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RESEARCH ARTICLE

SUBCUTANEOUS ORBITAL EMPHYSEMA IN DENTAL PRACTICE-A CASE REPORT

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ABSTRACT

The development of soft tissue air emphysema after dental treatment is an infrequently reported sequel. It may be caused due to inadvertent introduction of air into soft tissues during procedures using high speed, air driven hand-pieces or air–water syringes. However with scattered case reports and reviews in dental, surgical, anaesthetic and dermatologic literature, it appears to be under reported and rare. Orbital emphysema due to dental treatment is even a rarer entity with very few documented cases in literature. A case of subcutaneous orbital emphysema following routine metal crown removal is presented to illustrate the typical presentation, differential diagnosis, management and prevention of this uncommon condition.

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INTRODUCTION

The word emphysema originates from the ancient Greek language and means "to blow in". Various terms have been used such as subcutaneous emphysema, (Schuman *et al*., 2001) barotrauma, (Goorhuis *et al*., 1993) or more specific terms, such as surgical emphysema, (McDonnell, 1983) and interstitial emphysema. (Schlacter, 1975) The majority of cases resolve spontaneously but some may be potentially life threatening due to mediastinal, pericardial or retropharyngeal space involvement which may lead to cardiopulmonary distress. (Sekine *et al*., 2000) The first case of subcutaneous emphysema associated with a dental procedure was reported in 1900 by Turnbull who described facial emphysema after a premolar extraction. (Turnbull, 1900) Since then, it has been associated with air generating dental instruments during dental restoration, (Karras and Sexton, 1996) surgical extraction, (Buckley *et al*., 1990) endodontic treatment, (Matt *et al*., 2004) periodontal ultrasonic scaling treatment and high pressure bicarbonate cleansing. (Mitsunaga *et al*., 2013; Davies *et al*., 1990; Frühauf *et al*., 2005) Orbital emphysema is an rare condition that occurs because of air trapped in loose subcutaneous tissue around the orbit usually seen in cases with history of sneezing, spontaneous orbital emphysema (SOE), sinusitis, infection, surgery, facial trauma or surgery. (Shah, 2007; Zimmer-Galler and Bartley, 1994; Mohan and Singh, 2001) The clinical presentation subcutaneous periorbital emphysema is characterised by a sudden onset of periorbital or hemi-facial swelling with a sensation of fullness of the face and closure of the eyelids on the involved side. Crepitation on palpation is almost pathognomonic for subcutaneous emphysema. The purpose of this article is to present a case of peri- orbital emphysema encountered during routine crown removal procedure using an aerotor and to alert dental practitioners to the presentation, diagnosis, management and prevention of this unusual complication.

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Case report

A 65 year old female patient reported with the chief complaint of dull pain and food lodgement in the right maxillary premolars. On examination, there was a 6mm deep periodontal pocket in relation to a porcelain fused to metal (PFM) crown of tooth#14 which was cantilevered distally with a ridge-lap pontic on tooth #15. Tooth #16 was endodontically treated and a stainless steel crown had been fabricated several years ago, but it was not present in the patient`s mouth at the time of examination. Treatment plan was carefully devised;it was decided to remove the existing bridge by sectioning the PFM crown with the help of diamond/carbide burs and aerotor. A PFM bridge involving teeth #14 -15 -16 was advised after

addressing the periodontal status of the patient. Patient was reportedly healthy and gave a history of extraction of her maxillary right and left third molars six months ago. Local anaesthesia was obtained with supra-periosteal injection. It was planned to section the PFM crown on tooth #14 with an air driven hand -piece and diamond /carbide burs. During the sectioning of the crown, an immediate marked swelling was noted over the right side of the face, extending up to the lower eyelid. The patient experienced no pain and could breathe normally. Dental treatment was immediately discontinued, a physician was consulted immediately and vitals were monitored. The vital signs were all within normal limits (temperature 37.1°C, respiratory rate 16 breaths per minute, heart rate 80 beats per minute, blood pressure 120/70 mmHg) and she was warm and well perfused and hemodynamically stable. Examination of her respiratory and cardiovascular system by the physician revealed vesicular breath sounds with good air entry bibasally and a midline trachea. Patient was comfortable, able to swallow and was not in any respiratory distress. There was crepitus on palpation of the infra -orbital region on right side of the face. On lid retraction, there was minimal conjunctival congestion. Extra ocular movements were full and the pupil was briskly reacting to light. Fundus examination revealed no abnormalities.

Diagnosis of orbital emphysema was made after eliminating the other possibilities of anaphylaxis, angioedema, hematoma, cellulitis and soft tissue infections. Patient was gently informed about the situation and was instructed to contact the clinician if she had any post-operative problems. Prophylactic antibiotics, non-steroidal anti-inflammatory drugs and decongestant nasal drops were prescribed. Patient was advised to avoid blowing her nose for a few days and was recalled the next day for followup. Twenty four hours later, the swelling had reduced slightly. The patient was examined and monitored daily for five consecutive days. Clinical improvement with resolution of the orbital emphysema was noted with minimal crepitus after 7-10 days.

DISCUSSION

Orbital emphysema is generally a benign condition that occurs following forceful injection of air into the orbital soft tissue spaces. The medial orbital wall (lamina papyracea), which is known theoretically to be the weakest point of the orbital wall, has been reported as the most common site of pure orbital fractures and passage of air from paranasal sinuses. (Shah, 2007) Emphysema typically results from forceful entry of air into the orbital soft tissue spaces following an orbital fracture. However, other mechanisms including infection, pulmonary barotrauma, injury from compressed air hoses, complications from surgery, sneezing, airplane travel, and Boerhaave's syndrome (esophageal rupture) have been reported. (Zimmer-Galler and Bartley, 1994; Mohan and Singh, 2001) In the dental setting, it may be caused due to the use of high speed dental hand pieces especially those which are air turbine driven. These expel high pressure air towards the cutting surface of the bur. Due to inadvertent break in the integrity of the mucosa, air under pressure is able to travel subcutaneously. Periorbital emphysema as a complication during endodontic retreatment of an upper central incisor was reported by Al-Qudah in 2013. Cases of emphysema following scaling and crown preparation have also been reported. (Shah, 2007; Zemann *et al*., 2007) Hunts *et al*. (1994) proposed a classification to manage orbital emphysema. Stage I is detected only radiographically, without much clinical evidence; Stage II presents with globe dystopia or proptosis; Stage III presents with increased Intra-Ocular Pressure (IOP) and optic nerve ischemia. Finally stage IV shows orbital compartment syndrome with significantly raised IOP and central retinal artery occlusion. Stages I & II are managed conservatively with antibiotics, decongestants and avoidance of nose blowing. With stage III, orbital decompression is done with a needle attached to a syringe filled with saline and plunger removed. Additionally, treatment with high dose intravenous corticosteroids is indicated in patients with vision loss to prevent ischemic or direct injury to optic nerve.

Frontal view reveals well defined swelling in the peri-orbital region

Intra -oral view shows inadequate width of attached gingiva and ridge- lap pontic in tooth #15 region causing gingival tissue impingement

Stage IV orbital emphysemas are treated by immediate decompression with lateral canthotomy / cantholysis. Further management is as for stage III orbital emphysema. (Rajalaksmi *et al*., 2013)

Heyman and Babayof studied 74 cases, they reported that 71% of cases with subcutaneous emphysema were related with the use of an air syringe, high-speed hand piece or both. Their study also showed that subcutaneous emphysema affects the upper neck in 95% and the eye socket area in 45% of cases, concluding that this is not a rare complication, being caused principally by dental extractions and restorative procedures. (Heyman, 1995) As indicated by Gamboa *et al*, (2007) care should be exercised with periodontal pockets over 4 mm or when there is little attached gingiva, since it may predispose to production of subcutaneous emphysema. Therefore, it is of paramount importance to maintain a safe distance between the hand piece and the soft tissues and / or bone to prevent penetration of air even in the absence of a muco-periosteal flap. The unilateral enlargement of our patient's face was almost undoubtedly attributed to the compressed air from a high-speed hand piece which entered the connective tissue fascia through the periodontal pocket associated with tooth #14.

Since the peri- orbital space offers low tissue resistance, air accumulated readily in this space as was evident by the sudden onset of the swelling of upper and lower eyelids. The inadequate width of attached gingiva and the ridge- lap fixed partial prosthesis design causing gingival tissue impingement in tooth #15 region may have contributed to the occurrence of the peri orbital emphysema. Angioedema, hematoma, cellulitis and soft tissue infections which are an important differential diagnosis for a sudden onset head and neck swelling, had to be ruled out because it may be caused by the use of non- steroidal anti-inflammatory drugs or local anaesthetics, which were administered in the treatment procedure. (Pynn *et al*., 1992) Anaphylaxis would result in more profuse, bilateral facial manifestations with possible cardiorespiratory symptoms. Angioedema usually appears in the maxilla as a reddened area with well circumscribed rings and a burning sensation. (Pynn *et al*., 1992) Hematoma can also be suspected, although crepitus is not usually present. With orbital emphysema there may be complications with a range of severity including proptosis, loss of vision, increased intra ocular pressure, ischemic optic neuritis and central retinal artery occlusion, with the more severe complications caused by orbital compartment syndrome leading to visual loss. (Goldberg *et al*., 1987; Davies and Campbel, 1990) Cervicofacial emphysema may also develop 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. (Davies and Campbel, 1990)

Hence when orbital emphysema shows signs of pressure like restricted ocular motility, sluggish pupillary reaction, disc edema or decreased visual acuity, then drainage of trapped air in the subcutaneous tissue should be considered. It can be done effectively by simple underwater drainage of air by 24-gauge needle or lateral canthotomy and cantholysis. Further complications of subcutaneous emphysema include pneumothorax, pneumopericardium and mediastinitis. (Wearne *et al*., 1998; Benharbit *et al*., 2003) A CT scan is effective in identifying the presence and anatomical location of air when orbital emphysema is suspected. (Rajalaksmi *et al*., 2013) Diagnosis of orbital emphysema was made after eliminating the other possibilities. Prophylactic antibiotics, non-steroidal anti-inflammatory drugs and decongestants were prescribed to the patient. Clinical improvement of the emphysema was noted after 2-3 days, with minimal crepitus after 7-10 days.

Conclusion

Management of orbital emphysema is controversial due to the limited number of reported cases as many cases go unrecognised or are misdiagnosed. It can be alarming both for the patient and for the dentist. The most important immediate step in the management of emphysema is a correct diagnosis which is established by the sudden onset of neck swelling, crepitus sound, and the lack of significant tenderness, erythema, oedema, or lymph node involvement. In most cases, trapped air is absorbed in the course of three to seven days without active intervention; however, it may be recommended to give a course of prophylactic antibiotics, to prevent secondary infection from dissemination of oral flora along tissue spaces.It is important to make differential diagnosis of this complication with others that also produce volume increase like hematoma, allergic reaction or angioedema. It is therefore recommended to avoid direct contact between the head of the hand piece and the tooth, as this may cause air to penetrate directly into the tissues. Early recognition of sub- cutaneous emphysema is important and judicious use of intra-oral dental instruments using compressed air is advised.

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