Cervicofacial and Mediastinal Emphysema Complicating a Dental Procedure

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ABSTRACT

Cervicofacial subcutaneous emphysema is an infrequently reported sequela of dental surgery. It may be caused by the inadvertent introduction of air into the soft tissues during procedures using high-speed, air-driven handpieces or air–water syringes. In this paper, we present a case in which subcutaneous emphysema developed in a middle-aged woman following routine restorative treatment. We review the features of the condition and its treatment and discuss means of prevention.

MeSH Key Words: dental high-speed technique/adverse effects; face; mediastinal emphysema/etiology; subcutaneous emphysema/etiology

Subcutaneous emphysema in the head and neck is a well-known clinical condition associated with maxillofacial trauma, infections, tracheostomy and radical neck dissection. Emphysema resulting from dental treatment, although rare, has also been reported following the use of high-speed, air-driven surgical drills and compressed air syringes during restoration, extraction and endodontic procedures. The first case of subcutaneous emphysema associated with a dental procedure was reported in 1900.[1] Since then, it has been associated with air-generating dental instruments during restoration[2] and surgical extraction,[3–5] endodontic treatments,[6] trauma from biopsy[7] and cheek biting.[8]

Subcutaneous emphysema occurs when air is introduced into the fascial planes of the connective tissue. The trapped air is often limited to the subcutaneous space in the head and neck. However, it can disperse deeply along the fascial planes of the neck and result in para- and retropharyngeal emphysema, with potential extension into the thorax and mediastinum. These are rare but potentially life-threatening complications.

The clinical presentation is characterized by a sudden onset of hemifacial swelling with the sensation of fullness of the face and closure of the eyelids on the involved side. Crepitation is noted on palpation and is almost pathognomonic for subcutaneous emphysema.

A case of periorbital and cervicofacial emphysema is presented in which parapharyngeal, retropharyngeal and mediastinal extension occurred. The route of spread along contiguous fascial planes is reviewed and potential complications are discussed.

Case Report

A 43-year-old female patient was referred by her dentist to the department of emergency medicine at the Health Science Centre at the University of Manitoba with an immediate and

Figure 1: Orbital view shows an ill-defined swelling of the periorbital region.

Figure 2: Intraoral view reveals a defect at the attached gingiva.

Figure 3: Plain axial computed tomography (CT) scan demonstrating air (arrows) in the lateral pharyngeal spaces on the left side.

Figure 4: Plain axial CT scan demonstrating air (arrows) within the retropharyngeal space posterior to the trachea.

progressive swelling over the upper chest, neck, left cheek and temporal region. The dentist had noticed the hemifacial swelling develop during a routine dental restoration of the left maxillary second premolar under local anesthesia. A standard high-speed air-driven drill was used in the restoration. No rubber dam was placed during the procedure.

The swelling persisted, and the patient exhibited no systemic signs associated with an allergic reaction. On initial presentation, the patient denied any dyspnea or dysphagia.

Physical examination showed a marked swelling of the left neck, cheek and temporal regions. Palpation revealed crepitus of the affected areas. Her left eye was swollen shut and exhibited a large preseptal distension that was also crepitant on palpation (**Fig. 1**). Her vital signs were stable: blood pressure 131/73 mmHg, heart rate 104 beats per minute, respiratory rate 16 breaths per minute and body temperature 37.1°C orally. The trachea was midline, and auscultation revealed clear respirations bilaterally. The patient phonated normally with no evidence of airway obstruction or distress. She reported visual acuity unchanged. Light reflex and extraocular movements were intact. The remainder of her physical examination was normal.

Intraoral examination revealed partial dentition with no evidence of gross decay or infection. The patient's soft tissue was unremarkable with little or no evidence of edema or swelling. Adjacent to her upper left second premolar was a thin band of minimally attached keratinized tissue (**Fig. 2**), which was easily lifted from the underlying alveolus.

Computed tomography (CT) of the thoracocervicofacial region confirmed diffuse subcutaneous emphysema extending from the infratemporal space to the orbital–buccal region and branching into the submandibular, parapharyngeal (**Fig. 3**), retropharyngeal (**Fig. 4**) and mediastinal spaces. CT showed no evidence of any masses or fluid collections.

The patient was admitted to the oral and maxillofacial surgery service for airway monitoring and intravenous prophylactic antibiotic therapy. The following day, the patient's clinical condition was improved and swelling was slightly reduced. After 48 hours the swollen eye opened, cervicofacial distension was reduced and her vital signs were stable. She was discharged on oral antibiotics with a follow-up appointment. Complete resolution of her symptoms occurred over the next 3–4 days with no untoward sequelae.

Discussion

This case report recounts an occurrence of subcutaneous emphysema after routine restorative dental treatment in a healthy adult. The unilateral enlargement of her face was almost undoubtedly caused by compressed air from a high-speed handpiece, which entered the connective tissue fascia through a small intraoral dehiscence of attached gingiva.

Cervicofacial subcutaneous emphysema results from the entry of air or gas into soft tissue planes. The condition is usually a result of treatment with high-speed, air-driven surgical drills and compressed air syringes during restoration, extraction and endodontic procedures. The incidence of subcutaneous emphysema appears to parallel the increase in use of high-pressure dental instruments,[9] and it is remarkable that cervicofacial emphysema is not a more commonly reported complication of dental procedures.

The differential diagnosis of sudden onset head and neck swelling after dental procedures includes hematoma, cellulitis, allergic reaction, angioedema and subcutaneous

Table 1 Clinical features of cervicofacial emphysema

Immediate	Subsequent
Local swelling	Diffuse swelling
Crepitus	Local erythema
Local discomfort	Pain
Radiographic findings	Pyrexia

emphysema.[10] Anaphylaxis (loss of vascular tone indicated by a precipitous fall in blood pressure caused by contact with an allergen) would result in more profuse, bilateral facial manifestations with possible cardiorespiratory symptoms. Angioedema (a massive escape of fluid into the tissue from blood vessels causing large edematous swellings) usually appears in the maxilla as a reddened area with well circumscribed rings and a burning sensation. Hematoma (a pooling of blood in tissues) can also be suspected, although crepitus is not usually present.

Cervicofacial emphysema develops as a result of the introduction of air into fascial planes of the head and neck. These planes consist of loose connective tissue containing potential spaces between layers of muscles, organs and other structures. Once air enters the deep soft tissue under pressure, as is the case when air–water cooled handpieces or air–water syringes are used, it will follow the path of least resistance through the connective tissue, along the fascial planes, spreading to distant spaces.[11] Air travelling through the neck may enter the retropharyngeal space, which lies between the posterior wall of the pharynx and the vertebral column. From here it may penetrate the alar fascia posteriorly, to enter Grodinsky and Holyoke's so-called danger space, which is in direct communication with the posterior mediastinum. When air collects in this space, it can compress the venous trunks resulting in cardiac failure or compress the trachea resulting in asphyxiation. Further complications of subcutaneous emphysema include pneumothorax, pneumopericardium and mediastinitis.

Also of concern is the possibility of life-threatening air embolism.[12] Air enters an open vessel via a pressure gradient between the extravascular and intravascular tissue. When air enters the veins it travels to the right side of the heart, then to the lungs. This can cause the vessels of the lung to constrict, raising the pressure in the right side of the heart. In a patient who is one of the 20% to 30% of the population with a patent foramen ovale, if the pressure rises high enough, the gas bubble can then travel to the left side of the heart and on to the brain or coronary arteries. When death occurs, it is usually the result of a large bubble of gas stopping blood from flowing from the right ventricle to the lungs.

In over 90% of cases, the onset of emphysema-based swelling occurs either during surgery or within 1 hour afterward.[13] Considered an unexpected complication, the clinical presentation and course are generally predictable. The clinical features of cervicofacial emphysema following dental surgery (**Table 1**) commonly involve the initial symptoms of swelling due to a foreign, space-occupying material in the soft tissue — in this case air. The area rapidly becomes swollen and mild crepitus is detected when the tissue is palpated. Local discomfort is slight and is due only to tenseness of the tissues.[14] Limited inflammation of the tissue is observed. Trismus may also be present but is site dependent and often slight. More serious emergency situations arise with the spread of air into the para- and retropharyngeal spaces potentially resulting in respiratory difficulty with risk of airway embarrassment. Migration to the thorax and mediastinum may result in compromised respiratory and cardiac function with possible death.

The treatment of subcutaneous emphysema varies with the severity of the condition and the experience of the physician. Most cases will begin to resolve after 2–3 days of supportive treatment with complete resolution after 7–10 days.[15] Observation for potential airway embarrassment, cardiovascular or infectious processes is often all that is required. Surgical decompression of extensive emphysema should not be routinely undertaken as it is not likely to be effective and may increase or spread the entrapped gas.[16]

The potential for infection is also a concern as the air entering the tissues is contaminated with oral bacteria.[17] Post-resolution purulence within the fascial spaces has been reported.[18] Penicillin is an empirical first choice due to its appropriate narrow-spectrum coverage of normal oral flora.[2] Analgesics are prescribed as necessary, but are rarely required as discomfort is often minimal.

In most cases, patients can be reassured with an explanation of the nature and course of the process. Patients should be cautioned to return in the case of increased swelling or difficulty breathing.

Conclusions

Cervicofacial and mediastinal emphysema are rarely reported in the literature. The simple etiology of the condition and the frequent use of air-driven instruments that exhaust near the operative site make it likely. Although entry sites are often quite small and superficial, significant amounts of air are able to enter the soft tissues and travel easily along fascial planes for some distance. Operative sites should be closely inspected and protected to reduce or prevent air from entering. Handpieces that exhaust air into the surgical field should not be used. Air-cooled instruments used in surgical orofacial procedures should vent air away from the immediate area or recirculate the air to reduce the risk of introducing it into tissues. The

occurrence of sudden swelling during a dental procedure, marked by crepitus within the soft tissue, should raise suspicion of subcutaneous emphysema.

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