Management of the fractured maxillary tuberosity

The maxillary tuberosity is the most distal anatomical landmark in the maxilla bilaterally, and is an important consideration for dentists when planning upper molar extractions. Maxillary tuberosity fracture is one of the many risks associated with extraction of an upper molar tooth (**Figure 1**) and carries considerable morbidity if not managed appropriately. While the overall incidence of this complication stands at around 0.6%, figures as high as 18% have been reported for maxillary third molar extractions.[1] Operator inexperience is often cited as a risk factor for maxillary tuberosity fracture (**Table 1**); however, it is worth noting that this complication is not always preventable and can arise in even the most experienced of hands. Recognising the immediate signs of tuberosity fracture is crucial to the successful management of this complication. These include, but are not limited to:

- loud cracking noise;
- palatal mucosal tear;
- mobile alveolar segment; and,
- excessive bleeding.

Management options will vary depending on the site of the fracture and the size of the resulting defect. The immediate goal is to achieve stabilisation of the fracture segment, and to provide optimum pain management for the patient. What follows is an overview of the options available to dental practitioners for the immediate management of this complication. It is hoped that the tips provided herein will equip clinicians with the necessary knowledge and clinical expertise to achieve successful outcomes for their patients.

Treatment options

1. No intervention

In many instances, a fractured tuberosity is an incidental finding following an otherwise routine extraction of an upper third molar with no associated soft tissue trauma (**Figure 2**). In these cases, where there is no communication with the maxillary antrum, no intervention is required other than to explain this finding to the patient and reassure them that all should heal without incident.

2. Dissection of segment from mucosa

Where the tuberosity fractures during extraction of an upper third molar, but the segment remains attached to the epithelium, careful dissection of the tooth and bone segment should be undertaken with a periosteal elevator to enable delivery of the segment without causing any further mucosal trauma. The resulting soft tissue defect is then closed using resorbable sutures to achieve a seal from the oral cavity, and to promote soft tissue healing.

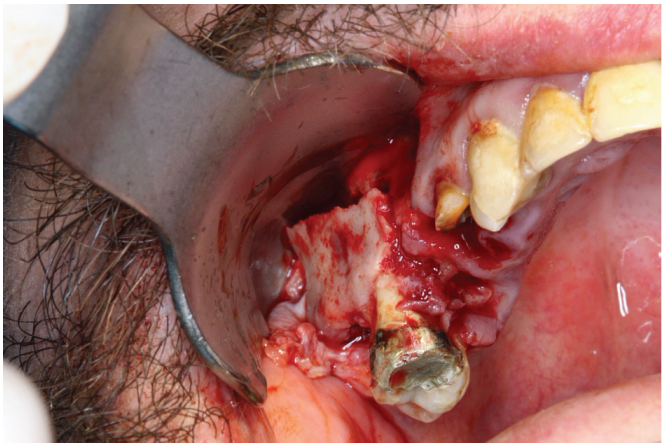

FIGURE 1: Clinical photograph showing right-sided maxillary tuberosity fracture during attempted removal of the UR7, three days following removal of the UR6.

Table 1: Risk factors for maxillary tuberosity fracture.

Divergent roots
Bulbous roots
Lone-standing molar
Ectopic third molars
Ankylosis
Multiple extractions in a single quadrant
Low-lying (pneumatised) maxillary antrum
Increasing patient age
Excessive force during elevation
Unsupported extraction technique

FIGURE 2: Left maxillary tuberosity fracture during routine extraction of UL8.

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Table 2: Postoperative regime for patients with large tuberosity fracture.

Soft diet
Excellent oral hygiene
Chlorhexidine 0.2% mouth rinse for one week
Paracetamol and non-steroidal anti-inflammatory analgesia, unless contraindicated
Oral antibiotics for one week, e.g., amoxicillin 500mg or suitable alternative if penicillin allergic

FIGURE 3: Vacuum-formed dual-strength splint extending over entire occlusal table, which can be used for stabilisation of a tuberosity fracture.

3. Composite wire splint

Tuberosity fractures encountered during extraction of an upper first or second molar in an otherwise fully dentate arch will result in a very large mobile bony segment. In such instances, the clinician must immediately abandon the extraction. Any attempt to deliver the resulting mobile segment in such cases would involve inadvertent partial maxillectomy, with considerable medicolegal implications for the clinician involved.

One management option here is to stabilise the dentoalveolar segment using a composite wire splint. The splint should be large enough to offer maximum stability; for every tooth involved in the fracture segment, at least one unaffected tooth should be included in the splint. As with any bony fracture, a minimum of six weeks is required for the initial stages of osseous healing, so the splint should remain in place for a minimum of six to eight weeks. Pain management during this time is crucial, and steps should be taken to address any active dental disease, such as placement of a zinc oxide and eugenol dressing, or performing primary endodontic treatment to manage dental pain until such time as it is safe to proceed with the extraction. Appropriate postoperative instructions should be followed by the patient (**Table 2**). Onward referral to oral surgery is recommended for removal of the offending tooth as surgical extraction may be indicated.

4. Vacuum-formed splint

An alternative to the traditional composite wire splint, which can be challenging to execute where there is active bleeding, is fabrication of an immediate vacuum-formed splint (**Figure 3**). This will require an on-site laboratory technician or an obliging local technician who could fabricate the splint on an urgent basis. This splint is worn by the patient full time for six to eight weeks, and is removed for cleaning. Judicious plaque control is essential for patients wearing such a prosthesis, and this should be emphasised at the outset.

Postoperative instructions are the same as for patients with a composite wire splint, and a referral should be made to oral surgery for removal of the tooth after a suitable healing period.

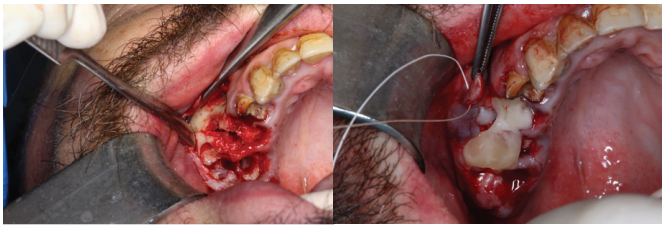

FIGURE 4: Patient in Figure 1 following surgical removal of the UR7. A: Reflection of a full-thickness mucoperiosteal flap showing reduction of the fracture segment. B: Reduced fracture segment stabilised with bone wax, and covered with plasma rich in growth factors (PRGF) to promote and accelerate healing at the site.

5. Autologous platelet concentrates

Special consideration should be given to the edentulous posterior maxilla. Extraction of the lone-standing upper molar is a prospect that fills even the most seasoned clinician with a sense of foreboding, and not without reason. The dual processes of alveolar resorption and maxillary sinus pneumatisation place the lone-standing molar at very high risk of tuberosity fracture and oro-antral communication. The latter complication is beyond the scope of this article.

Figure 4 shows the intra-operative management of the patient featured in **Figure 1**. In this case, extraction of the UR7, a lone-standing molar, was attempted three days following removal of the adjacent UR6. Splinting was not possible here due to a lack of sound teeth and poor standard of oral hygiene. As the affected area was no longer load bearing, a conservative approach could be considered. Following a discussion with the patient, the fracture segment was stabilised using bone wax. This material, which is typically used as a mechanical haemostatic agent in persistently bleeding extraction sockets, was sufficiently adhesive in this instance to achieve satisfactory reduction of the segment. Prior to wound closure, a layer of autologous platelet concentrate (plasma rich in growth factors (PRGF)) was placed over the site to promote soft tissue healing. Autologous platelet concentrates (APCs) promote hard and soft tissue regeneration through the controlled release of growth factors such as transforming growth factor-ß (TGF-ß), platelet-derived growth factor (PDGF) and epidermal growth factor (EGF), which stimulate the proliferation and migration of fibroblasts and osteoblasts.[2]

Final note

Dentists should be proficient in the recognition and immediate management of the fractured tuberosity. Knowledge and skill are two crucial prerequisites, but communication at all stages is key to a successful outcome.

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References

1. Shmuly T, Winocur-Arias O, Kahn A, Findler M, Adam I. Maxillary tuberosity fractures following third molar extraction, prevalence, and risk factors. *J Craniofac Surg.* 2022;33(7):e708-e712.
2. O'Sullivan L, Ní Ríordáin R. Autologous platelet concentrates in oral surgery: protocols, properties and clinical applications. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2022;133:156-164.