



# Traumatic genial tubercle fracture: a case description with 9-month radiographic follow-up and a literature analysis

Ahmad Albassal<sup>1</sup>, Nuraldeen Maher Al-Khanati<sup>1,2^</sup>, Munir Harfouch<sup>1</sup>

<sup>1</sup>Department of Oral and Maxillofacial Surgery, Faculty of Dental Medicine, Damascus University, Damascus, Syria; <sup>2</sup>Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Syrian Private University, Damascus, Syria

*Correspondence to:* Nuraldeen Maher Al-Khanati. Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Syrian Private University, 36822 Damascus, Syria. Email: nuraldeen.alkhanati@gmail.com.

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## Introduction

Mandibular fractures are one of the most frequent fractures of facial bones (1). Diagnosis of these fractures can be determined by both clinical and radiological examination. Clinical findings may reveal alterations in occlusion, soft tissues laceration, alterations in lower lip and/or tongue sensation, and possible mouth floor elevation (2).

Genial tubercles are sharp projections of bone on the lingual aspect of the mandible around the midline and at a mid-point between its inferior border and lower incisors apices (3,4). The morphological pattern of genial tubercles is very variable. Moreover, it is not influenced by the facial type or skeletal pattern (3). Five patterns (*Figure 1*) were described in the literature: the classical four spines (two inferior and two superior tubercles), two superior tubercles with one fused inferior tubercle, two superior tubercles with a rough impression below, one single median projection, or absence of any bony projections (5). They provide attachment for the genioglossus and geniohyoid muscles (5).

Fracture of genial tubercle is an avulsion of the tubercle or a separation of the inner cortex along with the tubercle (2). According to the mechanism of injury, it can be classified into two types: denture-associated fracture in an atrophied mandible; and tubercle fracture in traumatically fractured mandible (2). The first type may occur due to repeated collisions of the removable denture edges on the tendinous attachment of the genioglossus muscle leading to multiple

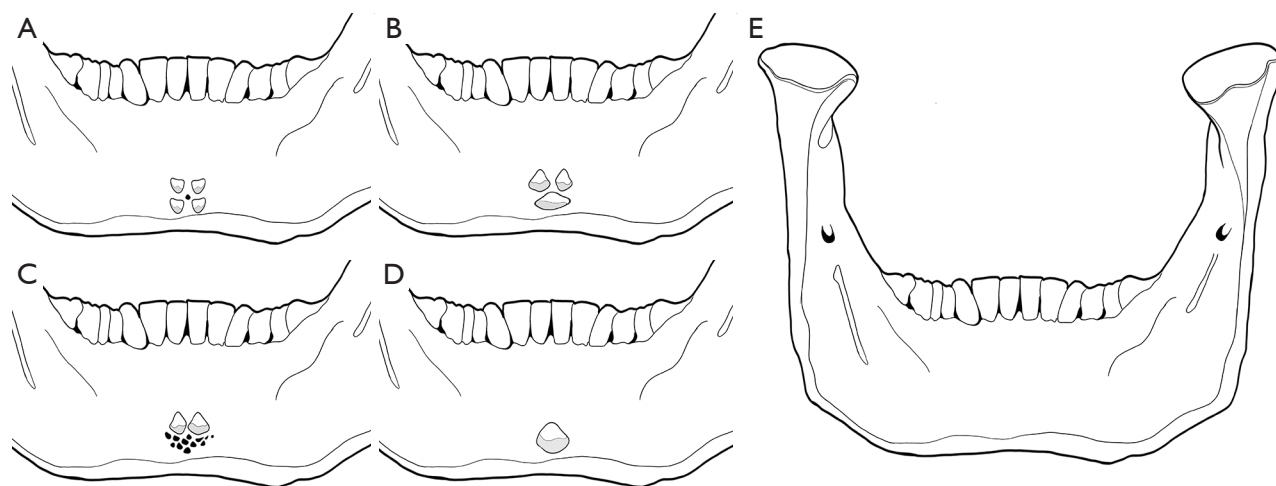
micro-fractures in the area of the tubercle (6). On the other hand, the genial tubercle fracture, which is associated with mandibular fracture, is rare with very few reported cases in the literature. This report aims to describe a case with this type of genial tubercle fracture and the offered conservative management. We also performed a literature search in PubMed, Scopus, and Google Scholar from inception until 10th of December 2020 with a combination of keywords (Trauma OR Symphysis OR Parasymphysis OR Parasymphyseal Fracture) AND (Genial Tubercle Fracture).

## Case presentation

A 22-year-old male patient was brought to the emergency services of a university hospital (Damascus, Syria) after suffering a traffic accident. A primary examination showed no head or spinal injuries. He was conscious, fully oriented, and did not experience vomiting, loss of consciousness, nor hemorrhage from the nose or ear. The patient's medical history revealed no underlying health problem, only that the patient was a smoker. He experienced painful and limited mandibular movements and mouth opening. However, speech-language pathology assessment and swallowing test showed neither speech difficulty nor dysphagia.

On profound clinical examination, extra-oral findings involved diffuse swelling and bruising in the mental and submental regions. The swelling was very painful on palpation. Palpation also revealed a step-like defect at

<sup>^</sup> ORCID: 0000-0001-9069-5069.



**Figure 1** Morphological patterns of the genial tubercles. (A) Type 1: the classical four tubercles. (B) Type 2: two superior tubercles and one fused inferior ridge below. (C) Type 3: two superior tubercles with rugged impression below. (D) Type 4: single median spine or projection. (E) Type 5: absence of genial tubercles.



**Figure 2** Patient's panoramic X-ray showing left parasymphyseal fracture of the mandible.

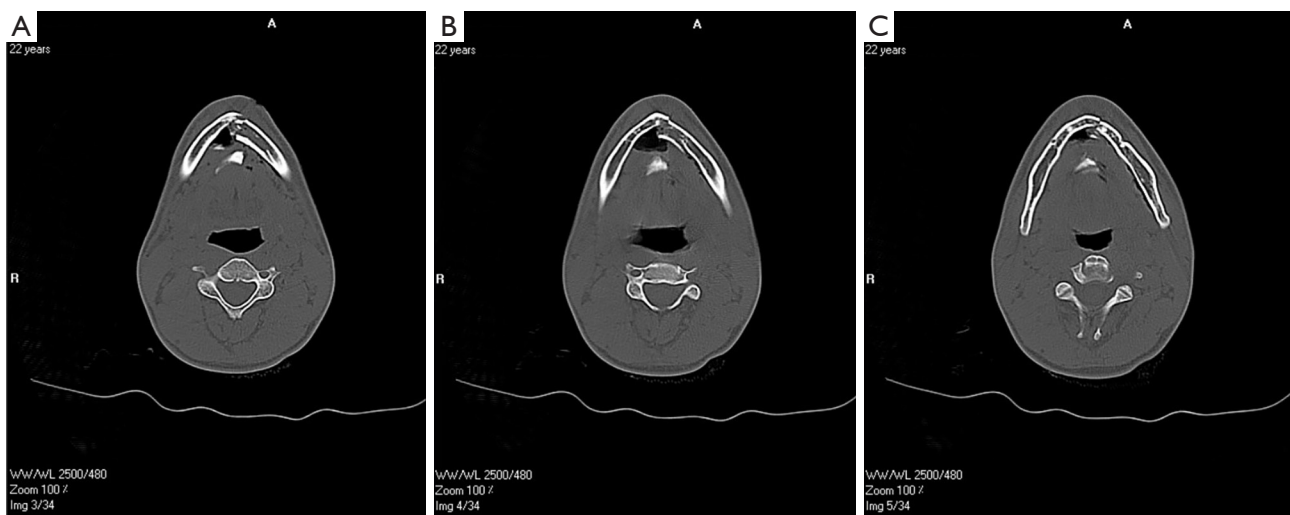
the lower border of the mandible in this region. Intra-oral findings included alterations in teeth positions and occlusion, step deformity in the left parasymphysis of the mandible and ecchymosis on floor of the mouth without being elevated. The patient was breathing normally with no signs of distress or airway obstruction. Nonetheless, the patient was kept under observation because compromise of patient's respiratory status could occur several hours after injury (2).

On radiographic exam, the panoramic radiograph revealed a left parasymphyseal fracture (*Figure 2*). Other splitting and avulsion fractures of the mandible couldn't be detected by panoramic radiography (7). Computed tomography (CT) image displayed a fracture on left parasymphysis and a splitting lingual-plate fracture with an avulsion fracture of the genial tubercle. The genial tubercle appeared on CT as a well-defined, radio-opaque object that

was triangular in shape, and suspended in the soft tissues of the floor of mouth (*Figure 3*).

Based on the clinical and radiographic findings, a definitive diagnosis of three fractures of the mandible was made. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal. The patient agreed to use his clinical/radiographic findings for academic purposes while concealing his identifying personal data. Treatment plan and decision were made to perform routine open reduction and internal fixation of the anterior mandibular fracture. Bicortical screws were used because the mandibular fracture line was not simple, but irregular, and as an attempt for rigid fixation of lingual-plate split fracture. The genial tubercle fracture was conservatively managed without any active intervention as long as the detached fragment of the mandible was not interfering with tongue movement or breathing. The patient was intubated only during the surgery, and extubated immediately post-surgery without issues.

The patient was followed up for nine months. The fracture healing during this period was uneventful. Normal tongue movements and functions were reported



**Figure 3** Immediate CT image of the patient showing the fractured mandible including the avulsed genial tubercle. CT, computed tomography.

by the patient in each follow-up appointment. Two cone-beam computed tomography (CBCT) follow-up images were made 10 days and 9 months post-surgery (*Figure 4*). Superimposition of these two images was made using OnDemand3D Software V1.0 (Cybermed Inc.; Seoul, Korea) in order to observe the differences in the position and shape of the avulsed tubercle (*Figure 4C*).

## Discussion

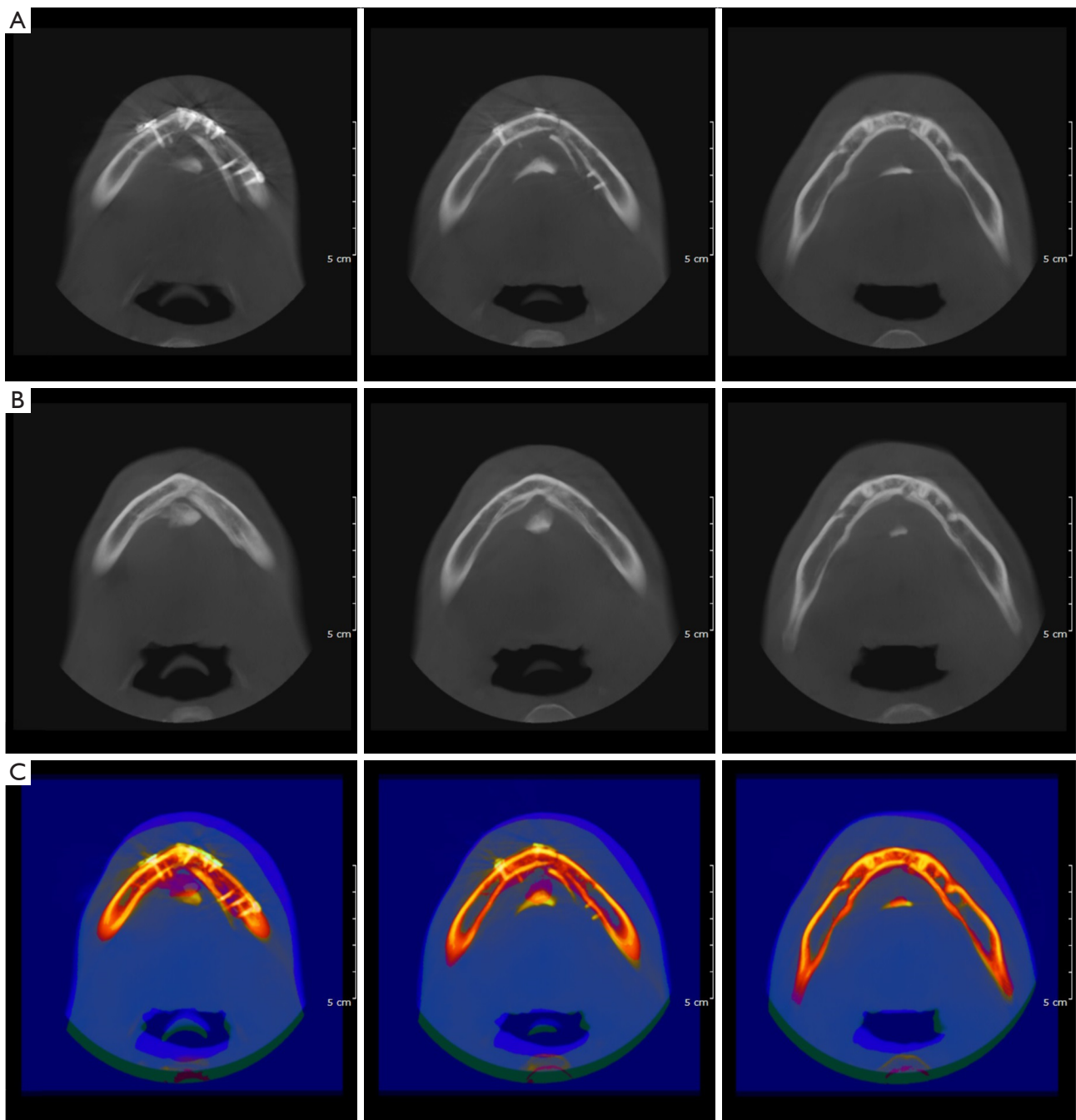
Genial tubercles are classically a group of four bony lingual extensions in the mental symphysis area of the mandible (5). They sometimes become more prominent because of calcification of the genioglossus muscle tendinous insertion (8). Genioglossus muscles play an important role in the protrusive extrusion of the tongue (9). Further, additional actions, related to respiratory, speech and swallowing functions, are believed to be performed by this muscle (9). In this report of genial tubercle fracture, this muscle was responsible for the posterior displacement of the fractured bony fragment. Moreover, the patient was expected to be unable to protrude his tongue (the main function of this involved muscle), but unexpectedly this was not the case after following up the patient.

Although the patient's airway volume was reduced as his CT images indicated, the patient's airway was apparently wide enough not to cause respiratory distress. Absence of lingual vessels injury was fortunately another factor that helped in avoiding airway concerns. However, the patient's

blood oxygen level was continually monitored. As it was found within normal ranges, emergency endotracheal intubation was not needed. Genial tubercle fracture was examined intraorally by bimanual manipulation. Bimanual manipulation of the jaws revealed mobility of the fractured fragments. Step-offs were found by palpating the internal and external surfaces of the mandible. Pain provoked by this manipulation was an additional sign of fracture.

On reviewing the medical literature, we have found 12 documented cases were reported heretofore (2,10-16). These cases of combined mandibular fractures with genial tubercle separation were summarized (*Table 1*). High-energy traumatic force probably striking the front of the chin was thought to indirectly cause lingual bone fracture or genial tubercle avulsion due to the propagation of the impact. All patients (100%) were males, while none of them was female. Their mean age was 28.25 ( $\pm 12.45$ ) years. This was in contrast to reported cases that were associated with edentulous jaws without history of trauma, where most of them were old females (17).

Many cases of genial tubercle fracture were surgically managed due to the presence of symptoms including speech difficulty, edema of mouth floor, dysphagia, and/or posterior displacement of the tongue (2,10-12,14,16). These fractures could be potentially fatal. In such cases, open reduction and fixation of the fractured genial tubercle restored normal swallowing and breathing functions. Limited tongue movement was rarely reported (17). On the other side, some cases of genial tubercle fracture, including the



**Figure 4** Comparison of two post-surgical CBCT images. (A) Radiographic examination after 10 days from surgery. (B) Radiographic follow-up after 9 months. (C) Superimposition of the two images showing the differences in the position and shape of the fractured genial tubercle. CBCT, cone-beam computed tomography.

present reported case, were left without any active surgical intervention (13,15). This was done after assuring that the patients had normal preoperative tongue movements with no associated respiratory distress. In this instance, leaving

the separated bony fragment to remain suspended in the mouth floor resulted in a favorable outcome.

In this case, muscular attachments of genioglossal and geniohyoid muscles apparently were not completely cut off.

**Table 1** Patients with genial tubercle fractures which were associated with facial trauma

Study, location	No. of cases	Gender	Age	Management	Follow-up period	Description
Graham <i>et al.</i> 2020, Auckland (New Zealand)	1	Male	26	Surgical	Not mentioned	A car accident caused mental symphysis fracture and genial tubercle avulsion. The report described surgical management of genial tubercle fracture via transoral approach (10)
Sasaki <i>et al.</i> 2019, Tokyo (Japan)	1	Male	34	Surgical	7 months	The patient's lower jaw was fractured due to a traffic accident. The separated fragment of the genial tubercle was surgically pulled, repositioned and fixed with lag screws to the outer cortex (11)
Manoj <i>et al.</i> 2015, Kerala (India)	1	Male	54	Surgical	3 months	The patient was hit with an iron rod while working, causing a fractured mandible in the anterior region with displaced fractured genial tubercles to mid-floor of mouth. This case was treated surgically by titanium rigid fixation plates and screws (12)
Buduru <i>et al.</i> 2015, Andhra Pradesh (India)	1	Male	52	Conservative	3 months	The patient was diagnosed with mental symphysis fracture and displaced genial tubercle fracture after a road traffic accident. The fractured genial tubercle was left in the mouth floor without any active intervention (13)
Elshal 2012, Mansoura (Egypt)	1	Male	28	Surgical	6 months	Fractured mandible with separated unilateral fracture of genial tubercles was reported. Surgical intervention and open reduction were done. Miniplates was used to fix the mandible and the lingual fragment was placed into its place with position screw (14)
Ryan <i>et al.</i> 2010, Washington, DC (USA)	1	Male	22	Surgical	Not mentioned	The patient had right parasymphysis fracture with separated genial tubercle after being hit with the end of a pistol. The genial tubercle was surgically reattached to the mandible using transosseous wiring osteosynthesis (2)
Maw and Lindsay 1970, IL (USA)	5	5 Males	18–21	Conservative	3–12 months	All patients had sustained gunshot facial wounds associated with mandibular symphysis and genial tubercle fractures. Palliative treatment with no surgical intervention was reported (15)
Davis 1894, Philadelphia, PA (USA)	1	Male	26	Surgical	10 weeks	A patient with evidently fractured jaw through the symphysis, and separation of the genial tubercle was surgically managed by silver suturing and wire splinting (16)

There was no noted limited tongue movement, dysphagia or airway obstruction. This might be explained by the anatomical possible variation that these muscles might not originate only from the genial tubercles, but rather extended beyond them on the lingual surface of the mandible (18). Further, action of these muscular fibers and healing of these muscles over time could be a potential reason for the noted anterior advancement of the fractured tubercle when comparing its position related to the mandible at different follow-up periods. The change in the shape of the separated

bony fragment between the first and 9-month follow-up periods indicates the occurrence of bone remodeling with an increased anterior bony deposition, bringing the piece closer to the lingual side of the mandible (*Figure 4*).

One of the strengths of this case report is being uncommon. It provides description of one of the few reported traumatic genial tubercle fracture cases in the literature. To the best of our knowledge, no previous publication described the potential anterior repositioning and remodeling of the fractured genial tubercle, as showed in

the follow-up radiographs, if left without active intervention. Speaking of which, this would significantly shorten the operative time, and minimize the need for additional detachment of periosteum which is the most important tissue in fracture healing process and bone repair (19).

Surgical intervention to reach, reduce and re-fix the fractured genial tubercle was not chosen in this case because it would have been very invasive, and was believed to cause more edema that might delay extubation post-surgery to protect patient's airway (20). The patient was satisfied with the treatment provided to him. Moreover, conservative management of genial tubercle fracture, when possible, is clearly more cost-effective. However, this treatment modality is limited to cases, where clinical findings confirm no risk of airway obstruction with the utmost importance of frequent clinical and radiographic follow-up.

## Conclusions

Genial tubercle fracture in combination with other mandibular fractures following traumatic facial injury doesn't appear to be so common. The decision of open reduction and fixation of the fractured tubercle is mainly dependent on the presence of breathing, speech, and swallowing dysfunctions. Otherwise, conservative management can avoid many unexpected surgical difficulties and complications, and may give very favorable results.

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## Footnote

*Conflicts of Interest:* All authors have completed the ICMJE uniform disclosure form (available at <https://qims.amegroups.com/article/view/10.21037/qims-21-736/coif>). The authors have no conflicts of interest to declare.

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional

and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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