

Soft Tissue Cervicofacial Emphysema After Dental Treatment

Report of 2 Cases With Emphasis on the Differential Diagnosis of Angioedema

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Background: The development of soft tissue cervicofacial emphysema after dental treatment is a rare complication, with few descriptions in the dermatologic literature. It is usually restricted to only moderate local swelling. However, spread of larger amounts of air into deeper spaces may sometimes cause serious complications, including airway compromise due to accumulation of air in the retropharyngeal space, pneumomediastinum, and pneumopericardium. Fatal air embolism and soft tissue infections through dissemination of oral flora microorganisms along the emphysematous tracts have also been described. Therefore, early recognition is important, but the unfamiliarity of dermatologists with this condition often causes diagnostic problems. Important differential diagnoses include angioedema, soft tissue infections, and hematoma.

Observations: We describe 2 patients with different severity of the emphysema and airway compromise, repre-

senting the wide spectrum of its clinical expression. Our first case was remarkable, because the emphysema was massive and extended far into deep spaces, including the orbita, mediastinum, and pleural cavity. The present case is only the third report of pneumothorax associated with dental treatment published to date. The patient's condition was initially misdiagnosed and treated as angioedema.

Conclusions: Dermatologists should be aware that soft tissue emphysema can cause acute swelling of the cervicofacial region after dental procedures. Angioedema is an important differential diagnosis, because it may be caused by the use of nonsteroidal anti-inflammatory drugs or local anesthetics, which are often administered during dental treatments.

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SUBCUTANEOUS EMPHYSEMA may occur in association with head and neck surgery, soft tissue infection, trauma, foreign bodies or neoplasms of the aerodigestive tract, any condition leading to rupture of alveoli with consequent pneumomediastinum (eg, asthma or pulmonary barotrauma), or sometimes pneumothorax.^{1,2} Cervicofacial emphysema due to dental procedures is uncommon and has rarely been reported in the dermatologic literature.³ It can be caused by invasion of compressed air into soft tissues through the disrupted intraoral barrier (dentoalveolar membrane or root canal) during tooth extraction (particularly of the third mandibular molars),⁴ restorative dentistry, dental implant surgery, and root canal or periodontal treatment using air syringes, air-water-cooled high-speed dental handpieces, or spray/jet devices.⁵⁻⁷ Gaseous invasion may be restricted to the connective tissues immediately adjacent to the entry site, but passage and accumulation of air between tissue spaces or fascial planes may also lead

to tissue-space emphysema.⁴ The clinical diagnosis of cervicofacial emphysema is based on the sudden onset of swelling with crepitation in the absence of erythema, edema, significant tenderness, or lymphadenopathy.⁸ The most important differential diagnoses are angioedema, hematoma, and infection.

We describe 2 patients who presented with subcutaneous emphysema that occurred after dental treatment; the patients were seen in our dermatology department in May and June 2004, respectively, indicating that this diagnosis is also important for dermatologists. The first patient, a 68-year-old man, developed subcutaneous cervicofacial and mediastinal emphysema as well as pneumothorax after root canal restoration of 2 mandibular teeth. He was initially treated for angioedema because of the initial absence of the typical features of subcutaneous emphysema and a history of allergy to nonsteroidal anti-inflammatory drugs, which he received after dental treatment. The second patient, a 39-year-old woman, pre-

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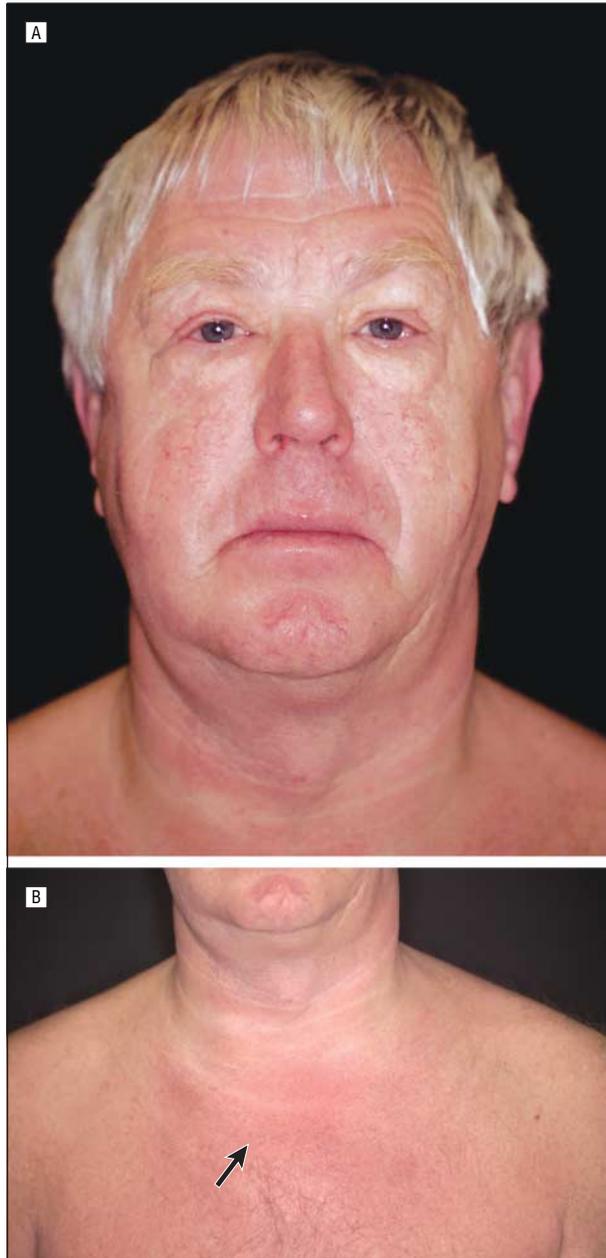


Figure 1. Patient in case 1. Ill-defined swelling of the face (A) and cervicothoracic area (B, arrow) 24 hours after dental treatment.

sented with only mild cervicofacial swelling and airway compromise, which developed immediately after periodontal treatment.

REPORT OF CASES

CASE 1

A 68-year-old man presented to the emergency department of the Medical University of Graz, Graz, Austria, in June 2004 with noncrepitating swelling of his cervicofacial region and tongue and globus hystericus (sensation as of having a lump in the throat). Two hours earlier, he had undergone root canal restoration of his second and third right mandibular molars as well as prepara-



Figure 2. A lateral cervical radiograph reveals air accumulation in the retropharyngeal space (arrow).

tion for bridges of 7 mandibular teeth. Treatment was conducted with a water- and air-cooled diamond dental drill. For local anesthesia, 1.7 mL of articaine hydrochloride–epinephrine hydrochloride (Ultracaine) (68 mg/0.01 mg) was used. Also, the patient received 100 mg of acetylsalicylic acid directly after dental treatment. He gave a history of allergy to nonsteroidal anti-inflammatory drugs. Therefore, acetylsalicylic acid was suspected to be the cause of his complaints. A diagnosis of angioedema was made, and the patient was treated with 250 mg of prednisolone and 4 mg of dimethindene maleate, which was followed by amelioration of his signs and symptoms. On the next day, however, he presented to the dermatology department with massive cervicofacial swelling and intense dysphonia (husky, whispering voice). On physical examination, skin-colored, not sharply demarcated, soft, slightly tender swelling with clear-cut crepitation was found on both sides of the neck, the cheeks, and the periorbital regions, covering a total of about 15% of his body surface (**Figure 1**). The findings of the rest of the physical examination were unremarkable. The patient was afebrile and had no hives. Soft tissue ultrasound examination of the head and neck region demonstrated air bubbles in the subcutis. Radiographs of the cervicofacial region revealed superficial emphysema of the laterocervical and presternal areas as well as trapping of air in deeper spaces, including the orbita, submaxillary area, and perimandibular and retromandibular spaces. Intense accumulation of air was found in the retropharyngeal space (**Figure 2**). Therefore, additional computed tomograms of the cervical and thoracic areas were obtained and showed widespread ventral, lateral, and dorsal soft tissue emphysema as well as air within the ventral mediastinum. Furthermore, a moderate laterodorsal pneumothorax was present on the right side (**Figure 3**).

A blood chemistry profile, whole blood cell count, and C-reactive protein, C1-esterase inhibitor, and total serum IgE levels were all normal. Histopathologic examination of a 4-mm skin punch biopsy specimen from the right cervical region revealed extensive separation of attenuated collagen bundles, which mirrors the amount of interstitial air (**Figure 4**). Adipose tissue showed fragmentation of cell membranes. Inflammatory cells, an increase of fibroblasts, or mucin deposits could not be demonstrated. The patient was hospitalized for monitoring and intravenous antibiotic prophylaxis with amoxicillin sodium plus clavulanic acid (2 g twice a day). Over the next 6 days, swelling and crepitation gradually resolved, and his voice returned to normal.

CASE 2

A 39-year-old woman presented to the outpatient clinic of our department in June 2004 with cervicofacial swelling and difficulty in breathing. Her symptoms developed immediately after a periodontal ultrasonic scaling treatment and high-pressure bicarbonate cleansing. She received no other therapy and was otherwise well. On examination, symmetrical mild swelling, crepitation, and tenderness of the periorbital, malar, and supraclavicular regions were noted. Radiographs of the cervicofacial region and thorax revealed subcutaneous emphysema as well as air in the retropharyngeal space. Soft tissue ultrasound confirmed the diagnosis. The patient did not appear for a follow-up visit.

COMMENT

Most patients who develop subcutaneous emphysema after a dental procedure have only moderate local swelling. However, spread of larger amounts of air into deeper spaces may sometimes cause serious complications. For example, the bases of the first, second, and third molars directly communicate with the sublingual and submandibular spaces. These spaces, in turn, communicate with the parapharyngeal and retropharyngeal spaces, where accumulation of air may lead to airway compromise.⁹ The retropharyngeal space (“danger space”) is the main route of communication from the mouth to the mediastinum. Once air enters the mediastinum, it can also reach the pleural cavity, the pericardium, and even the retroperitoneum.^{4,10} Consecutive cases of pneumothorax and pneumopericardium may cause cardiac and/or pulmonary failure.^{10,11} Cases of fatal air embolism⁶ and optic nerve damage¹² (by access of air to the orbita) have also been described. Furthermore, dissemination of oral flora microorganisms along the emphysematous tracts may be responsible for soft tissue infections (eg, deep neck infection and mediastinitis) and sepsis.^{7,13} Therefore, early recognition is important, but the unfamiliarity of dermatologists with this condition often causes diagnostic problems.⁷ Treatment of subcutaneous emphysema in mild to moderate cases consists of observation and reassurance of the patient.¹⁴ In the vast majority of cases, emphysema improves within 2 to 3 days, although residual swelling may be evident for up to 14 days.¹⁵ In severe cases, immediate medical attention is mandatory. Tracheostomy may become nec-

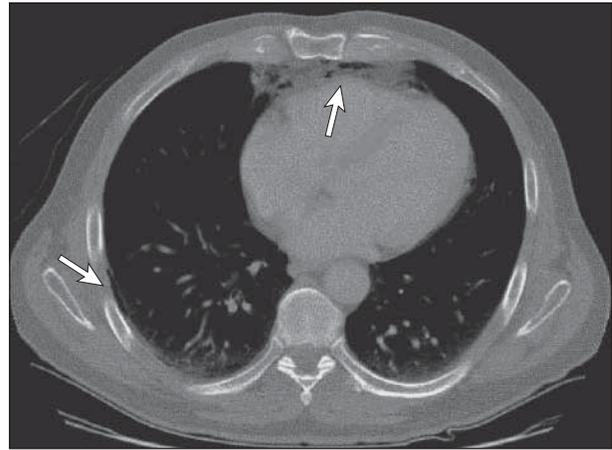


Figure 3. An axial computed tomogram (enhanced) reveals free air within the mediastinum and a moderate laterodorsal pneumothorax (arrows).

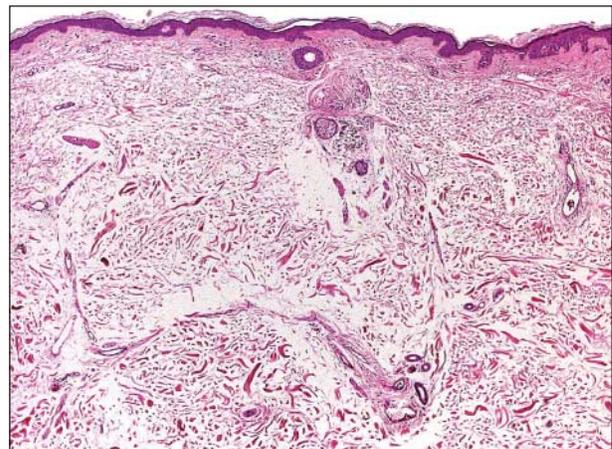


Figure 4. Case 1: Histopathologic examination of a skin punch biopsy specimen from the right cervical region shows cutaneous emphysema (hematoxylin-eosin, original magnification $\times 40$).

essary in case of retropharyngeal-space emphysema with consecutive airway compromise.¹⁶ It has also been reported that administration of 100% oxygen via a nonrebreather mask can hasten resolution of the emphysema, because oxygen, which replaces the air, is more readily absorbed.^{9,14} Prophylactic administration of antibiotics, preferentially amoxicillin plus clavulanic acid, is recommended to prevent secondary infections.¹³

Our first case demonstrates the difficulty in diagnosing subcutaneous emphysema after dental treatment. The patient's condition was initially misdiagnosed as angioedema, which was described earlier as possible but rare erroneous diagnosis of emphysematous complications after dental treatment.^{7,11} Physicians may be misled by the fact that the use of certain medications, such as nonsteroidal anti-inflammatory drugs or local anesthetics, as in the present case, can cause angioedema. Other differential diagnoses of acute swelling of the cervicofacial region include soft tissue infections, hematoma, acute contact dermatitis, and Melkersson-Rosenthal syndrome. Clinical presentation of subcutaneous emphysema is usually a soft, skin-colored swelling without inflammatory redness or edema that occurs during or shortly after dental treat-

ment. The area is not warm on palpation, and patients have no elevated temperature unless there is secondary infection. The results of blood chemistry profiles, C-reactive protein levels, and whole blood cell counts are typically within normal ranges. Importantly, compared with the other possible diagnoses, facial or cervicofacial swelling is always associated with crepitation, which may not be palpable before a latency period of several hours.

Case 1 was also remarkable, because the emphysema was massive and extended far into deep spaces, including the orbita, mediastinum, and pleural cavity. This is only the third case of pneumothorax associated with dental treatment reported to date.^{11,17} The severity of this case may have been caused by the extensive treatment, including root canal restoration of 2 mandibular teeth with an air-water-cooled high-speed dental handpiece. Air might have been introduced under pressure into the soft tissue space by passing through a lesion of the root canal. A "valve effect" could have developed to capture larger amounts of air.¹⁸ In contrast to our first case, the subcutaneous emphysema with swelling of the thoracocervicofacial region and airway compromise in our second case was only moderate, reflecting the large spectrum of severity in cases of iatrogenic emphysema. In cases involving more severe subcutaneous emphysema, soft tissue radiographs of the neck should be obtained for airway assessment, as well as chest radiographs to rule out mediastinal involvement.^{8,14} Anteroposterior chest radiographs usually show a radiolucent outline parallel to the margin of the heart. Lateral chest radiographs are often more helpful, because they show retrosternal radiolucency with outlining of the aorta and mediastinal structures.¹⁹ Computed tomographic scans are superior in assessing the topographic extension and accumulation of air.¹⁴ It has been shown that on computed tomograms, air bubbles in the retropharyngeal space and carotid spaces are strongly indicative of air migration into the mediastinum.⁸ Furthermore, computed tomographic scans are capable of distinguishing emphysema from necrotizing fasciitis caused by gas-forming organisms.⁸

In conclusion, dermatologists should be aware that the development of subcutaneous emphysema after dental procedures can cause acute swelling of the cervicofacial region. Thorough knowledge of the diagnostic clues is important for the early recognition and initiation of treatment, which are essential to prevent possible complications.

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