Case Report

# New bone formation in a cystic alveolar bone defect assisted with orthodontic tooth movement


## ABSTRACT

The objective of this case report is to demonstrate the role of orthodontics in rehabilitation of alveolar bone defects. A 9-year-old female patient presented with an unerupted maxillary left central and lateral incisors. The central incisor was severely dilacerated with a 1.5 cm x 2.0 cm cystic lesion causing displacement and failure of eruption of the adjacent lateral incisor. Surgical enucleation of the central incisor and the cystic lesion was done, and the bone defect was filled with synthetic bone paste and was covered with a resorbable membrane. Orthodontic closed reduction of the displaced lateral incisor was attempted. The involved lateral incisor actively erupted at the site of the missing central incisor by orthodontic traction, and *de novo* bone formation was noticed radiographically in the bone defect. Clinically, bucco-palatal alveolar bone thickness was maintained sufficiently. Alveolar bone defects can be adequately restored with new bone formation by means of active orthodontic tooth movement through a bone defect filled with synthetic bone.


**Keywords:** Cystic defect, impacted tooth, new bone formation, orthodontic tooth movement

## INTRODUCTION

Cystic bone defects at the anterior region of the jaws complicated with loss of one or more anterior teeth often cause problems such as bone and soft-tissue collapse and can jeopardize the normal dental development and teeth eruption. Moreover, especially with young patients, it may affect the normal growth and development of the alveolar bone.[1,2] Among dentoalveolar cystic lesions, the dentigerous cyst is the most common odontogenic cyst and considered to be an aggressive lesion causing displacement of teeth and root resorption, which indicate an early surgical intervention in young patients to provide the best chance for the eruption of teeth and an adequate alveolar bone growth and development.[3,4]

Variety of suggested procedures and methods had been used in this region for achieving sufficient repair and bone healing using osseous grafts including heterogeneous, homogeneous, autogenous, and bone-like material with varying success rates. All of these procedures have their own limitations.[5,6] On the other hand, bone regeneration was defined with orthodontic tooth movement in different regions in the alveolar bone.[7,8] Moreover, orthodontic forces can be applied to a tooth that was found to be associated with a dentigerous cyst after enucleation and treatment of the cyst.[5,7-9] Nonautogenous bone grafting followed by orthodontic tooth movement has been shown to help gain a better morphology of the alveolar ridge.[10]

According to Reichert *et al*.: "Both orthodontic tooth movement and tooth eruption through grafted bone are not only possible but also might provide promising results."[10]

## CASE REPORT

A 9-year-old female patient was referred to the orthodontic department at Al-Hussein Hospital complaining of missing


**Rana N. Hammodi , Ra'ad A. Batarseh[1]**

Departments of Orthodontics and [1]Oral and Maxillofacial Surgery, AL-Hussein Hospital, Jordanian Ministry of Health, Jordan

**Address for correspondence:** Dr. Rana N. Hammodi, Department of Dentistry, Al-Hussein Hospital, Salt, Jordan.
E-mail: rnizam506@gmail.com; raadbatarseh@hotmail.com



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left maxillary central and lateral incisor teeth. Her dental history revealed being subjected to severe trauma to the anterior primary teeth at the age of 5 years. Clinical examination showed that she was in the mixed dentition stage with a Class I malocclusion based on skeletal Class I relation, complicated with unerupted maxillary left central and lateral incisor teeth, while the contralateral central and lateral incisor teeth were fully erupted. Incisor overjet was within normal values with a slight decrease in overbite measurement. An orthopantomograph and periapical radiographs showed a large radiolucent lesion involving the maxillary left central and lateral incisors area measuring 1.5 cm × 2 cm [Figure 1]. Further investigation with cone-beam computed tomography (CBCT) revealed a severely dilacerated maxillary left central incisor with an underdeveloped root surrounded by a 1 cm × 1.5 cm × 2 cm radiolucency and displacing the adjacent lateral incisor causing it to become deeply impacted in a horizontal position. This lesion was initially diagnosed as a dentigerous cyst involving the dilacerated central incisor and displacing the lateral incisor leading to its failure of eruption. This clinical diagnosis was confirmed after histopathological examination of the enucleated cystic lesion, with no evidence of dysplastic changes.

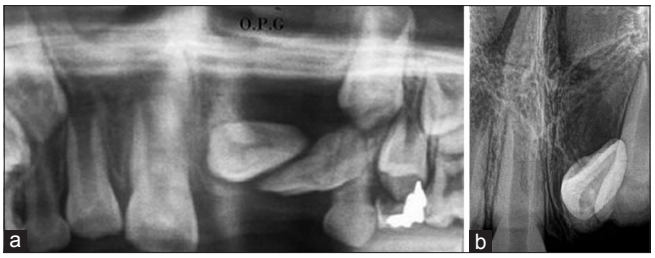


**Figure 1: Preoperative radiographs: (a) orthopantomograph and (b) periapical**

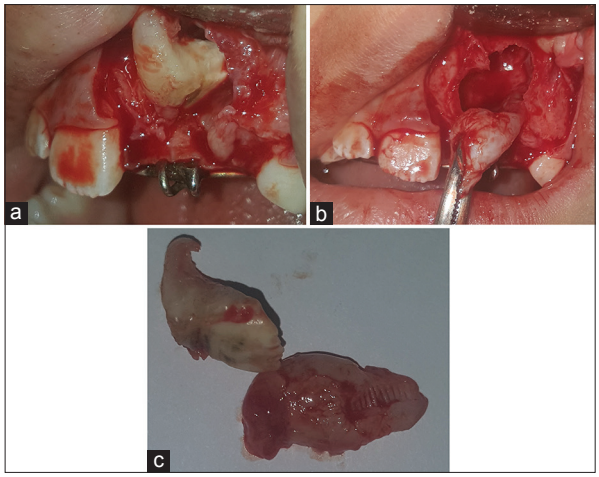


**Figure 2: Surgical procedure: (a) Exposure, (b) cyst enucleation, and (c) dilacerated tooth with the cyst**

## Treatment objectives and plan

The orthodontic treatment plan was made after consultation with the Oral and Maxillofacial Surgery Department to surgically enucleate the cystic lesion, remove the rootless malformed central incisor and prepare a synthetic bone path.[10] The decision was to keep the impacted lateral incisor in spite of its high position and apply an orthodontic traction on the tooth through the filled bone defect[9,11] into the site of the missing central incisor, in an attempt to maintain bone and enhance bone formation.[7,8,12,13]

## Treatment progress

First, the cyst was enucleated, and the biopsy was sent for histopathological final diagnosis, which was a dentigerous cyst without an evidence of dysplastic changes. During the procedure, the crown of the central incisor which was totally contained inside the cyst with rudimentary 90° dilacerated root was removed [Figure 2]. Soft-tissue debridement and irrigation around the impacted lateral incisor were done, and a gold chain was attached to it for orthodontic traction [Figure 3]. Synthetic bone paste was used to fill the defect and was covered with a resorbable membrane held securely in place using resorbable sutures. Finally, the flap was repositioned and sutured in place [Figure 4]. Two weeks postsurgery, the patient was followed up ensuring good soft-tissue healing [Figure 5]. Orthodontic treatment was initiated after 1 month using a fitted transpalatal bar

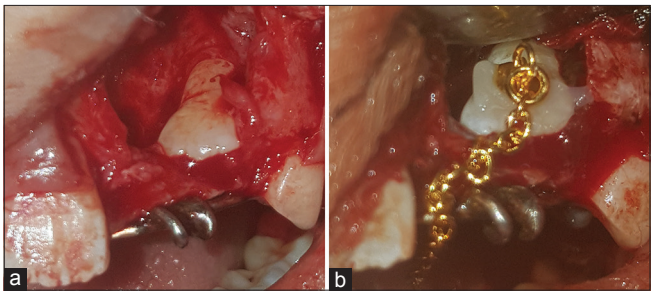


**Figure 3: Bonding on lateral incisor: (a) soft-tissue debridement and (b) gold chain attachment**

modified by an anterior arch with soldered hooks at the space area as an anchor unit. The gold chain was strained to the hooks using ligature wire and exerting light traction forces. This continued for 4 months with changing the traction through the chain every 4 weeks. After 3 months, the lateral incisor started to show up through the attached gingiva with a very good prognosis [Figure 6]. Clinically, the alveolar bone was thick and hard on palpation. Later on, the orthodontic traction continued for 2 months using the same technique [Figure 7]. An orthopantomogram (OPG), two-dimensional (2D) OPG, and periapical X-rays were taken to monitor the alveolar bone formation, all of which revealed an excellent prognosis with bone healing and new bone formation [Figure 8].

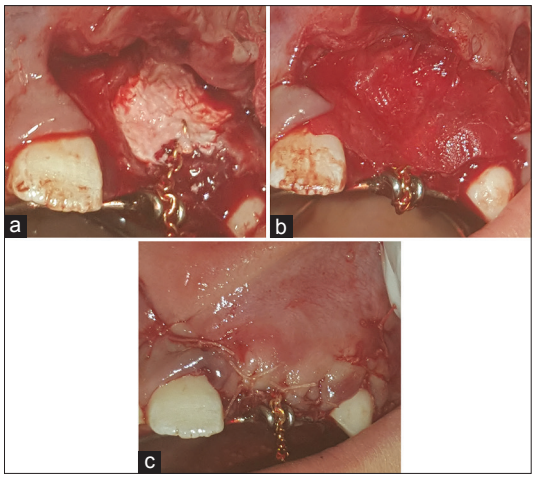


Figure 4: Final surgical steps: (a) bone paste filling, (b) membrane coverage, and (c) flap closure

Figure 5: Soft-tissue healing at 2 weeks postsurgical

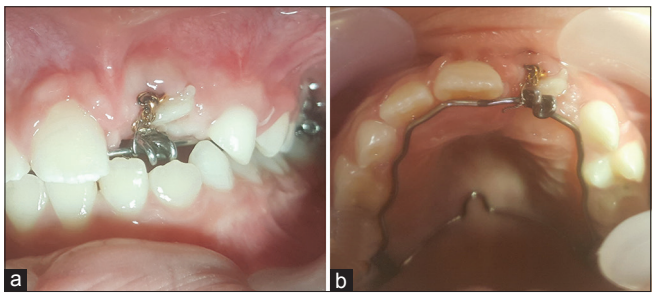


Figure 6: Emergence of the lateral incisor: (a) anterior view and (b) occlusal view

Figure 7: Orthodontic traction

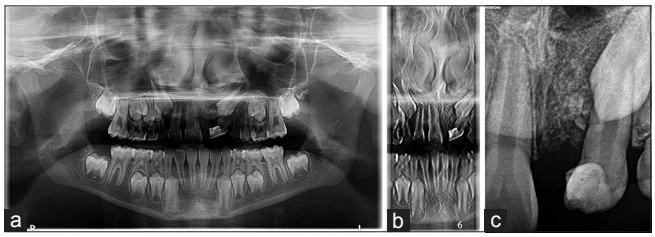


Figure 8: Five-month postoperative radiographs: (a) Orthopantomogram, (b) two-dimensional orthopantomogram, and (c) periapical X-ray

As treatment progressed a 2 × 3 fixed appliance 22ROTH prescription was used including the erupted lateral incisor using light orthodontic forces starting with 12 NiTi archwire in an attempt to position the tooth in the dental arch [Figure 9]. Four months later, a 16 × 22 NiTi archwire was fitted to proceed with orthodontic management [Figure 10].

### Treatment results

New OPG, 2D segmented OPG, PA X-ray, and CBCT were taken to evaluate the progress of postoperative bone defect management and to reevaluate the bone formation. These radiographs revealed sufficient bone repair and formation in both the defected area and along the path of the lateral incisor forming a defined lamina dura and a well-developed alveolar bone [Figure 11].

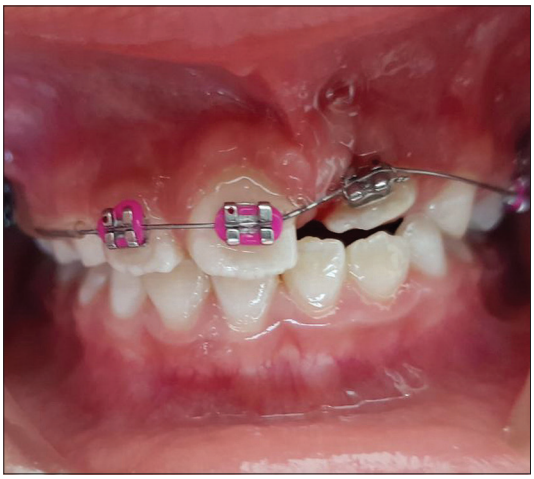

Figure 9: 2 × 3 fixed appliance 22ROTH with 12 NiTi archwire

## DISCUSSION

Trauma to the anterior region of the mouth at a very young age can have a long-term sequel on the normal development of permanent teeth. The disturbances to the permanent

Figure 10: 2 × 3 fixed appliance 22ROTH with 16 × 22 NiTi archwire

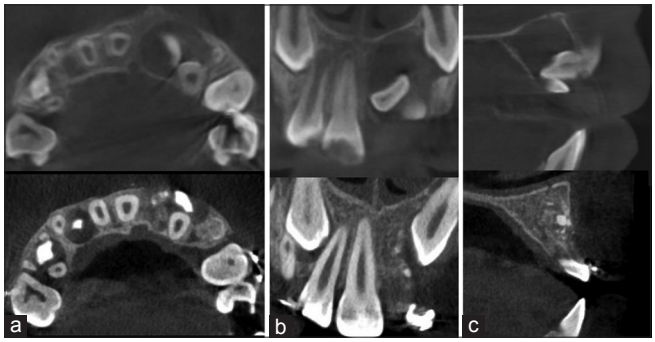


Figure 12: Cone-beam computed tomography: (a) axial view, pre- and post-operative, (b) coronal view, pre- and post-operative, and (c) sagittal view, pre- and post-operative

successor teeth range from a simple white- or yellow-brown discoloration, to enamel hypoplasia, crown dilaceration, root duplication, root dilaceration, partial or complete arrest of root formation, and disturbances of the permanent successor eruption.[14] The patient described in this case presented with a history of trauma in early age and reported complicated dental disturbances with a dentigerous cyst associated with a dilacerated left central incisor, recording a rare entity,[15] causing a large bone defect with displacement and impaction of the left lateral incisor. Our first aim was to regenerate the defected alveolar bone, and preserve the normal growth and development of the anterior region, by means of orthodontic tooth movement through the bone defect to propose a natural way to augment the local bone volume at the deficient site.[16]

The treatment progress of a bone defect is best evaluated by a radiographic examination. Panoramic radiograph is considered the standard radiographic view. However, recently CBCT has been introduced as a technique dedicated to the imaging of dental and maxillofacial structures on 3D basis.[17] Comparing the pre- and post-operative CBCT, it showed a subsequent restoration of bone in the previously occupied cystic cavity at three dimensional levels (axial, coronal,

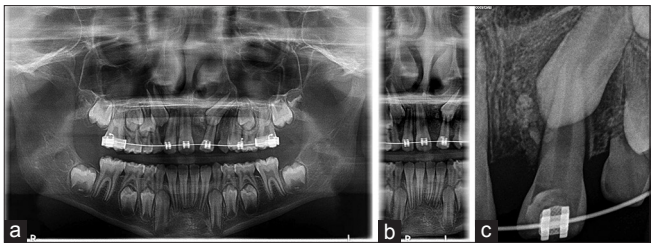


Figure 11: Ten-month postoperative radiographs: (a) orthopantomogram, (b) two-dimensional orthopantomogram, and (c) periapical X-ray

and sagittal views) [Figure 12]. This demonstrated that orthodontic tooth movement could aid in bone formation in a cystic cavity region filled with synthetic bone paste.

## CONCLUSION

The presented case report suggests that orthodontic tooth movement can have an empirical role in managing bone defects in the alveolar bone.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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