

AIR EMPHYSEMA AFTER DRYING THE CAVITY WITH AN AIR SYRINGE

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ABSTRACT

INTRODUCTION: Subcutaneous emphysema is defined as the abnormal presence of air or gas in the body tissues or tissue spaces. In dentistry, however, subcutaneous emphysema is most often a consequence of compressed air being forced into the subcutaneous tissues through the intra-oral barrier. Most often the air comes from the slow hand-piece, the turbine and the dental air syringe, although recent reports have surfaced of emphysema being caused by air coming from an air abrasion tool, CO₂ laser or a cryotherapy device.

CASE DESCRIPTION: A case of air emphysema following by drying the cavity with dental syringe. Discussion of prophylactic and treatment of air emphysema.

CONCLUSIONS: Subcutaneous emphysema is one of the less common complications that may occur during the treatment of carious lesions. It is usually limited to moderate swelling of soft tissues, which due to slow regression becomes an unpleasant complication for the patient. The air that has entered to the subcutaneous tissue carries the risk of causing an infection like cellulitis or necrosis of fascial and therefore requires the use of antibiotic therapy. Although emphysema is a medical complication, often harmless, it should be remembered that there is always a risk of serious consequences requiring specialized treatment. Prompt and appropriate diagnosis enables effective treatment of emphysema.

KEY WORDS: emphysema, complications, dental treatment.

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INTRODUCTION

Subcutaneous emphysema is defined as an unnatural collection of air or other gas in tissues or tissue spaces [1]. It may occur spontaneously, iatrogenically or as a result of a sustained injury [2]. Intrinsic (spontaneous) subcutaneous emphysema can occur, for example, when blowing a nose, sneezing or playing a brass instrument. Traumatic emphysema arises as a result of injuries sustained in the craniofacial region. In turn, iatrogenic emphysema is a result of medical malpractice committed by a physician during the diagnosis or treatment of the pa-

tient. Among treatments in the field of anaesthesiology, the most common cause of subcutaneous emphysema is poorly performed intubation or excessive ventilation of the patient [3, 4].

In dentistry, however, subcutaneous emphysema is most often a consequence of compressed air being forced into the subcutaneous tissues through the intra-oral barrier [5-7]. Most often the air comes from the slow hand-piece, the turbine and the dental air syringe, although recent reports have surfaced of emphysema being caused by air coming from an air abrasion tool, CO₂ laser or a cryotherapy device [8-12]. Procedures which entail a high

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risk of developing subcutaneous emphysema include extractions (especially those of third molars in the mandible), endodontic microsurgery (e.g. resections of root apex), root canal treatment, periodontal treatment (e.g. scaling), restorative dental treatment (Table 1), implantation, tooth preparation for crowns and bridges [1, 6, 7, 13-15].

CASE DESCRIPTION

A 52-year-old female patient arrived at the dentist's office for her biannual dental check-up. Over the course

of the clinical examination, the patient was diagnosed with secondary caries over the filling located in the cervical area on the buccal side of tooth 44. Before removal of the filling, a retraction thread was introduced into the gingival sulcus in order to pull the gums away from the tooth tissues and thus to avoid periodontal damage while preparing the cavity. After inserting the thread, the physician dried the tissue with a dental air syringe in order to improve the visibility in the treatment area. Immediately after drying the tooth, the facial soft tissues presented oedema on the right side along the sub-

TABLE 1. Case reports of subcutaneous emphysema occurred during restorative treatment in conservative dentistry

Reference	Gender	Age	Tooth	Procedure	Suspected cause	Type of emphysema	Antibiotics
Aquillina P, McKellar G	F	31	26	Cavity preparation, high speed handpiece	Laceration in the depths of the upper left buccal vestibule adjacent to tooth 26 measuring approximately 5 mm in length	Subcutaneous emphysema	Clindamycin 300 mg (4 x 1 i.v.)
Bohnenkamp DM	M	23	35	Occlusal reduction of the facial cusp with diamond bur and high speed handpiece	Laceration of buccal mucosa opposite tooth 35 caused by biting the cheek during food mastication	Subcutaneous emphysema	10 days
Chan DCN, Myers T, Sharaway M, <i>et al.</i>	M	47	44, 45	V class cavities (air coming from high speed handpiece or air-water syringe)		Subcutaneous emphysema	No
Iqbal M, Ikram M, Raza F, Bandy N	F	50	Lower left molar tooth	New restoration of fractured crown in tooth endodontically treated 12 years before (air coming from air-water syringe)		Subcutaneous emphysema, pre-vertebral space emphysema	Yes
Salib RJ, Valentine P, Akhtar S	F	56	44, 45	V class cavities		Subcutaneous emphysema	Yes
Libenberg WH, Crawford BJ	F	16	27	Cavity located in palatal fissure prepared by air-abrasive device	Laceration of gingival mucosa caused by rubber dam clamp	Subcutaneous and mediastinal emphysema	?
Steelman RJ, Johannes PW	F	5	75	Cavity preparation	Operculum flap covering freshly erupting tooth 36	Subcutaneous emphysema, mediastinal emphysema	Clindamycin
Mather AJ, Stoykewych AA, Curran JB	F	43	25	Cavity preparation, turbine	Thin band of attached gingiva	Subcutaneous emphysema, parapharyngeal and retropharyngeal emphysema, mediastinal emphysema	Yes
Vidal CAG, Pizzaro CAV, Arriagada AA	F	52	34	V class cavity, turbine		Subcutaneous emphysema	Yes
Shuman NJ, Owens BM, Shelton JT	F	32	16, 18	Cavity preparation	Unintentional injury of the mucosa during preparation of the cavity	Subcutaneous emphysema	Yes



FIGURE 1. Subcutaneous emphysema just after using a dental syringe



FIGURE 3. Subcutaneous emphysema 24 hours later

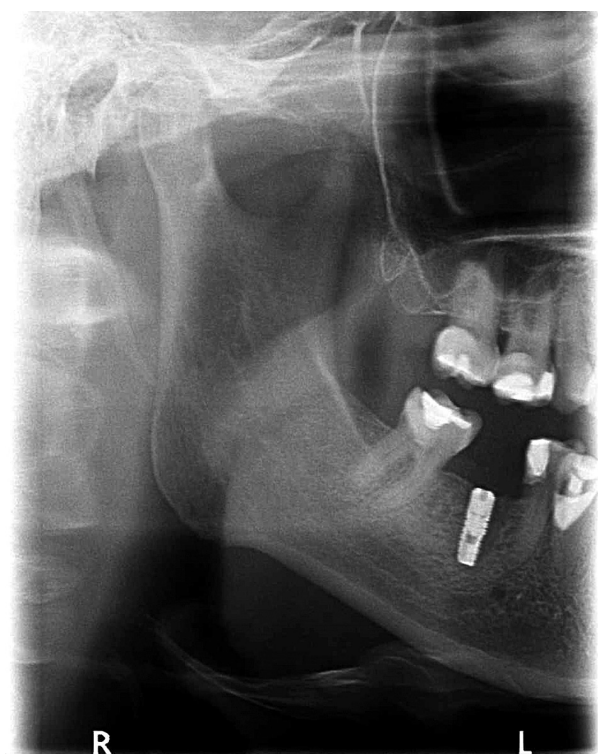


FIGURE 2. Panoramic radiograph showed restoration located under the gingiva in tooth 44

mandibular region, the cheek and the eye (Figure 1). The oedema was not accompanied by pain. In view of the significant oedema, the dentist desisted from further treatment of caries in tooth 44. A panoramic radiograph was taken, which showed a relatively low descension of the subgingival margin in tooth 44 (Figure 2). The patient was informed of the situation and was asked to register for a follow-up visit. The following day, the soft tissues oedema increased when compared to the immediate occurrence of emphysema (Figure 3). After a week, the oedema completely subsided; how-

ever, the patient did not decide to continue treatment of tooth 44.

DISCUSSION

Subcutaneous emphysema is one of the less common complications in dentistry [2]. Regardless of the type of dental procedure performed, the cause of oedema formation is due to air under pressure being forced into a soft tissue region, which usually occurs as a result of damage/breakage of natural barriers (e.g. periodontal space, periodontal pocket, alveolar bone, parotid duct). In the described case, the absence of an attached gingiva was considered as the probable cause of the occurrence of emphysema. Clinically, emphysema manifests itself as increased oedema of the facial soft tissue without changing its colour. Emphysema is not usually accompanied by pain symptoms. However, if it does appear, the pain is changeable and short-lived. Sometimes patients complain of pain during the appearance and enlargement of the oedema [3]. In addition, there may be difficulties in moving the head and when swallowing, especially in cases where the oedema has spread around the neck [16]. Emphysema occurs most often during treatment or shortly after its completion [7]. However, there was a case where the symptoms of emphysema appeared only one day after the surgery [17]. Typically, soft tissue oedema disappears spontaneously after 3 to 10 days from the moment of appearance.

The sudden occurrence of oedema of the face and/or neck following dental surgery requires differential diagnostics, which should take into account the possibility of a haematoma, inflammation of the connective tissue or the so-called cellulitis, an anaphylactic reaction, or angioedema (vascular and motor oedema) [3, 6, 15, 18]. The accumulation of blood within the submucosal or subcutaneous tissue contributes to the formation of a haematoma which, in addition to local volume enlargement of the tissue, manifests itself in its bruising.

It may be accompanied by pain and/or inflammation [19]. Cellulitis is an acute, diffuse inflammation of the skin or subcutaneous tissue, which is accompanied by both local and systemic symptoms. The inflamed tissue is tender when palpated/touched, swollen, red, hot and painful. There may also be efflorescence in the form of blisters, or petechiae. In advanced states, fever, chills, sweating, and headaches may occur [19]. Angioedema Quincke's/angioneurotic oedema is a hypersensitivity reaction characterised by subcutaneous or submucosal tissue oedema caused by increased vascular endothelial permeability and the passage of tissue fluid into the extravascular space [19, 20]. It applies most often to lips, eyelids, the mucosa of the mouth and cheek, and, therefore, to tissues containing large volumes of loose connective tissue. Angioedema develops within a few minutes or gradually over the span of several hours and it subsides quite quickly (24-36 h). It is not accompanied by pain but rather by a feeling of tension and burning, and sometimes superficial blisters may appear. It is important to bear in mind the dangers of dyspnoea occurring in the patient when the oedema involves the larynx tissues [21]. Emphysema is often confused with an allergic reaction. Sometimes the dentist considers its occurrence in patients who have been administered an anaesthetic. In these cases, it should be verified whether the case at hand is that of a real allergy or just a vasovagal reaction following an injection, which can be mistaken for an allergic reaction to the local anaesthetic [19]. The least dangerous symptoms of an allergic reaction are skin changes, which may occur in the form of pruritus, redness, oedema, urticaria or erythema [19]. An allergic reaction may occur immediately (type I – anaphylactic shock, urticaria, angioneurotic oedema) or with a delay (type IV – contact allergy) [22]. A pathognomonic symptom of pneumothorax is the characteristic crackling of tissue during palpation, which allows emphysema to be distinguished from the above-mentioned conditions [3]. In patients with neck and/or mediastinum oedema, it is necessary to take an X-ray and perform computer aided tomography or magnetic resonance imaging that will facilitate the correct diagnosis [16, 19]. The patient ought to be informed by their dentist that if their well-being deteriorates, they should report to the emergency room, especially if breathing problems occur.

Although the majority of emphysemas which occur due to dental reasons pertain to the subcutaneous tissue, there have been reports of air leakage into other tissue spaces, such as the mediastinum or the retropharyngeal space. The presence of air in the mediastinum or the medial space can lead to cardio-respiratory complications [23]. In patients with oedema located in the pericardium, changes in the ECG image are also observed [24]. Symptoms that may indicate the presence of oedema in the mediastinum are dyspnoea, back or chest pain and the so-called Hamman's symptom, i.e. a pulse-like sound of air moving in the mediastinum [17].

In patients with oedema, antibiotics are prophylactically recommended. This treatment aims to prevent the occurrence of a secondary infection, e.g. connective tissue inflammation or fascial necrosis. It is assumed that air entering other tissues from the mouth contains numerous species of bacteria that may cause the development of an infection [3, 6]. There is no clear information in the literature about the validity of administering antibiotics in protecting patients from secondary infections [23, 25-31]. In the majority of reported cases, physicians employed prophylactic antibiotic therapy in their patients [23, 25, 26]. There were also some doctors who did not choose antibiotics, nor did they report any complications [27-31]. Antibiotics were also not used in the above-described case.

The dentist can reduce the risk of emphysema occurrence, e.g. by conducting endodontic treatment in a rubber dam, by choosing not to use hydrogen peroxide to rinse root canals, or further by not drying the canals with compressed air from an air syringe and paying attention to the direction of the air outlet from the rear parts of the dental handpieces [7, 14]. During laser work the dentist should avoid concentrating the laser beam for a long time in one place, especially when working in narrow spaces, such as in the case of a submucosal abscess and by accordingly adjusting the flow of the air which cools down the laser [11]. When performing preventative air abrasion treatment, the tip of the nozzle should not be directed towards the epithelial attachment or towards the gingival groove, whereas it is recommended to exercise extreme caution when working in the area of deep periodontal pockets [32]. Following dental procedures, especially those in the field of surgery, the patient should be advised to refrain from smoking cigarettes, coughing, sneezing, vomiting and blowing their nose for a certain period of time; this restriction also involves other activities which increase the pressure in the mouth [3, 33]. During treatment, the patient's behaviour should be closely monitored and all their complaints ought to be responded to accordingly. This is of crucial importance, as a simple subcutaneous emphysema may cause a pulmonary embolism, which in the absence of a prompt reaction on the part of the physicians can lead to a patient's death [33].

CONCLUSIONS

This article presents the case of an iatrogenic emphysema which occurred when drying the treatment area by means of a dental air syringe. The emphysema is usually caused by introducing air under pressure into the soft tissues. However, the use of a dental air syringe is not the only cause of the formation of emphysema. Although emphysema tends to be a harmless medical complication, it should be remembered that there is always a risk of serious consequences which require

specialist treatment. Prompt identification of the symptoms, differential diagnostics, and then making the right diagnosis enables quick and effective treatment.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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