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Bone dehiscence , Fenestration with Cone beam computed tomography

*A Project Submitted to The College of Dentistry, University of Babylon,
Department of Orthodontics in Partial Fulfillment for the Bachelor of Dental
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ABSTRACT:

Background:To evaluate the changes of alveolar dehiscence and fenestration pre and after orthodontic treatment on cone-beam computed tomography (CBCT) both quantitatively and qualitatively.

Objectives:The purpose of this study was to investigate the prevalence of alveolar bone dehiscence and fenestration of individuals with normality patterns in the anterior region using cone-beam computed tomography (CBCT).

MATERIALS AND METHODS:

In this cross-sectional study, all CBCT images of patients who had been referred to a Private dr .Arkan clinic in Babylon Governorate were reviewed to a group consisted of (30) subjects . After evaluating all available CBCT images, those of CBCT images of the patients with normal dentoalveolar structures of anterior maxillary and mandibular teeth are included in this study. However, generalized bone loss secondary to periodontal disease or a systemic condition, positive history of trauma, orthodontic treatment, and the presence of apical lesion as well as root canal therapy on anterior maxillary or mandibular teeth were considered as exclusion criteria. CBCT images were obtained.After the reconstruction of volumetric data, cross-sectional Images were provided and evaluated cross-sectional and axial images for the presence or absence of fenestration and dehiscence.

RESULTS: In this cross-sectional study, image samples were reviewed to determine the presence of fenestration and dehiscence. A total of (6.6 %) of the images (cases) were from before orthodontic treatment and all the cases were dehiscence after orthodontic treatment (13.3 %) was dehiscence and fenestration .

INTRODUCTION:

Cone beam computed tomography is a three-dimensional imaging technology, and a very useful tool for proper diagnosis, it is especially useful in dental and maxillofacial radiology and has been used to overcome the problem with conventional two dimensional radiographic techniques.(**Whaites E fperiapical radiography.in essentials of dental radiology and radiography 4th ed Elsevier 2007**).

In CBCT exposes the patient to less radiation than does CT and is used for the diagnosis and treatment planning of many complex orthodontic condition and situations like in facial growth, cleft palate ,tooth eruption disturbances or impacted teeth, cleft palate, cleft lip and in orthognathic or craniofacial surgery (**. Kapila SD ,Nervina JM. CBCT in orthodontics assessment and its indication for use ,Dentomaxillofacial radiology 2015**) also has broadened opportunities for examining morphologic aspects of the craniofacial complex, including alveolar bone. CBCT has suitable capability in assessing the alveolar bone because of its high resolution. In this technique, the evaluation of small defects of the alveolar bone and their locations is possible because of the lack of superimposition of adjacent structures

The alveolar bone is part of the periodontal tissue, and its anatomy is different in different patients. It is affected by the location, angulation, and tilt of the teeth as well as by occlusal forces. The anatomy of the alveolar bone is of great clinical importance because moving teeth beyond anatomical limits with orthodontic treatment increases the risk of bone loss and formation of anatomical defects such as **dehiscence or fenestration**

BONE DEHISCENCE AND FENESTRATION:

1. Dehiscence: are isolated areas in which root is denuded of bone through marginal bone.

2. fenestration: are alveolar defects which expose the apical or medium third of the root surface but does not involve the alveolar margin

Naturally occurring alveolar bone dehiscence and fenestration are common findings in different types of malocclusions especially in the anterior region of class III malocclusions. Dehiscence and fenestration may lead to gingival recession and additional bone loss during orthodontic treatment. In addition, large amount of labial inclination such as decompensation in class III malocclusions may pose a greater risk of periodontal complications, such as alveolar dehiscence and fenestration and gingival recession.

Since these disorders can complicate orthodontic treatment by causing gingival recession and additional bone loss, it is important that they be detected before treatment so that they can be treated or prevented. The accuracy and reliability of buccal bone height and thickness measurements from CBCT are acceptable and appropriate. The diagnostic value of CBCT for detecting buccal defects was high for fenestrations. A CBCT method having a relatively high accuracy to diagnose alveolar dehiscence and fenestration. Nowadays, with CBCT widely used as an orthodontic pretreatment record, alveolar bone dehiscence and fenestration can be easily diagnosed.

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<u>state</u>	<u>No before orthodontic treatment</u>	<u>No after orthodontic treatment</u>	<u>%</u>
<u>Dehiscence</u>	2	<u>None</u>	<u>6.6 %</u>
<u>fenestration</u>	<u>None</u>	<u>4</u>	<u>13.3 %</u>

Features of fenestration and dehiscence :

1. more frequent over anterior than posterior teeth
2. more common on facial /buccal bone
3. bilateral
4. fenestration : maxilla (canine and first molar ;premolar)
5. dehiscence ;mandibular anterior teeth; buccal surface
6. the mesio-buccal root of maxillary first molar located buccally in the arch than the distobuccal root if the buccal bone plate is thin the mesio_buccal root frequently projects through the outer surface Of the alveolar bone fenestration and or dehiscence may occur.

Newman and Carranza's Clinical Periodontology, 13th edition (Elsevier).

Classification of fenestration :

Based on apico_coronal location in relation to root length

1. At the level of apical third of the root (48.5%).
2. At the level of middle third of the root (28%).
3. At the level of coronal third of the root (19%).
4. Extending from apical to the middle third of root (4.3%).

(AK Athienitis, M. Santamouris 2013)

Factor that cause dehiscence and fenestration:

1. Ectopic position of tooth (as buccal position)
2. frenal attachment : pressure on bone can cause bone resorption
3. during orthodontic treatment such as
 - A. direction of tooth movement
 - B. magnitude and frequency of orthodontic force or anatomic integrity
 - C. volume of periodontal tissues
 - D. Dental arch expansion and buccal-lingual movements of teeth can move teeth from their bone envelope and may cause dehiscence, fenestration, and gingival recession, depending on the initial morphology of alveolar bone and amount of tooth movement.

Therefore, orthodontists must know the anatomical limits of tooth movement to secure proper torque control and be aware of potential periodontal problems that can be aggravated during orthodontic treatment.

and dentists should have adequate knowledge of the anatomy of normal bone to achieve satisfactory results, to improve esthetic outcomes and to prevent complications of periodontal, endodontic, and orthodontic treatments. It is recommended that dentists determine the alveolar bone morphology through imaging before treatment.

using cone-beam computed tomography (CBCT), the precise analysis of periodontal defects becomes possible due to the third dimension. Thus, bone defects could be detected significantly more accurate.

Relationship between heavy force and alveolar bone loss dehiscence and fenestration :

- **Orthodontic force will result in the alteration of regulating alveolar bone function as well as its cell. The alteration is including bone formation on tension side and bone resorption on pressure side thus the tooth will move to the new position.**
- **Excessive force will cause the damage of periodontal tissue on pressure region, the adjacent bone will be necrotic followed by undermining resorption.**
- **Excessive force will cause injury by principle fibers rupture in periodontal ligament, and a part of alveolar bone will be necrotic due to vessel injury.**

- **The pressure which is exceeded than the blood pressure will make capillary blood vessel in periodontal ligament collapse, which can inhibit the blood supply.**

Diagnosis of fenestration and dehiscence

A. by using periodontal probe

1. Dehiscence : using graduated periodontal probe, recorded as lack of cortical bone at least 4mm apical to the margin of the interproximal bone
2. Fenestration : difficult to identify through probing as marginal bone is intact

B. by using cone-beam computed tomography (CBCT)

As it 3D images, high definition and sensitivity and ability to evaluate real anatomy with out superimposition of adjacent structure.

(Angle Orthodontics 2012)

Treatment of Fenestration and dehiscence

- Peri-implant defect - Guided bone regeneration
- Modified Pouch and Tunnel Technique — To treat gingival recession
- Bone graft with Guided Tissue Regeneration (GTR).
- Platelet rich fibrin
- Stem cell therapy.

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