

New bone formation by orthodontic tooth movement for implant placement

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ABSTRACT

Bone defects at the anterior regions of the jaws often cause esthetic problems such as gingival disharmonies and longer crowns than neighboring teeth. Variety of procedures can be used in this region for achieving sufficient bone volume with or without different bone graft materials. All of these procedures has their own advantages and disadvantages. New bone formation was defined with orthodontic tooth movement in different regions. In this case we present the use of orthodontic tooth movement, for achieving sufficient bone volume, in anterior maxillary region, for esthetic and functional results.

Keywords: Dental implant, new bone formation, orthodontic tooth movement

INTRODUCTION

In cases with missing maxillary incisor teeth, various treatment options such as orthodontic treatment, bridges, and implants are available. In cases in which dental implants are planned, bone volume has critical role. However, bone volume decreases after extractions.^[1] Hence, proper alveolar dimensions are required for implant placement; in such cases, approaches for bone augmentation are always sought. Numerous reconstruction procedures have been proposed to increase alveolar bone volume. These techniques include guided bone regeneration, bone grafts, distraction osteogenesis, alveolar split osteotomy, and combination of these procedures. A variety of graft materials are being used in these procedures with or without barrier membranes or fixation materials.^[2-5]

Orthodontic tooth movement is an alternative to bone grafting. Natural remodeling of new bone formation is achieved while the tooth moves through the alveolar bone.^[6,7] Previous investigators have demonstrated successful tooth movement “with bone” into the compromised bone by applying a carefully planned

force system that resulted in bodily movement with frontal bone resorption, rather than indirect bone resorption.^[8,9] Among clinicians, this approach has been well established as a method to generate new bone for pneumatized sinuses^[10] and implant placement.^[8,10] It is also reported that uprighting mesially tilted molars reduce or even eliminate intraosseous defects. It can also enhance the crown-to-root ratio and restore normal occlusal function.^[11,12] The aim of this case report is to present the multidisciplinary treatment of a patient with an extracted impacted maxillary central tooth 5 years ago.

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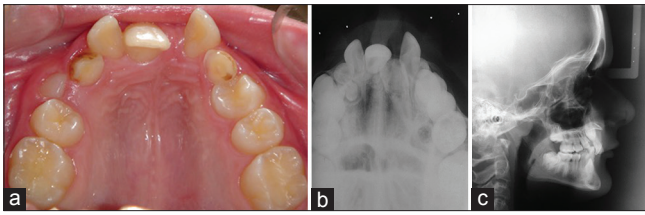


Figure 1: Initial records. (a) Maxillary occlusal photographs, (b) maxillary occlusal radiographs, and (c) cephalometric radiographs

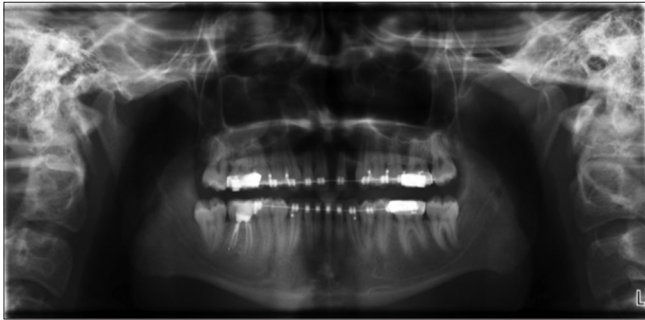


Figure 3: Panoramic view after orthodontic tooth movement



Figure 5: Final intraoral photographs of the patient

CASE REPORT

A 16-year-old male was referred to the Orthodontics Department with a complaint of missing central incisor and crowding [Figure 1a]. The occlusal and cephalometric radiographic evaluation of patient at the age of 11 showed supernumerary teeth in the right maxillary anterior region and an impacted left maxillary central, which were extracted at that time [Figure 1b and c]. The orthodontic treatment plan was made with consultation of both Restorative Dentistry and Oral and Maxillofacial Surgery Department: leveling, correction of sagittal relationship, bone formation by orthodontic tooth movement of maxillary left lateral into the central tooth space, space management for lateral single implant application, and also composite resin buildup of the maxillary lateral to turn it into central tooth [Figure 2]. After leveling, the left maxillary lateral was shifted gradually to the midline on 16 × 22 stainless steel wire, with the main aim to create new bone in the extraction space, until it was approximately 1.5 mm from the mesial surface of the

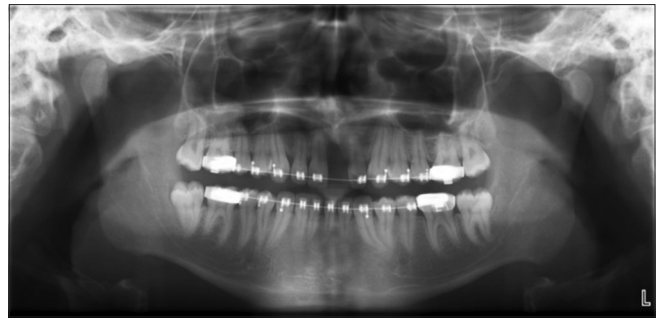


Figure 2: Panoramic view of bone defect at central incisor site



Figure 4: Panoramic view after implant placement

right central [Figure 3]. A temporary resin buildup (Z250 3M ESPE, St. Paul, USA) was made to reshape the lateral teeth. The width of right maxillary lateral was measured with digital caliper to manage the space for implant application in the opposite side. An implant (Nobel Biocare, Zurich, Switzerland) with 10 mm length and 3.0 mm diameter was placed into the opened place for the lateral teeth [Figure 4]. Hence, the gingival inflammation was observed in the maxillary anterior region; gingivectomy was performed during the osseointegration period of the implant. The definitive porcelain crown restoration with canine protected articulation and finishing of the composite resin buildup were fabricated 3 months later. After 25 months of treatment, the esthetic and functional requirements were achieved without any complication [Figure 5].

DISCUSSION

Successful results can be achieved by multidisciplinary approaches in patients with avulsed or extracted anterior teeth in the postpubertal growth period. Every department contributes to the results in its own way with the consultation to the other ones. For example, the Orthodontic Department plans the spaces between the teeth depending on the requirements of Restorative Dentistry and Oral and Maxillofacial Surgery Departments.

The treatment plan and age of patient for implant placement have been discussed in several researches.^[6,13,14] Overall, all investigators agree with each other that in cases with congenital missing or extracted anterior teeth, the main aim of the treatment protocol is to prevent the resorption of the alveolar bone. The guidance of the neighboring teeth into the edentulous space is preferred for preventing alveolar bone resorption by several authors as an alternative to bone grafts. The roots of

the neighboring teeth moving through the alveolar bone form a significant amount of bone for implant site.^[6,13,14] Cirelli *et al.* concluded that teeth can be moved orthodontically with reduced but healthy periodontal tissues, without damage to the periodontal attachment level.^[15] The timing for this orthodontic movement for bone formation is not clearly defined yet. Beyer *et al.* indicate that new bone also showed resorption after the orthodontic treatment and before implantation and advised to postpone the orthodontic treatment until the patient is old enough for implantation.^[16] However, other authors claimed that the new bone is stable over long term^[6,13] and age of the patient is not a crucial factor in the decision of treatment time. In the present case, the lateral tooth was moved to midline to form new bone in extraction space. The patient was 16 years old at the beginning of the orthodontic treatment and approximately 18 at implantation stage, so no time loss occurred between treatment steps. Therefore, there is no time for possible resorption.

In relation to atrophic edentulous jaws, available data indicate that all procedures assessed are successful in terms of bone augmentation, providing a high implant survival rate, with implants placed in the augmented bone. The clinician should be aware of the outcomes of different treatment options to assess the best option in each clinical situation.^[5]

We suggest that orthodontic tooth movement should be preferred if the patient will already undergo orthodontic treatment, for several reasons. Bone grafts require 6 months to 1 year before implant placement,^[17] so the treatment time will be prolonged after orthodontic treatment. By orthodontic tooth movement, patient does not have to wait for this period and treatment time will be decreased. In addition, by this treatment protocol, the risk and the need for additional surgeries will be decreased. The osseous contour of anterior maxilla has a crucial role for achieving acceptable esthetic results, and orthodontic treatment has been proposed as a means of achieving a more favorable osseous contour.^[15]

There are only few reports available in the literature about complications.^[9,18,19] It is reported that some side effects, such as root resorption, pulp vitality, and perforation of sinus membrane, can cause additional complications.^[20,21] In this case report, we present orthodontic tooth movement with the generation of new bone and good osseous contour in the esthetic region without any complication. In conclusion, orthodontic tooth movement can be defined as economic and time-saving procedure and satisfactory and esthetic results can be achieved.

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Conflicts of interest
There are no conflicts of interest.

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