

## DENTAL VOLUMETRIC COMPUTED TOMOGRAPHY IN THE RADIOLOGICAL DETECTION OF DENTO-ALVEOLAR FRACTURE

### DENTO-ALVEOLAR KIRIK TEŞHİSİNDE DENTAL VOLÜMETRİK BİLGİSAYARLI TOMOGRAFİ

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#### ABSTRACT

The face occupies the most prominent position in the human body rendering it vulnerable to injuries quite commonly. Fractures of the alveolar process are common while midfacial fractures are less common in children. Undistorted 3-D information of the maxillofacial skeleton as well as 3-D images of the teeth and their surrounding tissues can be obtained from DVCT. In this case report, we presented a 9-year-old boy with fracture of maxillary dento-alveolar process. Root apices, the cortical and trabecular bone and fractures regarding these structures may be clearly visualized on dental volumetric computed tomography.

**Key words:** Dental volumetric computed tomography; dento-alveolar fracture; child; diagnosis

#### ÖZET

Yüz insan vücudunda en ileri ve belirgin pozisyonda bulunur ve bu özelliği nedeniyle hasarlara karşı oldukça sık maruz kalır. Çocuklarda orta yüz kırıkları sık görülmemesine rağmen alveolar kemik kırıklarına sık rastlanır. Çene-yüz iskeleti, dişler ve bunları çevreleyen yumuşak dokuların şekil değişikliği olmayan üç boyutlu görüntüleri dental volümetrik bilgisayarlı tomografi ile elde edilebilir. Bu vaka raporunda maksillada dento-alveolar kemik kırığı bulunan 9 yaşında erkek bir çocuğu sunduk. Dişlerin kök uçları, kortikal ve trabeküler kemik ve bu yapıları ilgilendiren kırıklar dental volümetrik bilgisayarlı tomografi ile net bir şekilde görülebilir.

**Anahtar kelimeler:** Dental volümetrik bilgisayarlı tomografi; dento-alveolar kırık; çocuk; teşhis

#### INTRODUCTION

Dento-alveolar injuries represent a serious dental problem for the patients. Maxillofacial trauma is less common in younger children than in adolescent and adults.<sup>[1]</sup> Injuries to primary and permanent dentition are among the most common types of trauma to occur in the maxillofacial region.<sup>2</sup> In dental trauma, the teeth most commonly involved are maxillary incisors because of their exposed position in the dental arch.<sup>2</sup> Following maxillary incisors,

traumatic injuries affect most frequently in upper and lower lateral incisors and the upper canines.<sup>3</sup> However, the rate of traumatic injury is significantly higher for maxillary incisors, compared to other teeth.<sup>3</sup> Dento-alveolar injuries can occur due to occurrences such as falling, fighting, and vehicle accidents. The incidence of these injuries is variable.<sup>1</sup> Traumatic injuries to the dentofacial complex often cause dental hard tissue injury, periodontal injury and alveolar bone injury or combination of them.<sup>1,4</sup> These injuries may be quite dramatic, with blood, teeth and

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soft tissue debris in the mouth, causing the panic for child and parents.<sup>1</sup> Also, pediatric dento-alveolar fractures need to be managed at the earliest so as to facilitate the normal growth and development of the dentofacial complex.<sup>1</sup> Diagnosis of any dento-alveolar fracture requires a good clinical and radiological examination.<sup>5</sup> In the radiological examination, CT is the gold Standard for viewing craniofacial fractures.<sup>5</sup> However, CT has limitations for dentistry, because of their high cost, large footprint, and high radiation exposure.<sup>6</sup> Over the past decade, dental volumetric tomography (DVT) or other named cone beam computed tomography (CBCT) has been specifically designed for imaging hard tissue of the maxillofacial region. In addition, CBCT has gained wide acceptance and provides many advantages for dentistry.<sup>7</sup> High-contrast objects such as periapical and resorptive lesions, root fractures, root canal anatomy, and the true nature of the alveolar bone topography around teeth may be assessed by CBCT.<sup>7,8</sup> In addition, 3-D images of these structures can be obtained.<sup>7</sup> The high spatial resolution of cone-beam images is particularly important for several applications including treatment planning for dental implants, temporomandibular joints, and both evaluating traumatic injuries and dental and osseous disease involving the craniofacial structures.<sup>8</sup>

This case report focuses on the radiological diagnosis of maxillary dento-alveolar injury by using cone beam computed tomography in a child.

### CASE REPORT

A 9-year-old boy had visited department of oral diagnosis and radiology, dentistry faculty, Ataturk University within 3 hours immediately after the dental trauma with a complaint of swelling on the right maxillary anterior region and pain upon closing the mouth. The patient was conscious, and was found generally in a good condition. There was no evidence of head or neck trauma. Extra-oral examination revealed no significant abnormalities, and intra-oral examination revealed gingival hemorrhage and swelling, mobility of teeth numbered 11,12,13. But, lacerations were not observed. Maxillary left central incisor was fractured but other maxillary incisors were intact. In the radiological examination, signs of any trauma induced alveolar damage were not detected in

panoramic radiogram (Figure 1). With his parent's consent, we decided to perform a DVT scan for obtaining more detailed location and definition of the traumatic side. We used flat panel detector-based cone beam computed tomography (FPD-CBCT) (NewTom FP, Quantitative Radiology, Verona, Italy) in our department. CBCT analysis were made using the NewTom-FP software of axial and crosssectional images. In CBCT images, a maxillary dento-alveolar fracture was detected in the anterior maxillary region (Figure 2-4). Then, the patient referred department of oral and maxillofacial surgery to treat the fracture.



Figure1. Alveolar bone damage and the signs of any trauma were not shown on the conventional panoramic radiogram.



Figure 2. Maxillary dento-alveolar fracture, axial slice. On the right, fracture of alveolar bone (white arrow). CBCT scans reveal the presence and displacement of fractured alveolar bone.



Figure 3. Maxillary dento-alveolar fracture, axial slice. On the right, CBCT scans reveals the presence of widened periodontal space and displacement of teeth 11,12,13 (white arrow).

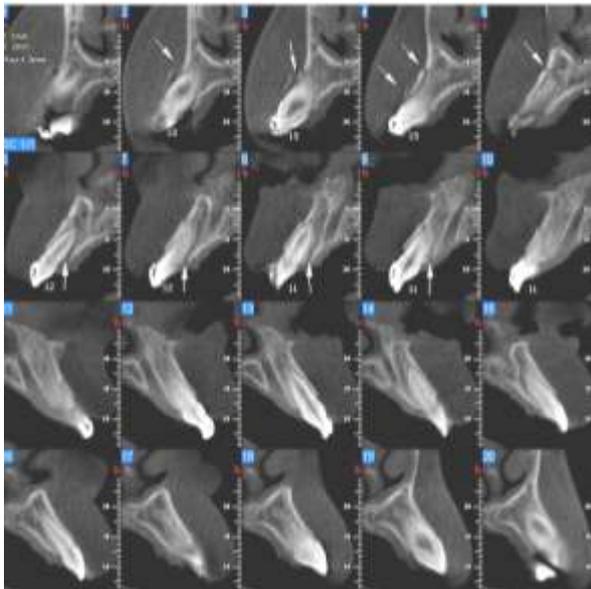


Figure 4. Maxillary dento-alveolar fracture, sequential cross-sectional slices. CBCT scans reveals the presence of widened periodontal space and displacement of teeth 11,12,13. CBCT scans also reveal the presence of bone fractions and displacement of fractured alveolar bone as a result of trauma (white arrow).

## DISCUSSION

Detection of dento-alveolar fractures is an important diagnostic task in that it affects treatment planning.<sup>9</sup> In detection of dento-alveolar fractures, intraoral radiography is the principal imaging modality.

Occlusal radiographs provide a larger field of view, with good detail. The panoramic radiography is useful as a screening view and can demonstrate unrecognized fractures of the jaws as well as indirect fractures of the alveolar ridges on teeth.<sup>8</sup> But, the literature suggest that conventional diagnostic methods to detect dento-alveolar fractures exhibit low diagnostic efficacy, because detection is limited due to projection geometry, the superimposition of anatomic structures, and processing errors.<sup>8,10,11</sup> In our case, panoramic radiography did not show a dento-alveolar fracture line from right upper canine to left upper central incisors. In addition, the fracture affected the palatal surface of these teeth. Because of this, we support that conventional film-based radiographies exhibit low diagnostic efficacy. While conventional CT provides 100% accuracy, this modality is not appropriate or practical for routine use being cost and dose prohibitive.<sup>8</sup> DVCT is a relatively new three-dimensional imaging technique requiring a significantly lower radiation dose than conventional CT.<sup>6</sup> CBCT may prove useful in the diagnosis of dento-alveolar trauma, because the exact nature and severity of alveolar and luxation injuries can be assessed from just one scan (Figure 2-4). Dento-alveolar fractures may have needed multiple periapical radiographs taken at several different angles to be detected and even than may not have been visualized.<sup>7</sup> A major advantage of DVCT is the three-dimensional geometric accuracy compared with conventional radiographs.<sup>7</sup> Sagittal, coronal and axial CBCT images also eliminate the superimposition of anatomic structures.

## CONCLUSIONS

DVT, which used in dentistry to image high-contrast objects such as teeth and bone, has advantages compared with conventional radiologic techniques such as panoramic film. In this case, a dento-alveolar fracture in anterior maxillary region was detected easily by using DVT; however that fracture line cannot observe in panoramic film. This case had importance to that, the use of DVT technology especially in complex bone destructions and fractions gives more true information for diagnosis when compared with conventional radiographic techniques.

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