



With two episodes of right retromandibular angle subcutaneous emphysema during right upper molar crown preparation: A case report

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Abstract

BACKGROUND

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.

CASE SUMMARY

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. The treatment plan for this patient involved close observation of the airway, and administration of dexamethasone and antibiotics *via* intravenous drip or orally. Ice bag compression was quickly applied and medication was prescribed to alleviate discomfort and promote healing. Although the main reason is unclear, the presence of a fissure in the molar is an important clue which may contribute to the development of subcutaneous emphysema during crown preparation. It is imperative for dental professionals to recognize such pre-disposing factors in order to minimize the risk of complications.

CONCLUSION

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.

Key Words: Subcutaneous emphysema; Dental procedures; Dental prosthesis preparation; Retro-mandibular space; Intraoperative complications; Case report

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Core Tip: Subcutaneous emphysema secondary to dental procedures such as crown preparation is rare. 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. Prompt diagnosis and management of subcutaneous emphysema is necessary for dentist.

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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/cm², rotation speed of 450000 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]. Conventional case management for subcutaneous emphysema including: (1) Immediate recognition: Quickly identify the signs and symptoms of subcutaneous emphysema, such as swelling, crepitus on palpation, and potential difficulty in breathing; (2) Airway monitoring: Closely monitor the patient's airway to ensure there is no obstruction or compromise due to the swelling; (3) Administration of medications: Prescribe medications, such as anti-inflammatory drugs (*e.g.*, corticosteroids like dexamethasone) and antibiotics (*e.g.*, cefuroxime), to manage inflammation and prevent infection; and (4) Follow-up care: Schedule follow-up appointments to monitor the patient's progress and ensure resolution of the subcutaneous emphysema and any potential complications.

We here 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. Crown preparation is generally considered a low-risk procedure for subcutaneous emphysema compared to tooth extractions, particularly when involving impacted third molars. The likelihood of air being forced into the fascial spaces is lower during crown preparation compared to more invasive procedures.

Repeated instances of subcutaneous emphysema in the same patient during similar dental procedures are unusual. Most patients who experience this complication once are unlikely to encounter it again, particularly if the dental professional is aware of the previous occurrence and takes extra precautions during subsequent treatments.

Individual patient factors may contribute to the rarity of this occurrence[11]. Some patients might have anatomical variations or predisposing factors that make them more susceptible to subcutaneous emphysema during dental procedures. In this report, case management was also described, along with the diagnosis. The purpose of this report is to alert the dental community about the incidence of subcutaneous emphysema from a routine dental procedure, and how to recognize and manage its

occurrence.

CASE PRESENTATION

Chief complaints

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 gingival sulcus depth. There was no bleeding on probing. We obtained a panoramic radiograph and periapical films before operations (Figure 1).

History of present illness

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.

History of past illness

There is no past illness.

Personal and family history

There is no personal and family history.

Physical examination

The tissue around the right 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).

Laboratory examinations

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 and Table 1).

Imaging examinations

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).

Treatment and follow-up

The treatment plan was close observation of the airway, and dexamethasone (10 mg/d) and antibiotics (cefuroxime 1.5 g/d) for 3 d. This approach aimed to manage inflammation and reduce the risk of infection. Ice bag compression was quickly applied and medication was prescribed to alleviate discomfort and promote healing.

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

Second emphysema episode

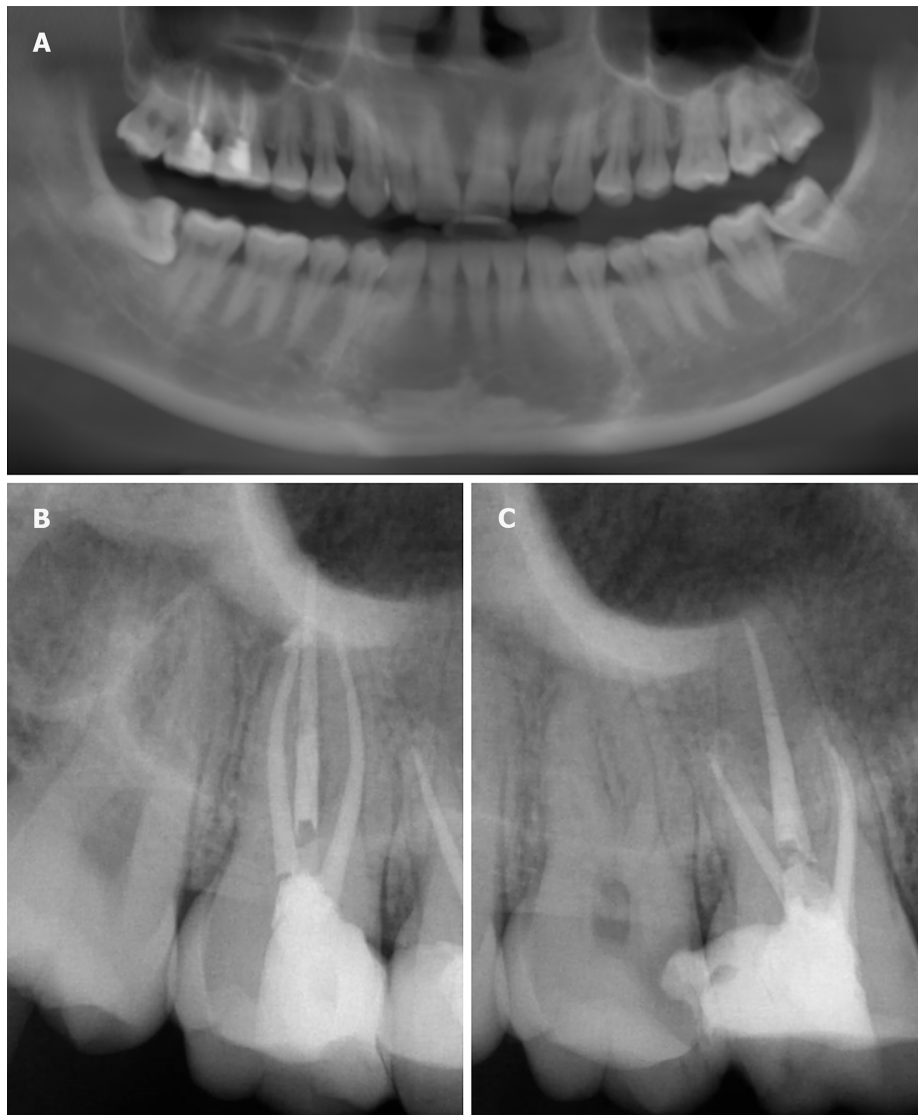
After 2 wk of observation, the swollen tissue in the right retromandibular angle had recovered well. As tooth preparation had not been concluded, the patient again visited our outpatient clinic to finalise the prosthodontic procedure prior to crown placement on the right upper molars. On this occasion, we proceeded with great care. When gently and slowly grinding the occlusion surface of the medial-buccal 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.

FINAL DIAGNOSIS

The affected area exhibited a striking similarity to previous instances, with the skin turning noticeably

Table 1 The gingival sulcus depth assessment result of #16 and #17

Teeth	Mesio-buccal site	Buccal centre	Distal-buccal site	Mesio-lingual site	Lingual centre	Distal-lingual site
#16	2.8 mm	2.0 mm	2.5 mm	2.5 mm	2.2 mm	3.0 mm
#17	2.7 mm	2.8 mm	2.7 mm	3.0 mm	2.5 mm	3.2 mm



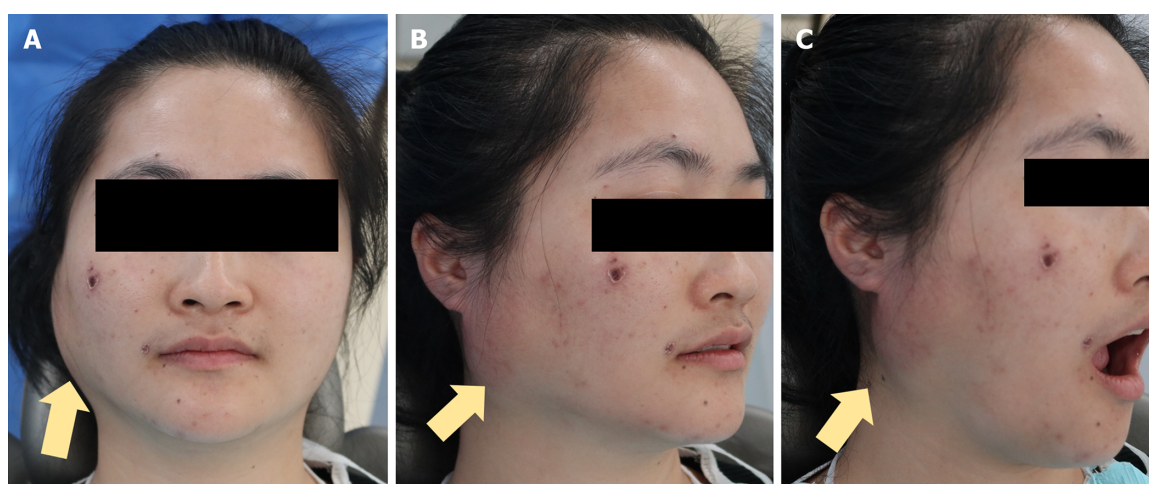
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Figure 1 Panoramic and periapical films of teeth #16 and #17. A: Panoramic of teeth #16 and #17; B and C: Periapical films of teeth #16 and #17, both #16 and #17 had undergone successful root canal treatment.

red and gradually swelling up as a reaction to the underlying issue. After a few seconds, crepitation was observed, which is a crackling sound produced when air is trapped under the skin. This is a classic sign of subcutaneous emphysema, a medical condition that occurs when air infiltrates the subcutaneous tissue layer beneath the skin. Therefore, we confirmed that the patient had subcutaneous emphysema in the same area once again.

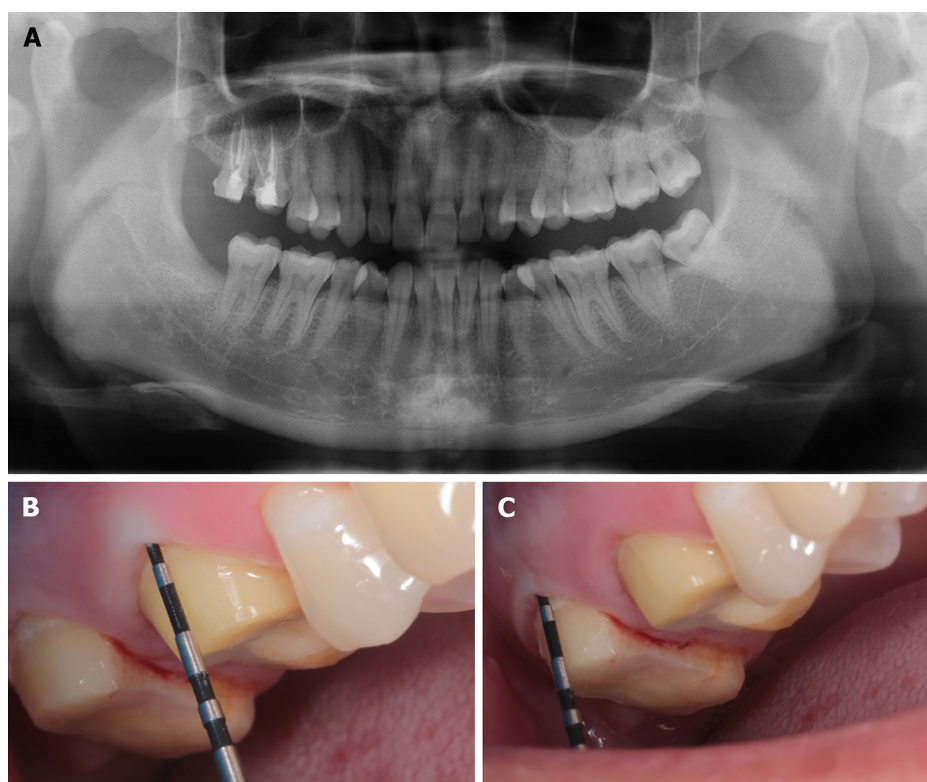
TREATMENT

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 inflammation



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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. A: Front view; B: Profile view; C: Profile view while mouth opening.



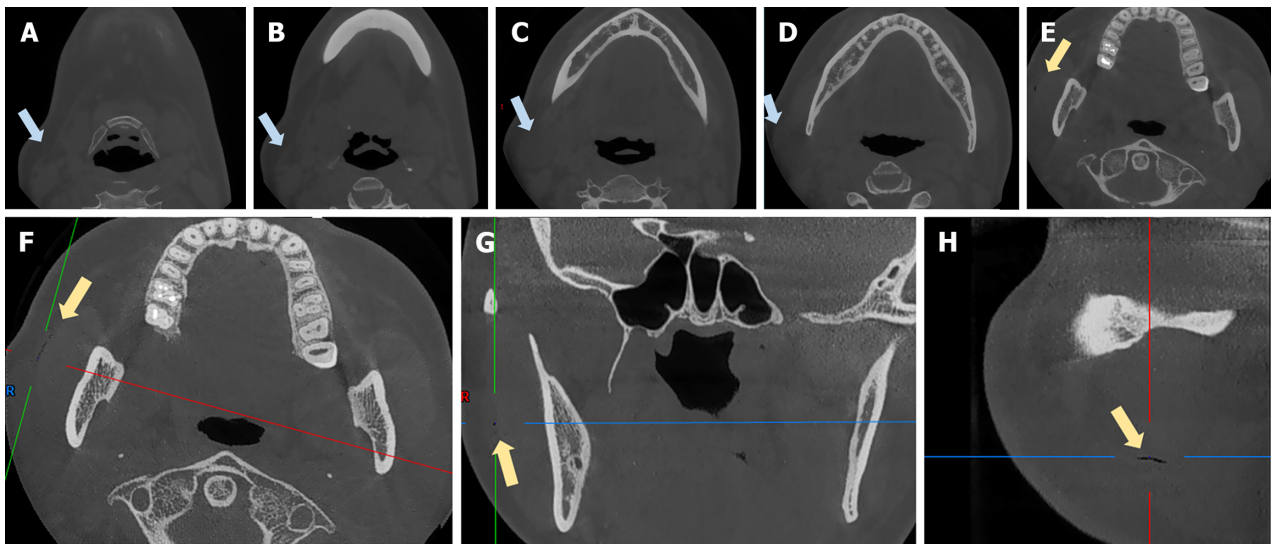
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Figure 3 Panoramic imaging and gingival sulcus depth probing were performed after emphysema developed. A: Panoramic imaging was performed after emphysema developed; B and C: Gingival sulcus depth probing were performed after emphysema developed. Gingival sulcus depth pocket probing was normal (buccal lateral: #16: 2 mm; #17: 2.8 mm). No significant anomaly was found.

around the tooth were found (Figure 6).

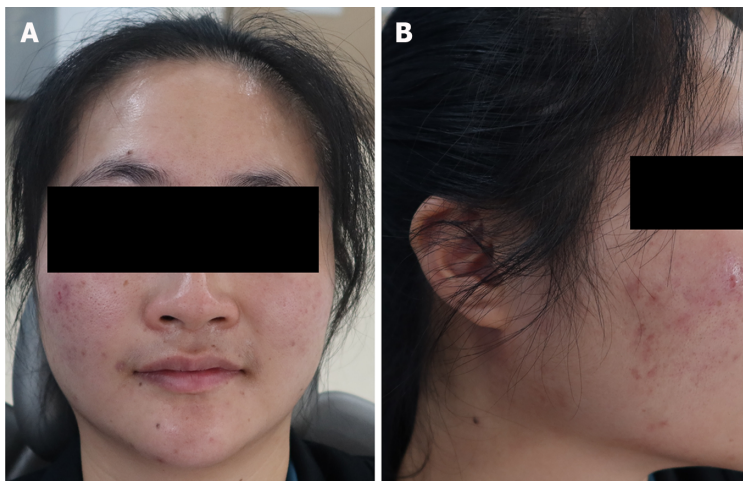
OUTCOME AND FOLLOW-UP

At the 1-wk follow-up, the symptoms had disappeared and there were no other complications. The patient then re-visited us and we placed provisional crowns.



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Figure 4 Cone-beam computed tomography 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.

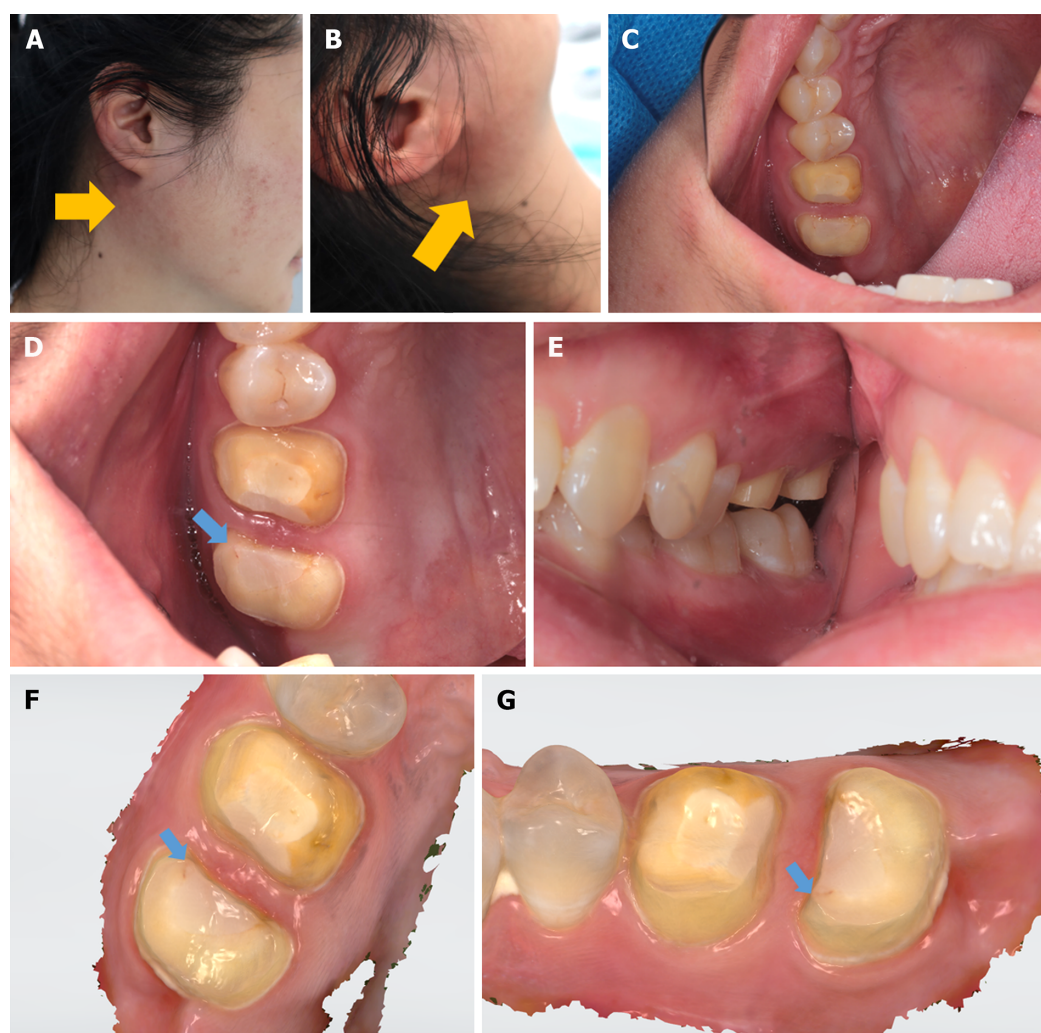


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Figure 5 After 3 d of intravenous drip, the swelling of the right retromandibular angle disappeared. A: Front view; B: Profile view.

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]. Subcutaneous emphysema developed during crown preparation for teeth #16 and #17 is rare, 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[3]. 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 we stopped the operation



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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.

immediately, and thus the air volume was limited. 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 gingival sulcus 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 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 than males. In their systematic review, emphysema was mainly reported in females (39/65) rather than males (20/65) and the age of the patients ranged from 18 to 63 years (mean = 38 years). In another study, Jeong *et al*[11] indicated that subcutaneous emphysema originating from maxillary teeth ($n = 8$; 66.7%) was two times more common than that originating from mandibular teeth ($n = 4$; 33.3%), meanwhile subcutaneous emphysema was more common in posterior teeth (91.7%, $n = 11$) than in anterior teeth (8.3%, $n = 1$). Approximately 18% (2 of 11 patients) of subcutaneous emphysema cases can be attributed to crown preparation[11]. Nadarajah reported a serious and huge cervical subcutaneous emphysema and pneumomediastinum occurring after extraction of a mandibular right molar by using an air turbine handpiece[10]. Although there are no documented cases in the literature, it is important for dental professionals to be aware that cervical subcutaneous emphysema caused by dental crown preparation can also potentially lead to very serious complications. Rapid diagnosis, management is critical for both patient and dentist.

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 d, depending on the severity of the condition. Beta-lactam antibiotics such as penicillin and amoxicillin, as well as various cephalosporins (given orally or intravenously), were the most common choices. Analgesics and non-steroidal anti-inflammatory drugs, 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, dental professionals 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 d and is frequently complete by day 7-10 after onset [11]. Oxygen inhalation *via* a nasal cannula accelerates this process by reducing the blood nitrogen pressure, thus enhancing air re-absorption[14].

When encountering iatrogenic air emphysema, airway restriction must be considered. CBCT is useful to determine the extent of the damage. 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.

CONCLUSION

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.

FOOTNOTES

Author contributions: Bai YP and Sun HP contributed to the conceptualization and visualization of the manuscript; Bai YP, Sha JJ, and Sun HP involved in the funding acquisition, original draft writing; Bai YP investigated; Bai YP, Sha JJ, and Chai CC contributed to the methodology of the manuscript; Bai YP and Sha JJ contributed to the supervision, writing-review and editing of this manuscript; and all authors have read and agreed to the published version of the manuscript.

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