# Diagnostic and Management Challenges and Medico-legal Impacts of Multiple Dento-Alveolar Injuries: A Case Report

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**Abstract**
Dento-Alveolar Injuries (DAI) usually present with multiple trauma to many teeth and alveolar bones. Treatment protocols vary according to the type of injury. The prognosis is determined by the type of injury and adherence to the recommended treatment protocol. A pedestrian who has been knocked down by a motorcycle presented with an alveolar bone fracture where the plain radiographs implied to have root fractures. Meticulous clinical assessment together with confirmative investigation using Cone Beam Computerized Tomogram (CBCT) revealed the absence of root fractures. This enabled the implementation of a proper treatment protocol and a better prognosis for the affected teeth. It had a significant impact from a Medico-legal point of view as it determined the absence of root fractures and the presence of only alveolar bone fractures. Therefore, reduced the number of grievous injuries. Thus, it can affect the amount of punishment given to the motorcycle rider and the compensation given to the victim by the court.

**Keywords:** Cone Beam, Dento-alveolar Injuries, Computerized Tomogram (CBCT), Medico-legal Impact Review protocol, Root fractures

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## Introduction

Root fractures of teeth convert the category of hurt of mobile teeth into grievous hurt under limb g (fracture) of section 311 of the penal code.[1] At times a single radiograph may be misleading toward a wrong diagnosis and management. Modern radiographic techniques are at times mandatory in determining the exact underlying pathology. This saves a lot of time and cost to the patient and the health system. Furthermore, it helps in determining the proper prediction of the prognosis and complications easing the medico-legal implications.

A careful diagnosis is obligatory in determining the optimal care for the patients following DAI. The described case highlights the importance of determining the diagnosis by mediating through clinical and other investigations. A traumatic dental injury (such as a serious sports injury, violence, or traffic accident) can cause an alveolar bone fracture or root fracture, which causes tooth loss, luxation/ sub-luxation and malocclusion.[2,3] Any suggestion of alveolar or root fractures should be further investigated with an appropriate radiograph or Cone Beam Computed Technology (CBCT).[4]

## Case report

A 30-year-old male presented to the dental clinic at the Naval Head Quarters, Colombo, complaining of an injury to the front teeth following being knocked down by a motorbike while walking along the road.

The facio-maxillary examination revealed that the upper right central, lateral incisor, and canine were having grade 3 mobility. Lip lacerations were bleeding, and the upper right canine showed tenderness to percussion. A full mouth assessment was done and there were no other injuries.

A peri-apical radiograph was taken and the diagnosis of alveolar bone fracture and root fracture in both upper right side lateral incisor and the canine was made. Since root fracture was diagnosed a composite splint was done on the palatal aspect from the left canine to the right canine (Figure 1). In addition, a soft tissue radiograph of the lower lip was taken to identify any foreign bodies within the soft tissues. It revealed numerous tiny radio-opaque masses within the lip. Since the numbers are many and of very small sizes, it was decided to leave them without surgical intervention.

Figure 01. Radiograph following the immobilization done at the OPD. The red arrow suggests the existence of a root fracture. The composite splint is visualized as a white-coloured band.

The sensibility test was done with the electric pulp tester and the results are shown in Table 1.

For expert opinion and management, the patient was referred to the consultant restorative clinic at the Naval General Hospital, Welisara. The patient was assessed at the consultant Restorative Unit. The central incisor was discoloured and had tenderness. The sensibility was done with heated gutta-percha and the results are shown in Table 1.

Table 1. Sensibility test results of upper anterior teeth

| Type of Sensibility test | Upper right canine | Upper right Lateral incisor | Upper right Central incisor | Upper left Central incisor | Upper left Lateral incisor |
|---|---|---|---|---|---|
| Electric pulp tester | 35 | 34 | 80 | 25 | 35 |
| Gutta-percha | (+) | (+) | (-) | (+) | (+) |

Examination revealed mobility of both upper right incisors and the canine. The radiographic assessment was correlated to the clinical findings to have a tentative diagnosis of alveolar bone fracture not involving the roots. This was contrary to the diagnosis made at the OPD level i.e. fracture of the roots in both upper central & lateral incisors.

The patient was informed about the possible diagnosis, management and treatment outcome. The patient's previous photographs revealed that there was a median diastema (space between the 2 front teeth) between the central incisors (Figure 2A). It was useful in determining that there was no displacement of teeth due to trauma. The palatal composite splint was removed, and a labial splint was placed from the upper right canine to the upper left lateral incisor (Figure 2B). This splint was performed using a wire and composite.


Figure 2A. The patient's pre-traumatic photograph showing the spacing between the front teeth indicated with a red circle,

Figure 2 B. Composite and wire splint. Note the healed wounds on the lower lip indicated by a white arrow

Since the central incisor was giving a non-vital response, discoloration and tenderness root canal treatment was started. The root canal was dressed with calcium hydroxide (Figure 3).

Figure 03. . The upper central incisor following root canal dressing with calcium hydroxide. The arrow shows the disappearance of the "pseudo" fracture line which was present before.

Since the diagnosis was not confirmed the patient was referred to the radiology department at the Faculty of Dental Sciences, University of Peradeniya, for CBCT and reporting for exclusion of any root fractures. The Cone beam radiography report revealed that there were no root fractures in the upper right lateral incisor and canine (Figure 4).

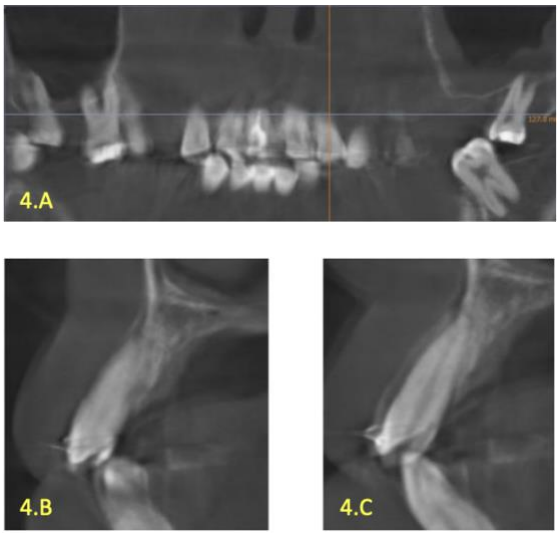


Figure 04. The radiograph a. shows the full mouth CBCT, the radiograph b. shows the absence of any fractures in the right lateral incisor and the radiograph c. shows the absence of any fractures in the right canine

At the review visit with the CBCT findings, the treatment planning was amended, adapting to the new diagnosis. As it was only an alveolar bone fracture not involving roots, it was decided to leave the splint only for 4 weeks adapting to the trauma guidelines. At the same visit, it was noticed that there is still some tenderness in the central incisor. The guidance was assessed and noticed that the upper right central incisor was the sole tooth involved during the forward guidance of the lower jaw. The anterior guidance associated with the upper central incisor was relieved. The patient was given an appointment to be reviewed in completion of one month from the placement of splinting.

At one month's review, the patient revealed that there was no tenderness, pain, or mobility of his teeth. The Splint was removed, and the sensibility testing was performed in the upper anterior teeth. The sensibility testing revealed that all upper anterior teeth gave positive responses except the upper right central incisor which was root filled.
The patient is on routine review protocol.

**Discussion**

DAI is always embraced with medico-legal implications.[24] Treatment protocols and prognosis are varying with the type of injury. Careful diagnosis and institution of the recommended treatment plan are mandatory for better treatment outcomes.[25] The diagnosis is equally important from a medico-legal point of view, especially in determining the category of hurt and compensation. [26, 27] Since the complications associated with these injuries do follow after long years it is always recommended to determine the prognosis and possible methods of rehabilitation in the long run.

An adequate investigation is mandatory to determine the exact type of injury in DAI. This will determine whether the injury is grievous or not. Such determination also contributes to identifying the compensation.

DAI compromise the patient's day-to-day activities.[5] They occur unexpectedly and impose a huge social, aesthetic, and psychological impact on patients. Implementing the best treatment plan will please the patient in many ways.[6] This also helps in minimizing complications and avoiding undesired treatment.

The case presented here gave a challenge to the clinician at the general practice level. Nevertheless, the emergency management performed at that level was a blessing in alleviating pain and other associated complications. The patient presented with the mobility of teeth. This sort of mobility can be due to various reasons. The common causes are sub-luxation, luxation injuries, root fractures, alveolar bone, and basal bone fractures.

The universally accepted classification of tooth mobility is Miller's classification. Accordingly, Class 1 describes >1mm of tooth mobility in a horizontal direction, class 2 has< 1 mm mobility in a horizontal direction and class 3 describes < 1mm in a horizontal direction with vertical mobility. The patient has originally presented with the most extensive type of mobility (class 3) affecting 3 teeth

The initial radiograph usually indicates the type of trauma together with the information obtained with clinical assessment.[7] In the described patient the tooth was in the original position and mobile. The mobility was too extensive to be more than a sub-laxative injury. Since there was no change from the original position, luxation injury too was excluded. The decision of any displacement of the tooth/teeth is obtained considering the patient's opinion, occlusion (the bite), and previous photographs if available. Ultimately it was to be diagnosed either as alveolar bone fractures or having both alveolar bone and root fractures. Without concluding the diagnosis, the patient was managed in the OPD with minimally invasive and conservative means. The splinting relieved the patient's pain and discomfort.

Sometimes the pre-existing periodontal disease may even lead to increased mobility of teeth even following trivial trauma. Root fractures associated with periodontal bone loss present a poor prognosis.[8] This patient's periodontal condition was assessed initially, and he was free of any active disease.

Root fracture occurs most often in the middle third of the roots of fully erupted and fully formed teeth. However, root-treated teeth are more susceptible to root fracture, as this involves removing root dentine, thereby weakening the tooth.[9] They often present with discomfort or soreness, which may be associated with an infection. Pain is usually mild to moderate in its intensity.[10]

According to the studies, the prevalence of alveolar fractures is lower than root fractures.[11] The kappa values for alveolar fractures ranged from fair to good, in contrast to root fractures, which ranged from good to excellent, leading us to consider that it is more difficult to diagnose alveolar fractures in CBCT.[12]Yet the alveolar bone fracture was obvious in this patient and the query was about the presence or absence of root fractures.

Alveolar bone fractures are categorized into two types. The first type is confined to the area surrounding a single tooth and the second type is defined as regional which is generally easier to detect since the entire dentoalveolar segment is dislocated.[13, 14]. The presence of complete or incomplete alveolar fractures may be observed in the human maxilla.[10]. Incomplete alveolar fractures occasionally produce false-negative results.[12]

Alveolar fracture results in tooth mobility, pain, pulpal necrosis, tooth loss, external root resorption, or alveolar bone loss.[15] The alveolar bone should always be examined for fractures where luxation, avulsion, or other tooth injury is detected.[16] Any suggestion of alveolar fractures requires immediate repositioning and immobilization of the bone fragments for 4 weeks, suturing of lacerated soft tissues, administering antibiotic therapy when necessary and providing clinical and radiographic follow-up.[3] Such standard of care was provided at the dental OPD level for the patient

Following referral, to the Restorative unit, it was clinically diagnosed as not having root fractures. The fulcrum of mobility, teeth involved in mobility and careful assessment of other investigations were all contributory in this regard. Yet again it is not conclusive, and a confirmative reliable diagnosis is always mandatory for optimal treatment outcomes. Furthermore, the splinting time required for root fractures is more extensive which is usually 3 months of duration. Contrary, the splinting requirement for alveolar bone fractures is just 4 weeks.[17] At this juncture, the CBCT was of utmost importance for ratifying the diagnosis. CBCT report revealed the absence of root fractures. This was more of a blessing for the patient as the splinting time was reduced by one-third.[18,19] Furthermore, the prognosis would have been worse if the root fractures were present.[20]

Management of root fractures is usually complex and strenuous. Root fractures in the cervical third present a poor prognosis and their treatment requires coronal fragment removal. Thereafter the apical fragment is orthodontically extruded and restored, alternatively, tooth extraction and replacement is performed.[21] Root fractures require long-term clinical and radiological follow-up. Assessing the pulpal vitality/ sensibility and integrity of the apical neurovascular supply is very important in traumatized teeth as they are vulnerable to lose the neuro-vascular supply. The test is performed either by using a heated object (eg. Gutta Percha) or by using an electrical impulse to assess the patient's response to determine the intact nerve supply of the tooth. The oblique root fractures may have a comminution aspect shown in the periapical radiograph with a good prognosis following clinical and radiological follow-up.[22] These should not be misdiagnosed with alveolar bone fractures.

Teeth that present with damage to the apical neurovascular supply have a poor prognosis in terms of pulp necrosis.[8] This is the probable reason the upper right central incisor becomes non-vital following trauma.[23] It was a luxated tooth showing extensive mobility. Subsequently, the tooth was root–filled and turned to be free of symptoms and function as a normal counterpart.

This case proves the importance of meticulous emergency management and subsequent specialist care in providing optimal care to the patient. Advanced facilities in radiography enable clinicians to make the right decisions and protect patients from unwanted treatment/ interventions.

This further helps in the reliable prediction of the treatment outcome which is also critical from a medico-legal point of view.

**Conclusions and recommendations**

DAI are quite common amongst present populations. They usually present with multiple injuries. Optimal diagnosis is challenging. Yet again it is indispensable in-patient management. Modern radiographic facilities merged with clinical expertise contribute to achieving the rational diagnosis and best care for the patient. An adequate investigation is mandatory to determine the exact type of injury in DAI. This will determine whether the injury is

grievous or not. Such determination also contributes to identifying the compensation

From the Medico-legal point of view, the determination of the absence of root fractures and the presence of only alveolar bone fractures reduced the number of grievous injuries. This reduces the amount of punishment to the motorcycle rider and the amount of compensation granted to the victim by the court.

Usually, DAI involves multiple injuries. Meticulous clinical and radiographic diagnosis is compulsory. Precise diagnosis determines the best treatment outcome and avoids unnecessary interventions. They also determine the magnitude of the medico-legal impact.

**Disclosure statement**

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