing abutment was placed to improve the emergence profile (Figs 8 and 9). In the same appointment, radiograph was taken to confirm complete seating of the modified healing cap (Fig. 10) and after initial healing implant level impression was made for fabrication of provisional prosthesis and tooth shade was determined with a standard shade guide (Vita classic; VITA Zahnfabrik, Bad Sackingen, Germany) and a dental spectrophotometer (SpectroShade; MHT Optic Research AG, Niederhasli, Switzerland). Provisional restoration was fabricated following Walter's protocol[5] and cemented with eugenol free cement (Freegenol Temporary Cement; GC Corporation, Tokyo, Japan). The gingival tissue was then allowed to heal for an additional 1 month.

After healing, another implant level impression was made with a customized impression coping (Fig. 11) and subsequent radiograph was taken to check seating of impression post (Fig. 12). Additionally, an impression of the esthetically acceptable provisional restoration in place was made to guide definitive restoration fabrication. Production of the casts including the gingival masks was done according to the manufacturer's instruction. After mounting the casts in a semiadjustable articulator, prefabricated zirconia abutment was selected, depending on the implant axis and the level of soft tissue. Abutment preparation was done so that finish line was placed 1 mm subgingival for all surfaces except for the palatal surface where the margin was placed at the level of the gingival margin (Fig. 13). During this process, special care was taken

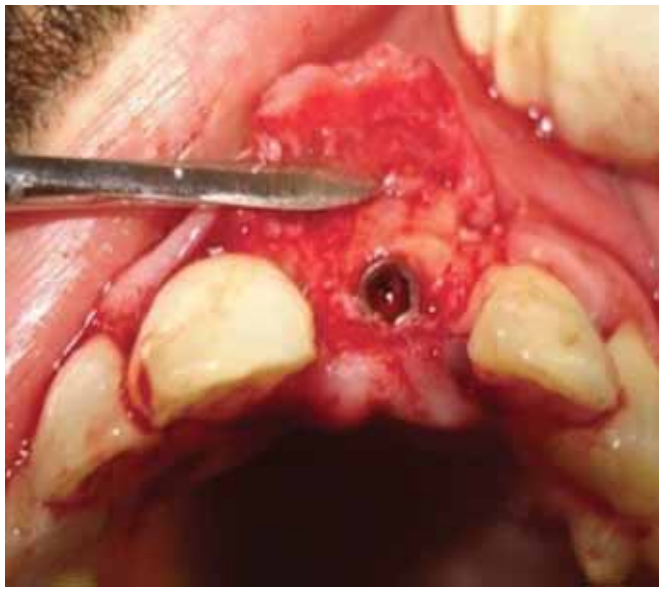

Fig. 7: Two-piece internal hex implant placed endosseously

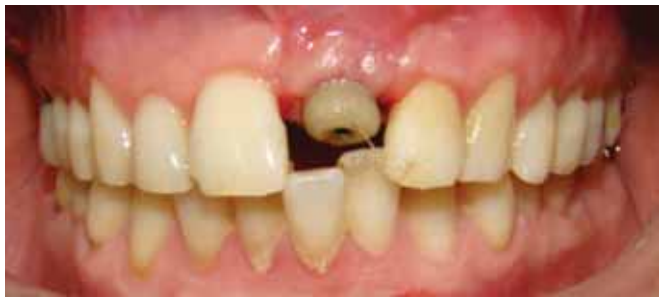

Fig. 8: Modified healing cap placed over the implant

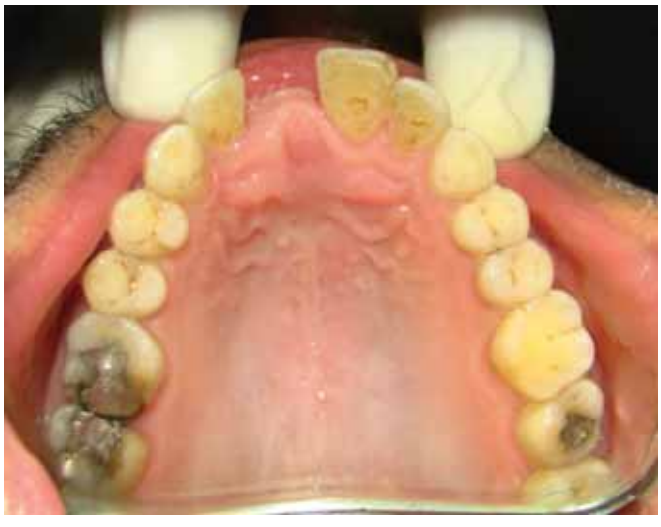

Fig. 6: 5 months postoperative intraoral photograph showing sufficient amount of alveolar bone

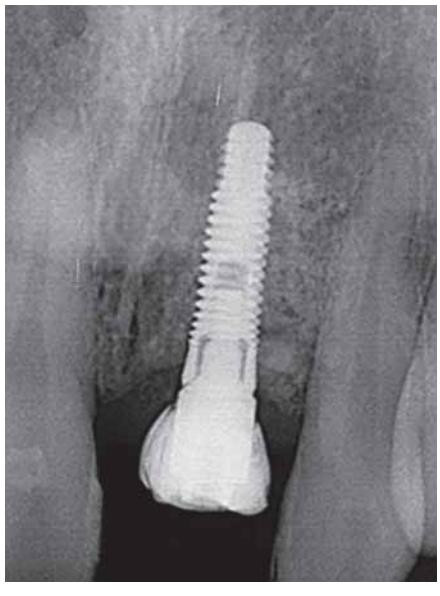

Fig. 9: Radiograph after seating of healing cap

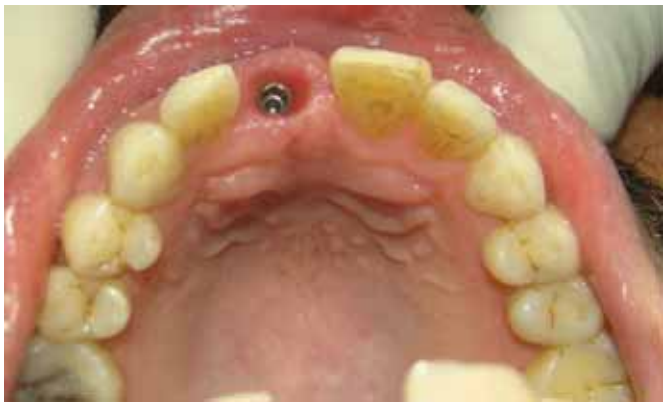

Fig. 10: Formed gingival sulcus around the implant

Fig. 14: All ceramic crown fabricated over zirconia abutment

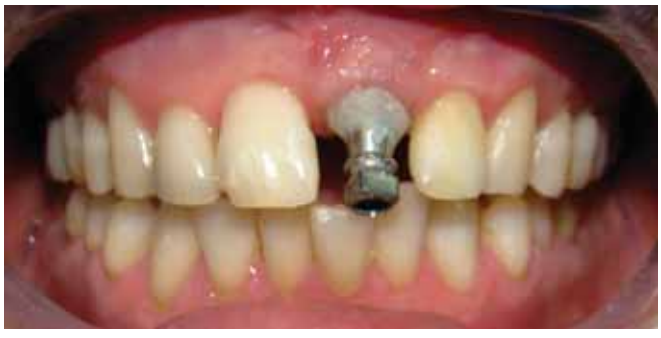

Fig. 11: Modified impression postseated into the implant

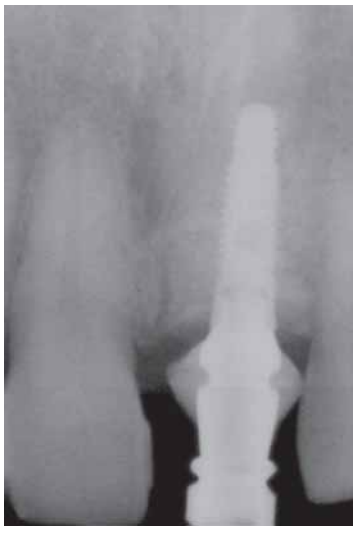

Fig. 12: Radiograph showing complete seating of modified impression post

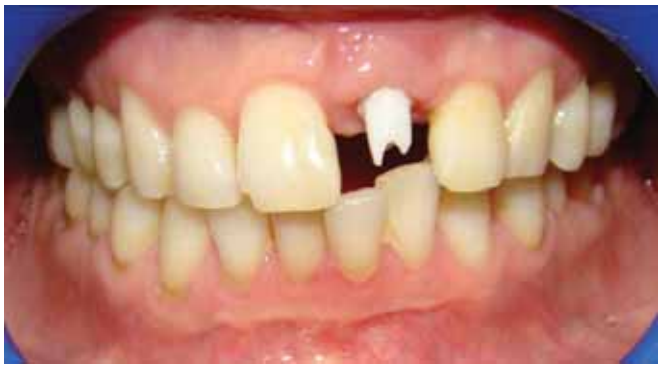

Fig. 13: Zirconia abutment in place

to reduce the wall thickness of the zirconium dioxide ceramic in the cervical region as little as possible. The ceramic was worked on with a turbine and diamond grinding tools (Bredent GmbH and Co. KG; Hamburg, Germany) under water cooling. The crowns were manufactured using a CAD/CAM system (Cercon smart ceramics; DeguDent, Hanau-Wolfgang, Germany). For this purpose, abutment was coated with thin layer of Cercon eye and scanned (Cercon brain; DeguDent), milled from a sintered zirconium dioxide blank (Cercon base; DeguDent) and densely sintered at 13501°C (Cercon heat; DeguDent). The frameworks were veneered using the system-specific veneering ceramic (CERCONs ceram kiss; DeguDent) according to the manufacturer's instructions (Fig. 14).

The abutment and crown were evaluated and modifications were made to the crown contours. Extrinsic characterization was also accomplished before final glaze. Input from the patient and spouse was sought during the evaluation phase, and a final preference was ascertained.

The crowns were required to demonstrate centric contact but no contact during dynamic occlusion. Any necessary adjustments were made with diamond grinding tools of 46 mm granulation (Gebr. Brasseler GmbH & Co. KG, Lemgo, Germany). Depending on the extent of corrections, either a polishing (Dialite II Polishing Kit; Gebr. Brasseler GmbH & Co. KG) or a renewed oven glazing was applied. Cementation of the crowns was carried out using glass ionomer cement (GC FujiCEM; GC Corporation, Tokyo, Japan) (Figs 15 and 16). Finally, a thorough inspection was performed to ensure that the peri-implant sulcus was free of remaining cement particles. This was done to prevent any foreign body reaction or iatrogenic inflammatory process.

DISCUSSION

Good initial stability, sufficient bone volume and adequate bone quality are three important factors influencing the clinical result of implant surgery. An esthetically successful

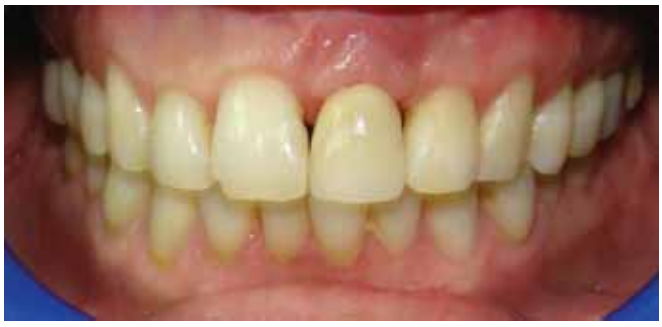

Fig. 15: Final restoration in place

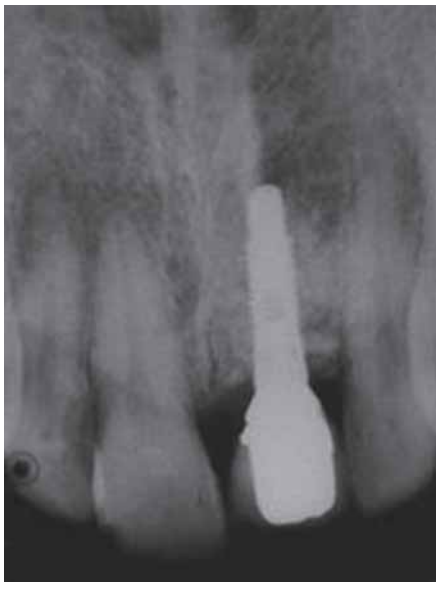

Fig. 16: Postloading radiograph

treatment can be achieved if the anatomy of the alveolar ridge permits optimal implant placement. Extensive resorption of the alveolar ridge may make implant insertion impossible (bone width < 4 mm and height < 7 mm). The options are either not to insert implants or to augment the residual ridge with, for instance, a bone graft before or simultaneously with implant surgery. The method described in the present case made it possible to insert implants when insufficient bone volume was available, and the technique provided enough bone for optimal implant placement.

Autogenous bone grafts can be used in block or particulate forms. It is well-documented that autogenous bone graft can be harvested from intraoral and extraoral sites.[6-8] Classical extraoral donor sites, such as the calvarium, ilium, mandibular ramus, and symphysis have been reported in the literature.[9] Extraoral harvesting of a bone graft unusually requires general anesthesia and hospitalization, moreover there are more chances of bone resorption so avoided in normal practice.[10] Successful treatment of localized ridge defects can be achieved with autologous intraoral bone transplant with and without combined guided bone regeneration.[11] The advantages of intraoral bone harvesting are its simplicity, can usually be accomplished under local analgesia, ease of surgical access and close proximity of the donor site. These reduce both operation time and patient anxiety.[12] Morbidity of intraoral donor sites is usually minimal. In addition, the donor and recipient sites are comprised of bone having the same embryologic origin (i.e. intramembranous). There seems to be some difference in treatment outcomes, intraorally, between endochondral and intraoral donor bone. Endochondral grafts have been widely used in oral and maxillofacial reconstructions, with and without osseointegrated implants. Intramembranous mandibular symphysis grafts have shown less delayed resorption and less morbidity than extraoral endochondral grafts.[13] The placement of implants in areas grafted with chin bone has been documented.[14] Other locations in the mandible have also been used to obtain intramembranous bone; these include the retromolar region, the ramus and tori.

One disadvantage in using an intraoral donor site is that only a limited amount of bone can be harvested. Complications, including altered sensation in the teeth, neurosensory disturbances, wound dehiscence and infection, have been reported for various intraoral donor sites.[15]

A piezosurgical unit was used to harvest the autogenous monocortical mandibular block graft. It has been shown that cell viability is significantly influenced by the harvesting technique. Becker et al had shown that autogenous bone chips harvested with piezoelectric unit contained vital cells which differentiated into osteoblasts *in vitro*.[16]

The introduction of ceramic implant abutments made from aluminum oxide or zirconium oxide offer advantages over metal abutments, including improved esthetics, translucency, ease of fabrication, adaptability and biocompatibility.[17,18] Recent studies, both *in vivo* and *in vitro*, have demonstrated that zirconia ceramic surfaces accumulate fewer bacteria than commercially pure titanium.[19] In addition, it has been reported that the soft and hard tissue response to zirconia has been favorable.[20] Tooth-like coloring combined with customized preparation and contouring allow for superior mucogingival esthetics in implant-supported single-tooth restorations. Ceramic implant abutments can be prepared in the desired shape with the recommended dental rotary cutting instruments (DRCIs) by the dentist or dental technician in the laboratory and refined intraorally by the dentist for cemented restorations. Unfortunately, the published longitudinal trials to determine the clinical life span of these abutments are limited in the length of follow-up and indicate that alumina abutments have a slightly higher failure rate than prefabricated metal abutments.[21-23] The reported failure mode was abutment fracture. Propagation of cracks created during abutment preparation has been suggested as the reason for fracture. For optimal tissue response and obtaining maximum esthetics a zirconia abutment with zirconia all-ceramic crown was used in this case.

CONCLUSION

The described method provided enough bone volume for insertion of an implant in an optimal position with total bony coverage and esthetics. It is simple to use and has minimal morbidity.

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