Extensive Subcutaneous Emphysema After Extraction of a Mandibular Third Molar: A Case Report

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Surgical emphysema is an uncommon but potentially serious complication of third molar removal and other oral procedures. The purpose of this case report is to remind dentists of the risk of surgical emphysema. Surgical emphysema developed in a 32-year-old female after removal of a mandibular third molar using a high-speed dental hand-piece. Because of the extent of the swelling, the patient was admitted for observation. Because of progressive swelling, a submandibular surgical incision and drainage was performed, which led to rapid resolution. The diagnosis and differential diagnosis of surgical emphysema are discussed to draw dentists' attention to the management and prevention of this complication.

Key Words: complications, emphysema, extraction
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Surgical removal of the mandibular third molar is a frequent surgical procedure in dental clinics. Pain, infection, bleeding, dry socket, nerve injuries and trismus are common complications associated with this operation [1]. Subcutaneous emphysema is a relatively rare complication of lower third molar extraction, but it is potentially serious and may cause medicolegal problems. Subcutaneous emphysema associated with dental extraction usually results from using air-water-cooled high-speed dental hand-pieces, which let the air penetrate the soft tissue through the reflected flap and invade the adjacent tissues. Occasionally, the air may pass through the tissue spaces of the fascial planes to cause extensive cervicofacial emphysema, or pneumothorax and pneumomediastinum [2–6]. Early and correct recognition is extremely important to prevent secondary complications. Anaphylactic reactions to local anesthesia, hematoma and infection are usually included in the differential diagnosis [7]. Treatment of subcutaneous emphysema is symptomatic. Antibiotic treatment and careful observation of the airway are usually required. Subcutaneous air will resolve over time. Incision, drainage and aggressive supportive treatment, such as a chest tube, are sometimes necessary [8]. We present a case of extensive subcutaneous emphysema, which was caused by the use of an air-water-cooled high-speed dental hand-piece to extract a mandibular third molar. We discuss the related dental procedures, diagnosis and treatment of emphysema to emphasize the importance of correct surgical procedure to avoid this complication.

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Case Presentation

A 32-year-old female presented to our emergency department complaining of swelling and pain over

her left face and neck, and difficulty in swallowing about 1 day after third molar extraction. According to her statement, she had an impacted left lower third molar extraction at a local dental clinic, and a conventional dental hand-piece was used to cut the tooth during extraction. The procedure went smoothly and she did not notice any discomfort until she developed swelling over her left face about 4 hours after the extraction. This swelling progressed gradually to the neck.

The patient was admitted to the hospital under the impression of emphysema to observe the progression of dysphagia, dyspnea and potential infection. She was an otherwise healthy woman. There was marked swelling and crepitus on palpation over the left infraorbital area, cheek, mandibular angle, submandibular area, and left upper chest wall; mild redness was also noted in these areas (Figure 1). Her mouth opening interincisal distance was 28 mm. There was no evidence of dyspnea, vomiting or fever. Her breathing was clear, and the cardiovascular system was normal. Her blood pressure was 107/70 mmHg, pulse was 90 beats per minute, respiratory rate was 20 breaths per minute, and her body temperature was 36.8°C. Her white blood cell count (WBC) was 19,700/μL, C-reactive protein (CRP) was 5.79 μg/mL, potassium was 3.0 mmol/L, and other laboratory examinations were all within normal limits. Computed tomography (CT) showed air accumulation in the left infratemporal space, pterygomandibular space, buccal space, masseteric space, upper part of the parapharyngeal and retropharyngeal space, along the deep cervical fascia (not including the carotid sheath), and extending to the anterior wall of the chest, but no pneumothorax or pneumomediastinum (Figures 2A–C).

Our treatment plan was close observation of the airway and prophylactic administration of antibiotics (Unasyn®, ampicillin sodium/sulbactam sodium; 1.5 g, every 6 hours). On the 2nd day, CRP increased to 68.45 μg/mL and she felt discomfort over her neck and chest area, with some difficulty in turning her

Figure 1. *Mild erythematous swelling with crepitus over the left infraorbital area, cheek, submandibular area, neck and anterior wall of the chest.*

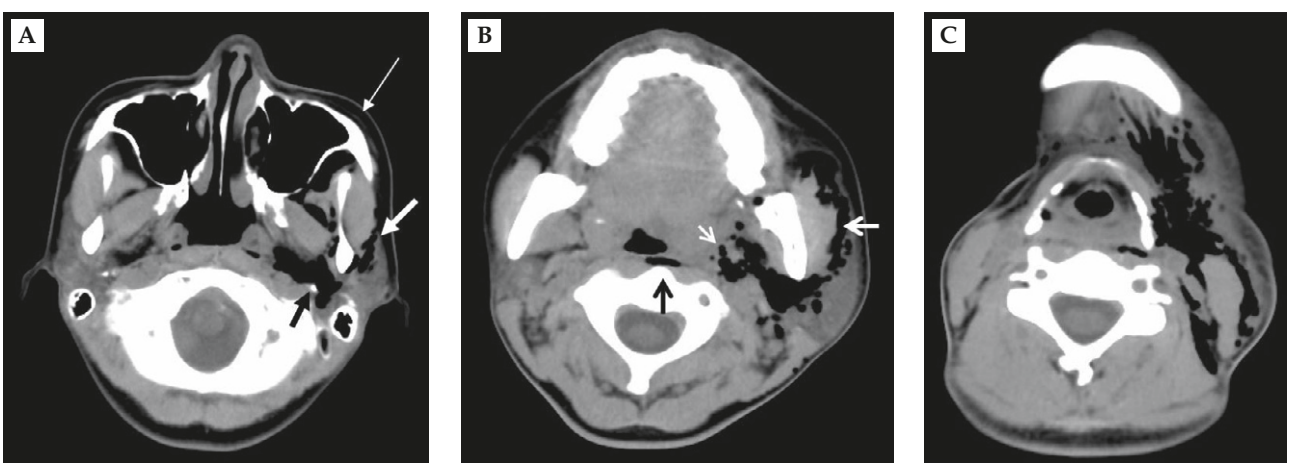

Figure 2. *(A) Air accumulation in the subcutaneous spaces of the infraorbital area (thin white arrow), infratemporal space (black arrow) and posterolateral area of the masseter muscle (thick white arrow). (B) Air accumulation in the pterygomandibular space (black arrow), parapharyngeal space, retropharyngeal space (small white arrow) and masseteric space (large white arrow). (C) Air accumulation in the submental space, submandibular space, deep cervical space and parapharyngeal space (not including the carotid sheath).*

neck and her WBC was 13,200/μL. We decided to perform an incision and drainage (I & D) at the left submandibular area under local anesthesia to ease the patient's discomfort, to prevent extension of air into the mediastinum, and to minimize possible cardiopulmonary complications. No fluid discharge was evident but gas was noted when the incision was made. A 4.5-cm drainage tube was inserted to the submandibular area, without irrigation, but the patient could feel gas passing through the drainage opening. The symptoms and signs improved after the I & D. Her CRP was 20.69 μg/mL, WBC was 6,800/μL, and potassium was 3.4 mmol/L. Her mouth opening was 24 mm on Day 4. The patient was discharged on Day 6, with the swelling almost completely subsided, and without any pain, crepitus, or difficulty in swallowing and breathing. The patient was advised to do mouth opening exercises. At the 2-week follow-up, her mouth opening was normal (> 40 mm) and there were no other complaints.

Discussion

Emphysema is defined as a condition created by the introduction of air or other gases into the soft tissues resulting in distension of the overlying skin or mucosa [9]. The first report of subcutaneous emphysema related to a dental procedure (a premolar extraction) was published by Turnbull in 1900 [10]. In 1995, Heyman and Babayof reviewed the literature from 1960 to 1993 on emphysematous complications in dental treatment. Seventy-four cases have been reported [8], which means that it is not very rare. The report states that the incidence was evenly distributed between the sexes, and that extraction and restorative dentistry were the two main procedures responsible for this complication. The most important factor is the use of an air-water-cooled high-speed dental handpiece, particularly for mandibular third molar extraction [8,11]. When the mucoperiosteal flap is reflected, and the tooth is excised with a standard dental handpiece, air penetrates the soft tissue through the reflected flap. It usually only invades the spaces around the tooth, but sometimes it may spread along the fascial planes to distant areas.

Many papers have reported that air can penetrate the deeper tissues from the root apex and primarily involve the submandibular and sublingual spaces [3,5–7], but this is quite different from lower third molar extraction, where air invades from mucoperiosteal flap. In our case, the air passing through the flap for a lower third molar extraction may have spread by three possible routes. The first route is into the pterygomandibular space and ascending to the infratemporal space; the second route is descending to the submandibular and parapharyngeal spaces, then extending to the upper part of the chest and possibly migrating downwards into the mediastinum; and the third route is into the masseteric spaces and extending to the buccal and infraorbital areas. The air that invaded the primary spaces might move into loose, deeper spaces on function (i.e. during chewing, swallowing or speaking). This offers one possible reason why the swelling of this patient might have extended to the supraclavicular area about 24 hours after the operation.

Diagnosis of subcutaneous emphysema can be made by comprehensive history assessment, physical examination and imaging studies. The presenting symptoms and signs of our patient, including trismus, dysphagia, swelling and crepitus, can be explained by the widespread presence of air on CT scan. It is difficult to ascertain the extent of gas invasion without such imaging examinations. Therefore, we would like to emphasize the importance of early detection of air extension to make an appropriate treatment plan.

Subcutaneous emphysema is usually resorbed spontaneously without complications, which explains why treatment of subcutaneous emphysema is usually symptomatic. Prophylactic antibiotics, close observation of the airway and monitoring the progression of the extension of the gas are recommended. Initially, we administered antibiotics and observed the patient because the CT scan did not show obvious evidence of pneumomediastinum and pneumothorax, but the symptoms and signs worsened on the 2nd day of hospitalization, so we decided to perform I & D as soon as possible, to prevent the progression to pneumomediastinum. We then found the patient's condition improved very quickly. If migration of the accumulated gas is reported, if imaging shows pneumothorax or pneumomediastinum, or if the patient is in significant distress during the observation time, aggressive treatment such as I & D or chest tubing are necessary.

Cervicofacial emphysema can result from several dental procedures, including tooth extraction [2,3,7,12], restorative dentistry [13,14], prosthodontics [8], root

canal [5,6,11] or periodontal treatment [5,9]. The use of air-water-cooled high-speed hand-pieces, air syringe or spray devices, and irrigants for root canal (particularly hydrogen peroxide) [5,8] are all possible causes of emphysema. Dentists performing these procedures daily should exercise great care. Surgical procedures with mucoperiosteal flap elevation should use surgical hand-pieces that vent the air away from the operation field [3]. When a dental high-speed hand-piece is used, the dentist should cut the tooth before flap elevation, or elevate a smaller flap and avoid directly ejecting the air into the pocket of the flap. If emphysema does occur, differential diagnosis from angioedema, hematoma or infection should be made first, which should be followed by observation to detect the spread of the gas. If the extension is limited, the patient may be given antibiotics. The patient must be told how to watch for extension of the emphysema and be advised to go to the emergency department if such extension occurs.

Case reports from Taiwan are rare, but emphysema after dental treatment has occasionally been encountered in our department. The purpose of this presentation is to remind dentists, oral surgeons and emergency physicians to be alert to the signs of subcutaneous emphysema resulting from dental procedures, so that early and accurate diagnosis can be made and appropriate treatment applied.

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下顎智齒拔牙後廣泛性皮下氣腫 — 病例報告

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拔牙或其他牙科治療造成皮下氣腫是一種罕見，但卻嚴重的併發症，本文旨在提醒牙醫師皮下氣腫的嚴重性。本病例報告為一 32 歲女性，在牙科診所以牙科高速磨牙機切斷牙冠，拔牙後造成的皮下氣腫。因腫脹的範圍較大，故安排病患住院觀察，由於臨床表症沒有改善，於是決定採切開引流方式治療，腫脹很快便獲得改善。本文報告一個嚴重的病例，並討論皮下氣腫的鑑別診斷，以提醒牙醫師如何避免與處理此類手術併發症。

關鍵詞：併發症，皮下氣腫，拔牙

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