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Case Presentation

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A Rare Case with Two Episodes of Right Retromandibular Angle Subcutaneous Emphysema during Right Upper Molar Crown Preparation

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Abstract

Subcutaneous emphysema is a well-known complication of oral surgery, especially during mandibular wisdom tooth extraction. However, subcutaneous emphysema secondary to dental procedures such as crown preparation is rare. The main symptom of emphysema is swelling and crepitus on palpation. Uncontrolled emphysema may spread along the fascial planes and cause deep space infections or a pneumomediastinum. In this paper, we report a 34-year-old female who underwent upper molar tooth preparation for crowns and subsequently developed extensive subcutaneous emphysema on the retromandibular angle on two different occasions. Ice bag compression was quickly applied and medication was prescribed. This case highlights the need for prompt diagnosis and management of subcutaneous emphysema because of the risk of much more serious complications. Awareness of relatively “benign” subcutaneous emphysema during any dental procedure is critical not only for inexperienced dentists, but also for those who work in rural and remote settings as members of surgical teams. In this study, we review the clinical presentation, mechanism, and differential diagnosis of subcutaneous emphysema.

Keywords: Subcutaneous emphysema; Dental procedure; Crown preparation; Retromandibular swelling; Intraoperative complication

Introduction

Subcutaneous emphysema is a rare but serious complication of dental and oral surgery that can arise during tooth extraction, crown preparation, and endodontic therapy **[1].** High-speed air turbine drills are widely used during dental procedures such as exodontia, tooth sectioning, and dental restoration. The drills are driven by compressed air (rate of 3.5–4.0 kgf/ cm^2, rotation speed of 450,000 rpm) **[2].** The use of high-speed air turbines appears to be associated with most cases of subcutaneous emphysema; pressurised air is blown into the deep space **[3].**

The maxillofacial fascial spaces are close to the retropharyngeal space and mediastinum. Therefore, air and water that enter the maxillofacial spaces could trigger deep space infections with serious life-threatening complications **[4].** Subcutaneous emphysema caused by dental procedures can involve the facial area, orbital region **[5]**, neck **[6],** and (rarely) mediastinum **[7].** One case of vision loss caused by optic nerve damage has been reported **[8].** Sometimes, all of these complications develop simultaneously **[9],** and are then very difficult to manage **[10].** Fortunately, most emphysema is self-limiting, benign, and resolves safely **[11].** The most common symptom of subcutaneous emphysema is some degree of rapid swelling that generates crepitus when pressed by the fingers **[4].** Most cases occur after mandible third molar extraction while using an air turbine; the deep facial and soft tissue spaces swell in such cases **[1-3].** We present a rare case of subcutaneous emphysema that occurred twice during crown preparation of the right upper molars (teeth #16 and #17); sudden swellings developed around the mandibular angle while the patient was being treated in the Department of Oral Implantology and Prosthodontics, Shenzhen Stomatology Hospital, Shenzhen, China. Case management is described herein, along with the diagnosis and prevention of this surgical complication.

Materials and Methods

This research followed the principles of the Declaration of Helsinki and was approved by the Ethics Committee of Shenzhen Stomatology Hospital. The patient signed a detailed informed consent form allowing us to report the diagnostic and therapeutic procedures, and to present radiological images and facial photographs.

Case Presentation

First emphysema episode

A 34-year-old female with no medical history consulted us for crown restoration of the right upper molars (teeth #16 and #17) after successful endodontic treatment. The patient stated that these teeth were painful when biting even soft food. The distal surface of #16 and medial surface of #17 had undergone composite resin restoration. Both teeth were mildly painful on percussion, but were not loose. The gingiva was healthy, exhibiting a normal colour and periodontal pocket depth. There was no bleeding on probing. We obtained a panoramic radiograph **(Figure 1).**

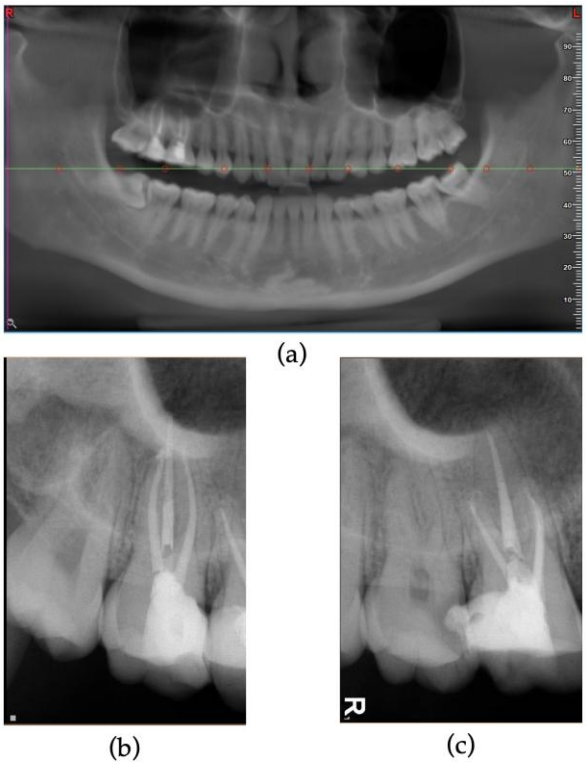

Figure 1: Panoramic (a) and periapical films (b and c) of teeth #16 and #17. Both #16 (c) and #17 (b) had undergone successful root canal treatment.

Crown preparation proceeded smoothly until the occlusion face of #17 was ground; the patient reported a sudden transient pain at this point. The operation was stopped and we immediately examined the patient. She was alert and complained of a bump in the right retromandibular angle that gradually hardened, but was not in pain and spoke in full sentences. The tissue around the retromandibular was obviously swollen, but was non-erythematous and non-tender. On palpation, there was a sensation of crepitation. The patient did not experience much pain, and had no difficulty with mouth-opening or breathing **(Figure 2).**

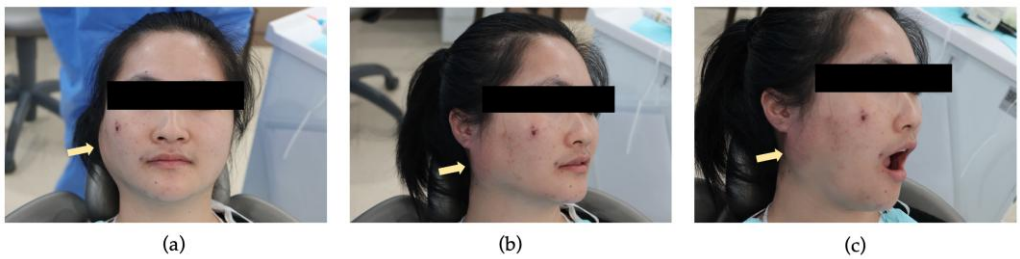

Figure 2: Subcutaneous emphysema is clearly evident in the right retromandibular angle. The skin temperature rose and the skin became red. Mouth-opening was not restricted and the patient felt no pain in the region of swelling. Yellow arrows: Subcutaneous emphysema.

As crepitations were noted during palpation, we diagnosed subcutaneous emphysema. The operation was immediately interrupted; the patient's blood pressure, heart rate, respiratory rate, temperature, and oxygen saturation were normal. No deep periodontal pocket was found around the tooth **(Figure 3).**

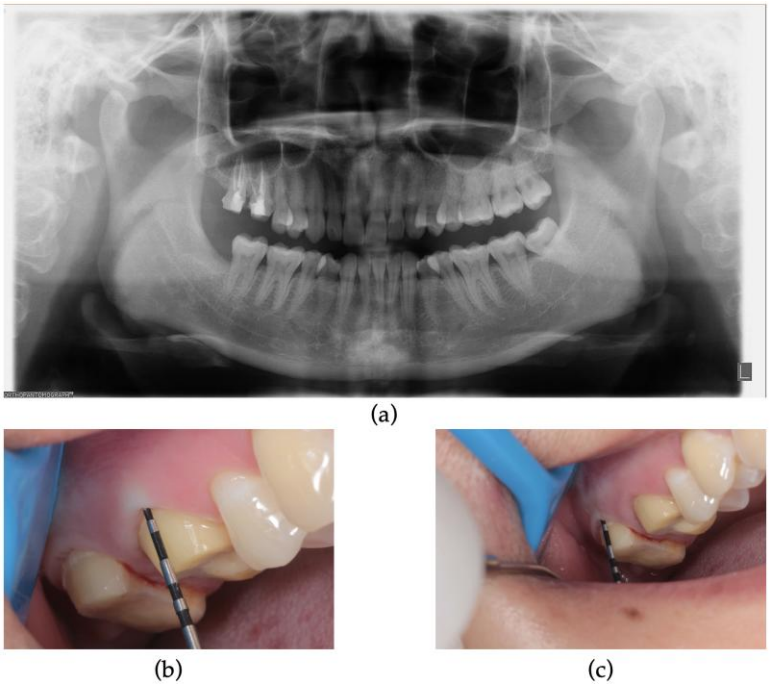

Figure 3: Panoramic imaging (a) and periodontal pocket probing (b and c) were performed after emphysema developed. Periodontal pocket probing was normal (buccal lateral: #16: 2 mm; #17 2.8 mm). No significant anomaly was found.

We performed Cone-Beam Computed Tomography (CBCT) after the emphysema developed, which revealed obvious swelling and thickening of soft tissue on the masseter muscle and a discrete region of emphysema in the layer between the masseter muscle and subcutaneous fascia **(Figure 4).** The treatment plan was close observation of the airway, and dexamethasone (10 mg per day) and antibiotics (cefuroxime 1.5 g/day) for 3 days.

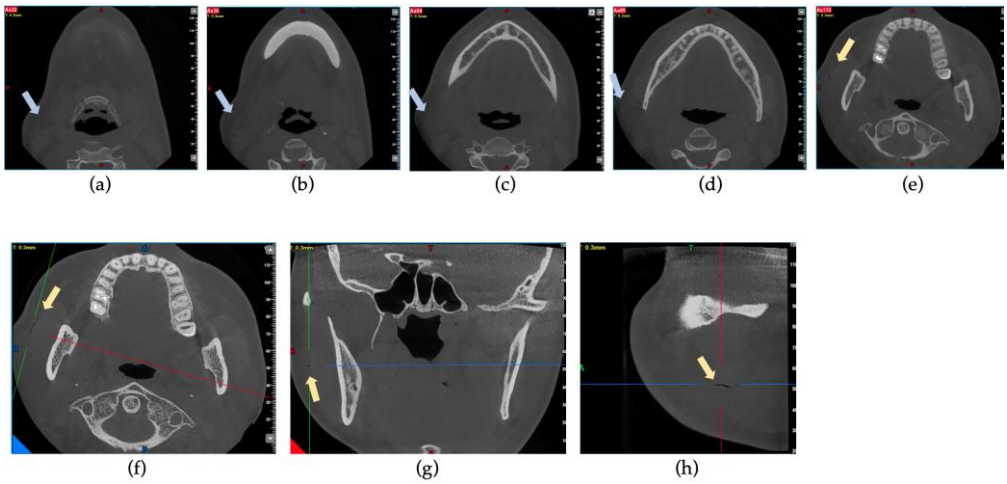

Figure 4: CBCT scans obtained after emphysema developed. (a)~(e) Coronal views of the swelling. (f)~(h) An air-filled fissure between the masseter muscle and soft tissue. Blue arrows: swelling. Yellow arrows: the fissure.

The patient was not admitted but visited our outpatient clinic daily for intravenous drip therapy. After 3 days of treatment, the swelling had completely disappeared and there were no complications **(Figure 5).**

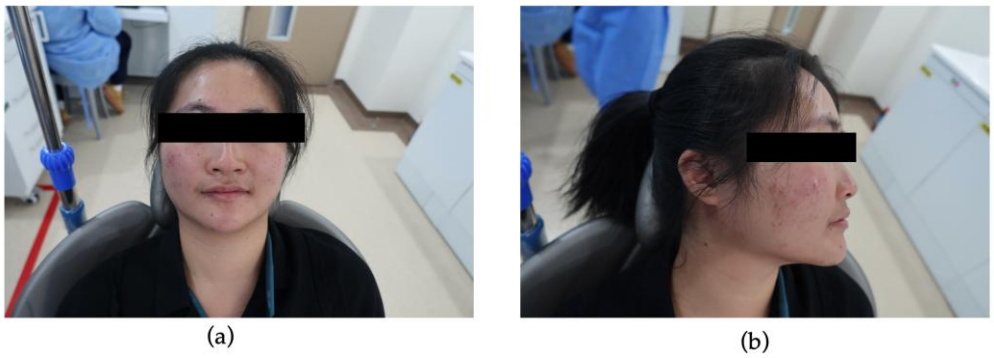

Figure 5: After 3 days of intravenous drip, the swelling of the right retromandibular angle disappeared.

Second emphysema episode

After 2 weeks of observation, the swollen tissue in the right retromandibular angle had recovered well. As tooth preparation had not been concluded, the patient again visited our outpatient clinic to finalise the prosthodontic procedure prior to crown placement on the right upper molars. On this occasion, we proceeded with great care. When gently and slowly grinding the occlusion surface of the medialbuccal cusp of #17 with a low-speed turbine and normal water and air flow, the patient again reported a sudden pain in the right retromandibular angle. The affected area was the same as before; the skin reddened and gradually swelled, and crepitation was noted after several seconds. We stopped the operation and applied an ice bag (cold compress) to the swelling. Ibuprofen and cephalosporin were immediately given orally. After 2 h of observation, the swelling was limited to a very small area and the temperature of the skin had normalised, but the swelling was light red in colour and the tissue was hard when palpated. As before, no deep periodontal pocket or gingival inflammations around the

tooth were found **(Figure 6).** At the 1-week follow-up, the symptoms had disappeared and there were no other complications. The patient then re-visited us and we placed provisional crowns.

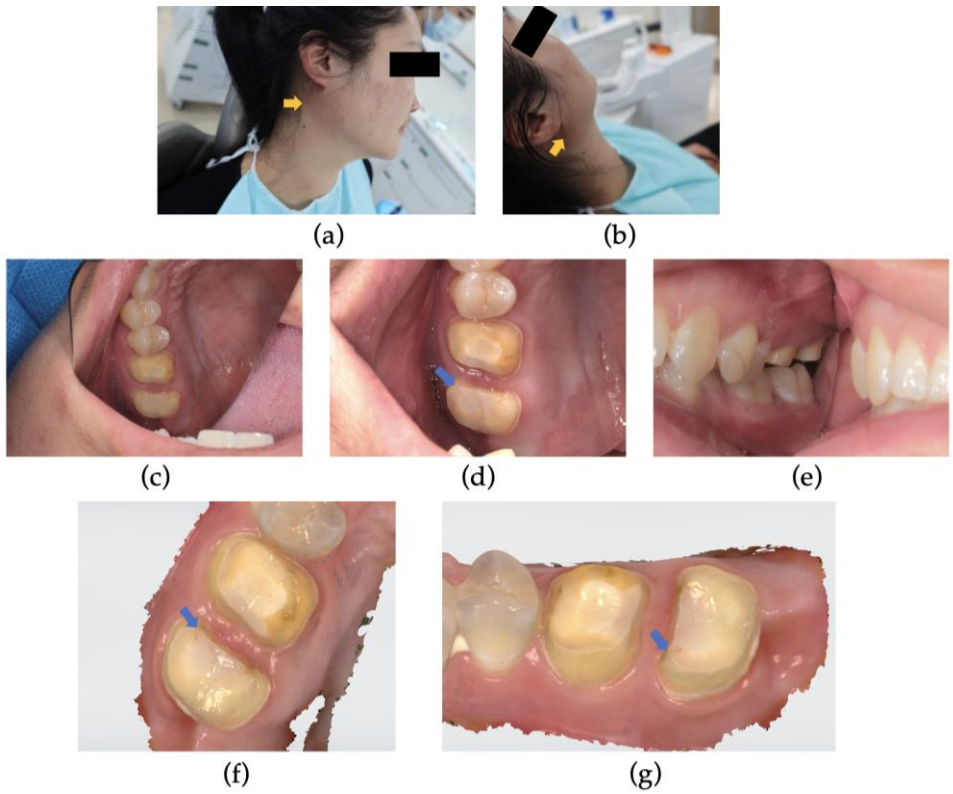

Figure 6: The symptoms were similar to those on the first occasion. (a) and (b): The emphysema was in the retromandibular area; the yellow arrows indicate the swelling. (c)–(e): The teeth and gingiva were normal and healthy. (f) and (g): Optical scans acquired using an oral scanner (3Shape, Copenhagen, Denmark) also revealed very good general health. However, beginning on the occlusion surface of #17, a subfissure line was found between the tooth and resin (blue arrow). Grinding at this point triggered subcutaneous emphysema in the retromandibular area.

Discussion

Dental procedures can disrupt the mucosa of the oral cavity and introduce air into connective tissue spaces, thereby triggering subcutaneous emphysema. Although this is generally benign, there is a risk of progression to serious consequences including pneumothorax, air embolism, mediastinitis, cranial nerve palsy, and cardiac tamponade **[12].** Subcutaneous emphysema spreads near sites where valves are located. When the upper teeth are involved, periorbital swelling is the most common symptom; when the lower teeth are implicated, cheek and neck bulges are more common **[3].** Our case is unusual; subcutaneous emphysema developed during crown preparation for teeth #16 and #17, especially when addressing an occlusion surface, but the emphysema affected the right retromandibular angle rather than the periorbital area (which was the most frequently affected area in previous studies). The reason for this is unclear; we offer two possible hypotheses. First, strong air flow into the gingival sulcus destroyed a loose connective tissue attachment. Then, gingival tissue was detached from the bony maxillary tubercle bone and air entered the layers between the buccinator muscle and buccal fat tissue. The gingival valve closed immediately, triggering the valvular effect described in other clinical situations. The air

did not travel beneath the buccinator muscle along the bone; if it had done so, emphysema would have occurred in the infraorbital area. The air spread to the masseter muscle layer along the buccinator muscle fascia to reach the posterior edge of the mandible. The reason why the swelling was confined to this area, and thus did not spread into the deeper cervical region, was because the air volume was limited; we stopped the operation immediately. The other hypothesis involves the subfissure of tooth #17 **(Figure 6).** When preparing the occlusion surface, the turbine moved the tooth, thereby increasing the size of the subfissure, and air entered deep tissue to cause subcutaneous emphysema. The air pathway in this case would be the same as that described above. This hypothesis may be supported by the fact that both emphysema episodes started during preparation of the occlusion surface of #17, but the periodontal pocket depths of #16 and #17 were healthy and normal. The patient also reported pain in the right upper molar when biting, especially on hard food. However, the Root Canal Treatment (RCT) had been successful, so we suspect that the subfissure hypothesis may be correct. We plan further studies to test this hypothesis. As stated by Fasoulas et al. **[13],** subcutaneous emphysema is almost twice as common in females as males. In most articles cited herein, the endodontic procedure most associated with soft tissue swelling was initial RCT (78%), with rates of 14% during non-surgical RCT, 5% during endodontic surgery **[14],** and 3% during surgical management of acute apical abscesses **[15].**

The rationale for antibiotic therapy is that introduced air may contain bacteria, which could trigger rapidly spreading cellulitis or necrotizing fasciitis **[1].** Fasoulas et al. **[13]** prescribed antibiotics to 40 cases for 2–10 days, depending on the severity of the condition. Betalactam antibiotics such as penicillin and amoxicillin, as well as various cephalosporins (given orally or intravenously), were the most common choices. Analgesics and NSAIDs, cold or hot compresses, pressure or massage of the swollen area, and ice bag treatment have been recommended by some studies. Based on our experience, when crown preparation triggers subcutaneous emphysema, immediate cessation of the operation and application of an ice bag to compress the swelling controls the emphysema very effectively; oral medicines can be added if required.

Subcutaneous emphysema can also be induced by sneezing, blowing forcefully, coughing, or vomiting after a dental procedure **[1].** Dentists may attribute immediate swelling after a dental operation to angioedema or an allergic reaction, and delayed symptoms to a hematoma or soft tissue infection such as cellulitis or Ludwig's angina. Patients with subcutaneous emphysema typically exhibit painless oedema of the face and neck; the palpable crepitus is pathognomonic, which clearly distinguishing emphysema from other conditions **[13].** However, dentists should be vigilant if a patient complains of breathing difficulties; the emphysema may have spread to the paratracheal, mediastinal, or thoracic spaces. In most cases, air re-absorption begins within 2–3 days and is frequently complete by day 7–10 after onset **[16].** Oxygen inhalation via a nasal cannula accelerates this process by reducing the blood nitrogen pressure, thus enhancing air re-absorption **[17].** When encountering iatrogenic air emphysema, airway restriction must be considered. CBCT is useful to determine the extent of the damage.

Conclusions

Subcutaneous emphysema in the posterior region of the right retromandibular angle during molar crown preparation in #16 and #17 is rare. Caution should be exercised when using air turbines. Rapid diagnosis and appropriate management reduce the risk of serious complications. Clinicians should regularly service the

pneumatic turbine. Also, patients should be told to avoid any activity after treatment that might increase the oral cavity pressure, including coughing, smoking, nose blowing, the use of a straw, and vomiting.

Author Contributions

Conceptualization, Y.B., J.S. and H.S.; funding acquisition, Y.B.; investigation, Y.B., J.S., and C.C.; methodology, Y.B., J.S.; supervision, Y.B., and H.S.; visualization, Y.B., J.S., and C.C.; writing—original draft, Y.B. and J.S.; writing—review and editing, Y.B., J.S., C.C., and H.S. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Ethics Committee of Shenzhen Stomatology Hospital (protocol code LLWYH-PJ-202301-001, 2023/01/31).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the patient(s) to publish this paper.

Conflicts of Interest

The authors have no conflict of interest to declare.

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