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CASE REPORT

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Management of subcutaneous facial emphysema secondary to a class V dental restoration

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Key Clinical Message

Subcutaneous facial emphysema (SFE) is a potentially serious complication of dental treatment typically associated with surgical removal of teeth using air-driven handpieces. A case of SFE is presented occurring after routine dental restoration, along with a framework to aid prevention of this complication and guide management where it occurs.

KEYWORDS

fascial spaces, medical emergency, restorative dentistry, retraction cord, subcutaneous facial emphysema

1 | INTRODUCTION

Subcutaneous facial emphysema (SFE) is a less frequently encountered complication of dental treatment where penetration of air into the subcutaneous tissues and fascial planes results in distension of the overlying skin.[1] This introduction of air into the subcutaneous connective tissue layers may arise from maxillofacial trauma and pathological events, incidentally or iatrogenically.[2] The dental literature is replete with cases of SFE arising from surgical extractions performed with air-driven handpieces[3]; however, it is particularly unusual for this condition to arise as a result of dental restoration without the use of an air-driven handpiece.

Subcutaneous emphysema in dentistry was first documented in 1900 when a bugle player commenced playing his instrument soon after a dental extraction.[4] Since this time, the vast majority of cases arising in the dental setting have been associated with the use of air-driven high-speed handpieces and air syringes.[1,3] High-speed dental handpieces generating air have documented associations with SFE during the surgical removal of teeth and delivery of restorative treatment including direct restorations, crowns, and stainless steel crowns.[1,3,5-9] Instances of SFE during endodontic treatment have been reported, an outcome typically linked to air from high-speed handpieces and air syringes.[10] Extrusion of hydrogen peroxide irrigants beyond the apical foramen produces oxygen which can accumulate within tissue compartments to produce emphysema.[11] Air cooling sprays from dental lasers have also been reported as causes of SFE where lasers have been used for incision and drainage of abscesses, frenectomies, and periodontal debridement.[12,13] Procedures for site development prior to dental implants, such as maxillary sinus floor elevations, as well as placement of zygomatic dental implants have also been identified as causes of SFE.[14-16] A number of authors have also described the occurrence of SFE subsequent to air-powder units for polishing and cleaning of teeth and implants.[17,18]

This report presents a rare occurrence of SFE following delivery of a class V dental restoration in a lower right second molar. Diagnostic features, potential complications, and the expected clinical course of the condition are discussed, along with presentation of a framework for prevention and management of SFE arising during class V restorations.

2 | CASE REPORT

A 43-year-old male patient was referred to a hospital emergency department by his general dental practitioner. The patient was seen 6 hours previously for placement of a class V buccal restoration on the lower right second molar (tooth 47). The cavity preparation was completed without the use of

an air-driven high-speed handpiece; however, an air syringe was used to dry the operative field and aid visual assessment during treatment. At the completion of treatment, facial swelling was noted on the right side. The patient was initially prescribed four milligrams of dexchlorpheniramine postoperatively for management of a suspected hypersensitivity reaction. In the hours subsequent to this, neck pain and dysphagia were noted, resulting in referral of this patient to the emergency department. The patient was generally assessed to be fit and healthy and had an unremarkable medical history. No history of smoking and no previous drug allergies were reported.

On examination, testing of cranial nerves revealed no deficits. Both eyes showed full range of motion, and pupils were equally sized and reactive to light. Vital signs including heart rate, respiratory rate, oxygen saturation, and blood pressure were found to be within normal limits. The patient was generally alert, afebrile, and well perfused. Swelling was noted from the right infraorbital region to the buccal and submandibular regions (Figure 1) with crepitus on palpation.

FIGURE 1 A, Extraoral frontal appearance upon initial presentation. B, Extraoral lateral appearance upon initial presentation. Swelling with crepitus involving the infraorbital and cervicofacial tissues was present

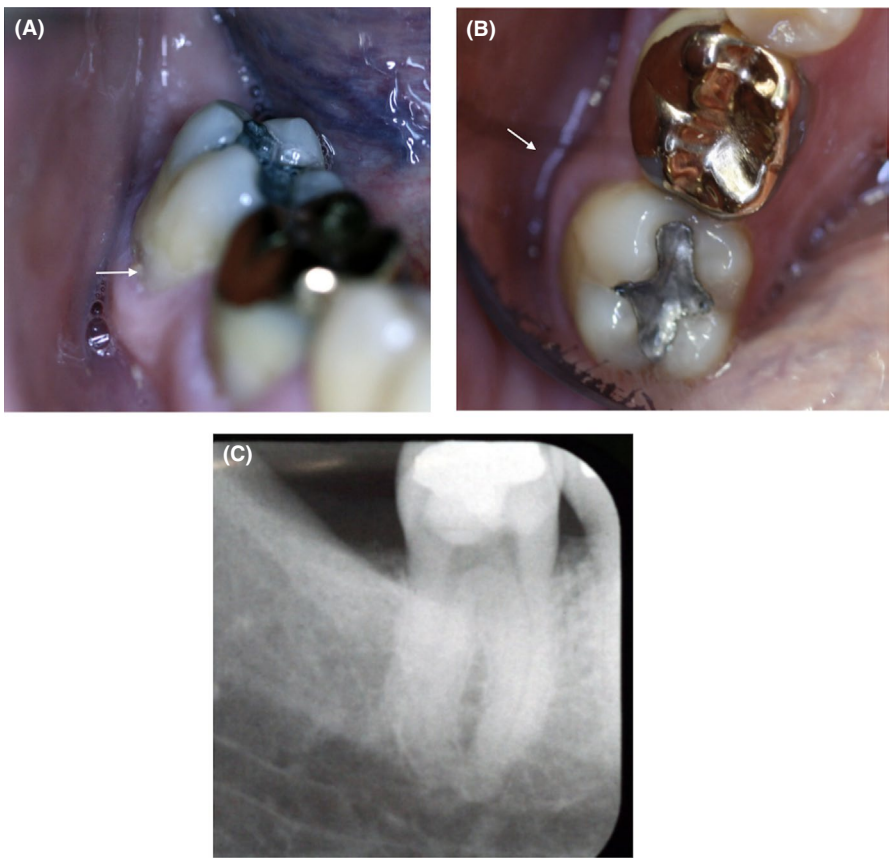

FIGURE 2 A, Intraoral view demonstrating recently placed restoration on buccal surface of tooth 47(arrow); B, Submucosal emphysema adjacent to the tooth (arrow); C, Periapical radiograph of tooth 47

Tenderness to palpation was noted through the right submandibular region and extending through the patient's neck. Signs of dysphagia were noted with no associated dyspnoea or chest pain. Emphysematous involvement of the right periorbital spaces resulted in difficulty in opening the right eyelids.

Intraoral examination revealed a recently placed restoration on the buccal surface of the lower right second molar, with some swelling of the soft tissues adjacent to the tooth (Figure 2). No soft tissue lacerations were present. Periodontal probing depths of 5-6 mm were recorded across the gingiva on the buccal surface of the lower right second molar. A periapical radiograph of tooth 47 was taken at this time which did not reveal the presence of any periodontal or periapical pathology. Lateral cervical and anteroposterior cervical radiographs were taken for the patient, demonstrating radiolucencies in the submandibular, cervical, and retropharyngeal spaces (Figure 3). A definitive diagnosis of cervicofacial emphysema was established clinically and radiographically.

Management involved prescription of 500 mg of amoxicillin taken eight hourly for a duration of 7 days. Paracetamol was taken as required for management of discomfort and pain; this was ceased by the patient after 2 days. The patient was reassured and advised to avoid activities that would increase intraoral air pressure including blowing balloons, drinking through straws, and sneezing. Reviews were conducted on the second, third, and seventh days after presentation. Significant clinical and radiographic resolution of the patient's SFE was noted by the third day after presentation, with complete resolution noted after 7 days (Figure 4). At the 7-day review, probing depths around tooth 47 were reassessed and found to have reduced to 2-3 mm. The patient suffered no further symptoms or complications and was discharged without the need for further review.

3 | DISCUSSION

It is important for dental practitioners to be aware of SFE as its occurrence may be distressing to both patient and clinician. Emergency physicians must also be aware of this condition as patients are often referred to emergency departments for further management, and the complication may also arise some hours after dental treatment, resulting in patients presenting directly to a hospital emergency department. The condition may be misdiagnosed as illustrated in this report, which can have dire consequences for the patient in the absence of appropriate management.

Fascial spaces or planes are areas of loose connective filling potential spaces that exist between musculature and anatomical structures. The roots of the lower molar teeth are anatomically related to the sublingual and submandibular spaces inferiorly and the buccal space laterally.[19] Once introduced into these spaces, air has travelled along the paths of least resistance to involve the related infraorbital, cervical, lateral pharyngeal, and retropharyngeal spaces. Involvement of the retropharyngeal space is of particular concern because it is the main communicating space between the orofacial region and the mediastinum.[20]

Differential diagnoses for swelling of rapid onset during or after dental treatment include hypersensitivity reaction, hematoma, cellulitis, necrotizing fasciitis, angioedema, and subcutaneous facial emphysema.[21] In cases of subcutaneous facial emphysema, signs of swelling may occur immediately or within minutes to hours after a procedure.[22] Patients typically show marked swelling and discomfort where air has penetrated the submucosal tissues. Involvement of the paratracheal, mediastinal, or thoracic spaces can result in dysphagia, respiratory alterations, dysphonia, chest pain, and dyspnoea.[23] Where pneumomediastinum has occurred, cardiac auscultation typically reveals a friction rub (Hamman's sign) during systole. If the pericardial space becomes involved, alterations to echocardiogram results may also be noted.[2] Crepitus on palpation is pathognomic of SFE[24] and an important diagnostic feature in excluding differential diagnoses for acute swelling such as hypersensitivity reactions and angioedema which are typically firmer in consistency and present with other local features such as increased erythema and urticaria, as well as with systemic symptoms.[25] Hematomas will typically present as a rapid swelling with tissue distension and discoloration following trauma to a blood vessel.[26] Infective swellings as may be caused by cellulitis or necrotizing fasciitis are usually accompanied by systemic

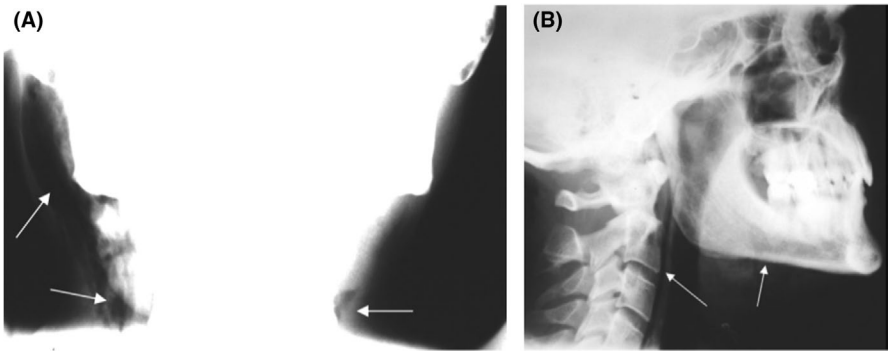

FIGURE 3 A, Posteroanterior cervical radiograph; B, Lateral cervical radiograph. Areas of emphysema are clearly visible (arrows)

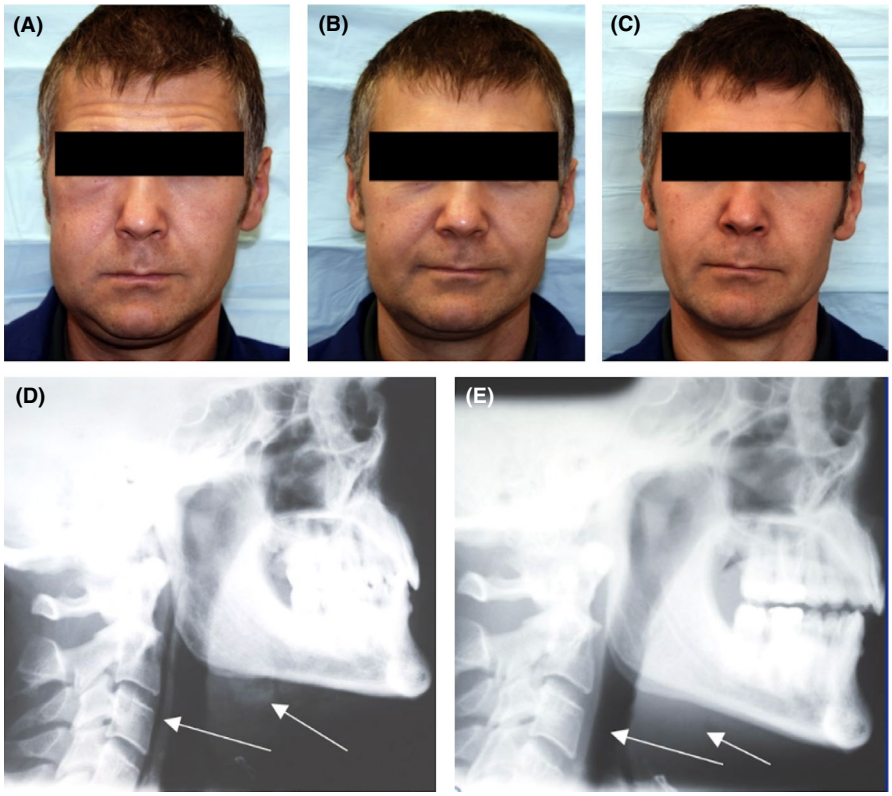

FIGURE 4 Patient at: A, initial presentation; B, 3 d; C, 7 d; D, lateral cervical radiograph at initial presentation; E, lateral cervical radiograph at day three. The emphysema has begun to resolve by day 3 both clinically and radiographically, with complete resolution by day 7

symptoms and changes in hematological markers. A suspected diagnosis of SFE can be confirmed radiologically by the appearance of radiolucencies within fascial spaces.[25]

While the typical course of SFE arising from dental treatment is self-limiting and innocuous, the consequences may be severe and potentially life-threatening. Pneumopericardium, tension pneumothorax, and air emboli have been reported previously.[1,3] Instances of blindness may arise if there is hypoperfusion of the central retinal artery.[27] Mediastinitis and necrotizing fasciitis may arise from introduction of oral bacteria into the fascial spaces. Involvement of the parapharyngeal spaces may result in tracheal compression in severe cases. Pneumomediastinum may result in venous distension, hypotension, hypocarbia, and acidosis.[21]

In the present case, air most likely entered the subcutaneous fascial spaces via the gingival sulcus through use of an air syringe. The increased probing depths at presentation were due to the use of a gingival retraction cord used to improve moisture control during preparation and restoration of the tooth. During cord placement, the tissues at the base of the gingival sulcus were probably separated from the underlying periosteum, forming a conduit allowing passage of air generated by the air syringe into the submucosal tissues. The diagnosis of SFE for this patient was confirmed clinically and radiographically, and broad-spectrum antibiotic therapy was commenced to reduce the risk of complications such as necrotizing fasciitis, which may arise from nonsterile air containing oral microbes being introduced into the fascial spaces.[1] Air is typically absorbed by tissues over time, and the condition usually begins to resolve within 2-3 days with most cases showing complete resolution clinically and radiographically by 7-10 days.[1,3,17,21,25] The lack of airway compromise and cardiorespiratory symptoms in this patient precluded the need for more extensive imaging and enabled conservative management with antibiotic treatment, oral analgesics, patient reassurance, and frequent review. Complete resolution was noted 7 days after initial assessment. Cases of greater severity, especially where cardiorespiratory symptoms develop, warrant investigations such as computerized tomography (CT), as well as hospitalization for airway monitoring, tracheostomy, thoracic drainage, or peritoneal decompression. Some authors have described the administration of corticosteroids in management of SFE to reduce edema,[2,28] but the benefits of this are inconclusive.[1,3] The administration of 100% oxygen is also purported to hasten resolution of SFE as the oxygen replaces air in fascial spaces and is more rapidly absorbed by the tissues.[29]

Cautious cord packing and use of smaller retraction cords may reduce the risk of separating the gingival tissues during restorative treatment. The use of polytetrafluoroethylene (PTFE) tape has been suggested as a gentler alternative to conventional retraction cords during class V restorative treatment. Alternatives to tissue retraction such as laser surgery, electrosurgery, and ceramic tissue trimmers have also been suggested to reduce risk of SFE where their use is appropriate.[21] Rubber dam isolation with appropriate root clamps is another

preventive measure which may act as a physical barrier to air entering the gingival sulcus.[7] Furthermore, it is important to limit the use of air-driven handpieces and air syringes near the gingival sulcus as much as possible after retraction cords have been removed; where they are used, careful attention must be paid to instrument angulation to limit or avoid apically directed airflow. Where preventive measures are unsuccessful in preventing emphysematous complications, knowledge of diagnostic features is important so that appropriate management is provided. A framework including preventive measures, diagnostic features, and management of SFE in relation to class V dental restorations is presented in Figure 5.

4 | CONCLUSION

While a rare complication of routine dental restorative treatment, subcutaneous facial emphysema can occur even in the absence of air-driven handpieces. Gingival retraction cords may cause tissue separation, increasing potential for emphysematous complications in the delivery of class V restorations. Alternative gingival management strategies may be considered along with cautious use of air-driven handpieces and air syringes to reduce the risk of SFE during delivery of class V dental restorations. Where emphysema arises, medical consultation is recommended to determine need for monitoring or intervention, along with prescription of broad-spectrum prophylactic antibiotics.

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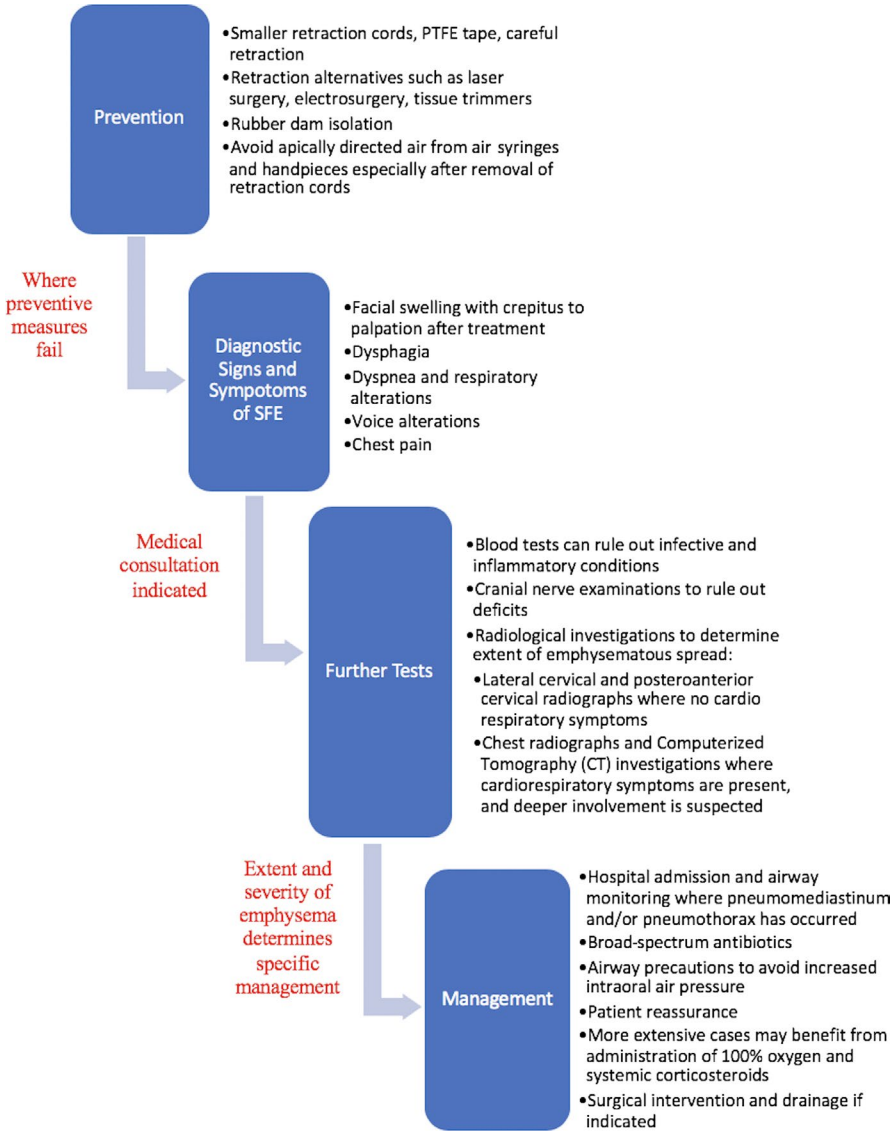

FIGURE 5 Framework for prevention, diagnosis, and management of SFE during class V dental restorations

CONFLICTS OF INTEREST

The author reports no conflicts of interest. The patient has provided consent for the use of photographs and clinical records for publication.

AUTHOR CONTRIBUTION

RM: prepared, edited, and revised this manuscript for publication.

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