CASE REPORT

DOI: 10.5336/caserep.2019-66716

An Unusual Complication of Periodontal Debridement: Subcutaneous Emphysema and Pneumomediastinum

Hasan Gökhan AÇIKGÖZ[a],
Aydan AÇIKGÖZ[b],
Burcu KARADUMAN[c],
Önder DEMİRBAŞ[d]

Departments of
[a]Periodontology,
[b]Oral and Maxillofacial Diseases and Radiology,
İstanbul Aydın University Faculty of Dentistry,
[c]Department of Periodontology,
Biruni University Faculty of Dentistry,
İstanbul, TURKEY
[d]Department of Radiology,
Gizze Hospital,
Ankara, TURKEY

Received: 01 May 2019
Accepted: 03 Jul 2019
Available online: 08 Jul 2019

Correspondence:
Burcu KARADUMAN
Biruni University Faculty of Dentistry,
Department of Periodontology,
İstanbul, TURKEY
bkaraduman@biruni.edu.tr

This study was presented as a poster presentation at Turkish Dental Association 23. International Dental Congress, 21-24 September 2017, İstanbul, Turkey.

ABSTRACT Cervicofacial subcutaneous emphysema (CSE) and pneumomediastinum (PM) are rare complications after dental interventions. In this case report, an unusual case of CSE and PM developed following air-powder polishing is presented because of the rare occurrence in the literature. Oral hygiene instructions, periodontal debridement, and air-powder polishing were carried out. The patient complained of discomfort and swelling on the right side of her face and her throat immediately after the procedure. The patient was referred to the emergency care unit. Crepitation was noted on palpation at the right lateral face and neck of patient. Computed Tomography confirmed cervical emphysema with pneumomediastinum. Patient was hospitalized, and parenteral antibiotic therapy was administered. The recovery was uneventful. Dentists and physicians should be aware that the use of air-flow devices can lead to the risk of CSE and PM. The diagnosis and treatment should be provided quickly to reduce further complications.

Keywords: Subcutaneous emphysema; pneumomediastinum; postoperative complications; periodontal debridement; dental air abrasion

Cervicofacial subcutaneous emphysema (CSE) is defined as the appearance of immediate swelling due to the penetration of air into the subcutaneous tissues of the head and neck.[1] Subcutaneous emphysema (SE) is typically characterized by crepitus upon palpation of the affected area.

Although CSE is a self-limiting condition; due to the loss of the integrity of the soft tissues, the air can spread to the mediastinum and thorax along the fascial planes.[2] Once the air is forced into the mediastinum, the condition is called pneumomediastinum (PM), PM can lead to a life-threatening situation.[3] Secondary infection, difficulty in swallowing and breathing, air embolism and airway obstruction can be major complications in severe PM cases.[4] Proper evaluation is therefore critically important to prevent morbidity and mortality; however, the diagnosis may be delayed or even missed because of the low incidence, its unclear presentation and symptom delay. Confirmation of the diagnosis by computed tomography (CT) which shows air in the mediastinum may be useful for early detection. Complications of the extensive emphysema or infection can also be evaluated with CT.[4]

Cervicofacial subcutaneous emphysema is an uncommon complication of dental procedures. The invasion of high-pressured air produced by the use of air-driven, high-speed hand pieces or air-water syringes may cause CSE during dental treatments such as tooth extraction, restorative and endodontic treatments, orthognathic surgery, and maxillary sinus augmentation.[3,5]

Periodontal debridement involves conservative cleaning procedure meant to remove deposits of dental plaque, calculus, and stains that have accumulated on the crown and root surfaces of the teeth. It is indicated for patients with periodontal disease. Air-powder polishing devices (air-flow) which use an abrasive agent such as sodium bicarbonate in combination with compressed air and water have been widely used to remove dental plaque and stains from tooth surfaces in dentistry and periodontology.[6-8] Cervicofacial subcutaneous emphysema may also result from air-powder polishing during routine periodontal treatment. Only a few reports have described CSE associated with air-powder polishing.[5,8-17]

In this case report, it is aimed to present clinical manifestation and treatment of cervicofacial emphysema and pneumomediastinum developed after the use of air-flow because of the rare occurrence in the literature.

CASE REPORT

A 31-year-old female patient presented with localized chronic periodontitis was referred to our clinic for periodontal therapy. The patient had no remarkable medical history and was not taking any prescribed medications. She had no known allergies or prior allergic reactions. Intraoral clinical examination revealed abundance of dental plaque and calculus deposits, and deep periodontal pockets. Periodontal probing depths were increased at upper right first and second molars. Radiographic examination showed localized moderate bone loss particularly seen around the maxillary right first and second molars (Figure 1). Based on the clinical and radiological examination, a diagnosis of chronic periodontitis was made.[18] Informed consent was obtained from the patient for publication of the paper.

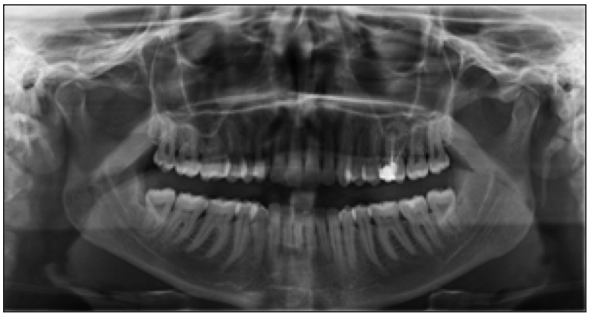

FIGURE 1: Pretreatment panoramic radiography showing moderate bone loss.

Initial periodontal therapy including oral hygiene instructions, periodontal debridement, and air-powder polishing was planned. Following administration of oral hygiene instructions, the patient received mechanical debridement with hand (Hu-Friedy, Chicago, IL, USA) and ultrasonic instruments (EMS, Nyon, Switzerland) under local anesthesia to minimize her discomfort. Air-powder polishing was also carried out using a standard air-polishing unit (NSK Prophy-Mate Polishing System, Japan) for the removal of stains. The intervention was performed by an experienced senior periodontist.

After the completion of the procedure, the patient complained of discomfort and swelling on the right side of her face and her throat. There was no apparent swelling detected by the dentist. She reported swallowing and breathing difficulties. An allergic/anaphylactic reaction to the locally administered anesthesia was considered; however, the patient did not exhibit any systemic signs or symptoms associated with an allergic reaction. She was therefore discharged. Approximately 3 hours later, the patient contacted by phone, and she reported that swelling had worsened and begun to affect her ability to swallow and breath. The patient was immediately referred to Emergency Department of Biruni University Medical Faculty Hospital.

On examination at emergency department, the patient's vital signs were as follows: heart rate, 85 beats/min; blood pressure, 110/75 mmHg; temperature, 36°C with an oxygen saturation of 100%. Routine laboratory tests including complete blood

cell count and comprehensive blood chemistry were normal. Laryngeal endoscopic examination showed no evidence of airway obstruction.

Diffuse swelling with crepitus on palpation from the right infraorbital region to the neck and upper chest was evident, and a computed tomography (CT) was ordered to assess for CSE and its complications. Computed tomography of head, neck, and chest confirmed extensive cervical emphysema with no evidence of infection. No fluid collections were seen. Numerous air densities were noted in the soft tissues of the right anterior and inferomedial orbit, right nasal wing, right perimaxillary area, masticator space, right mandibular ramus and corpus extending into the oropharyngeal and hypopharyngeal lateral wall, temporal bone styloid process and masseter muscle (Figure 2). Air densities were also seen in the soft tissues of posterior laryngeal area, right perivascular sheath and right jugular vein, posterolateral right thyroid gland lobe with thoracic inlet, right paraesophageal, paratracheal area and superior mediastinum extension (Figure 3 and Figure 4). Pneumothorax was not observed. Subsequent cerebral magnetic resonance (MR) venography revealed no thromboembolism or air embolism (Figure 5). There was no air in jugular veins or carotid arteries.

The patient was diagnosed with CSE and PM and hopitalized for close observation and airway monitoring. She received intravenous prophylactic antibiotic therapy. The patient's facial and cervical swelling reduced gradually. Her vital signs were stable. She was discharged 2 nights after admission and continued oral antibiotics. The recovery was uneventful. The patient did not come for a follow-up visit.

DISCUSSION

Cervicofacial subcutaneous emphysema may develop traumatically, infectiously or spontaneously, and sometimes iatrogenically after dental and surgical procedures.[3] The use of air-driven and high-

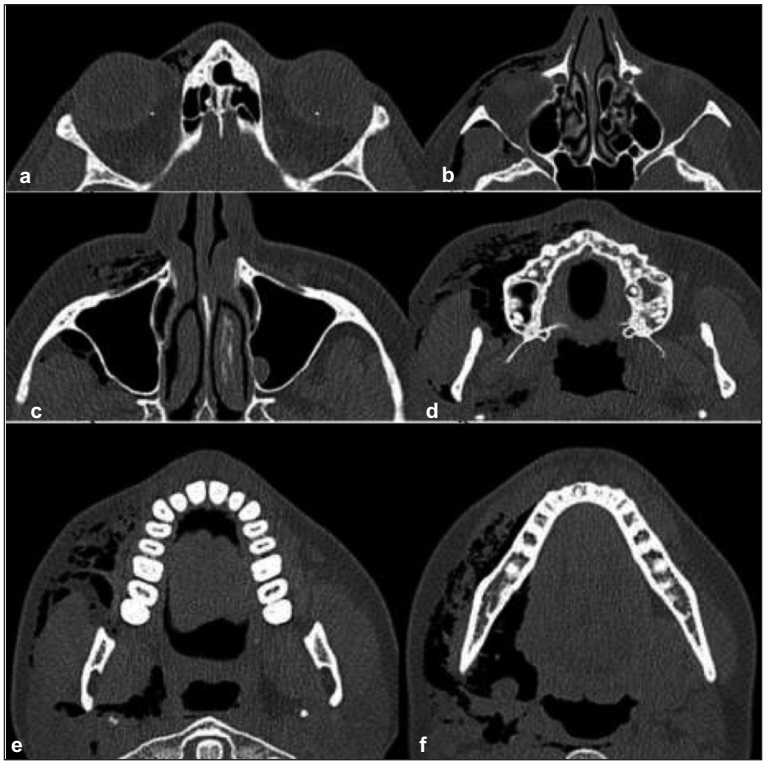

FIGURE 2: Axial Computed Tomography (CT) scans of the head and maxillofacial region showing subcutaneous emphysema (SE) extending to oropharyngeal and hypopharyngeal spaces on the right side.

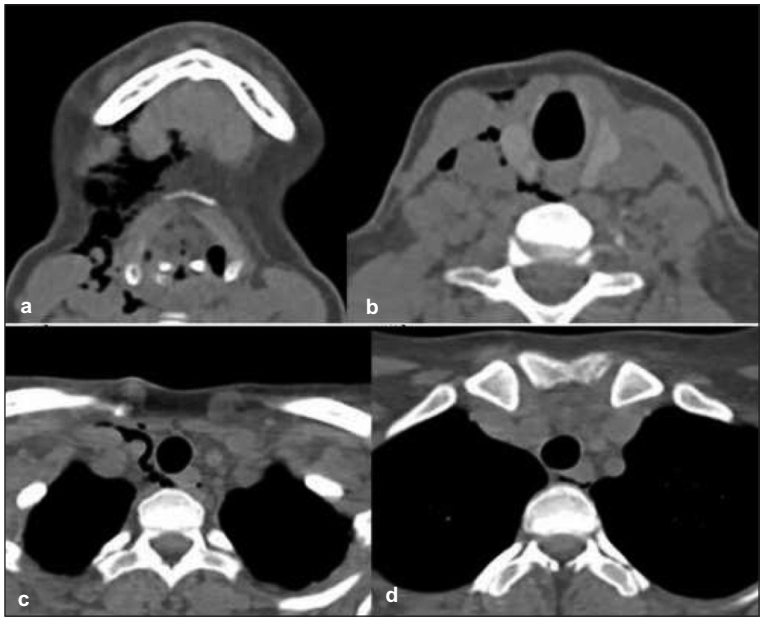

FIGURE 3: Axial Computed Tomography (CT) scans of neck and chest revealing air densities in the soft tissues extending to mediastinum (Soft tissue window set) on the right side.

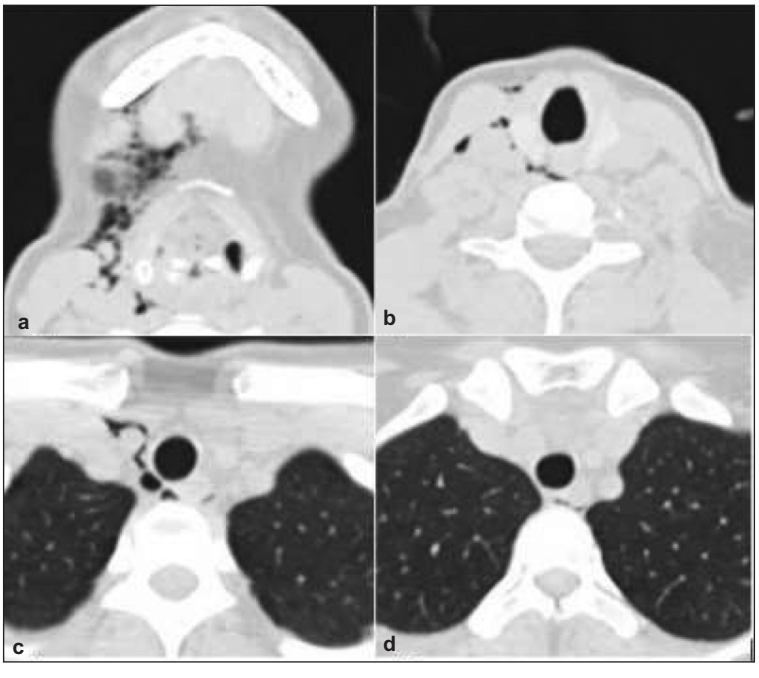

FIGURE 4: Computed Tomography (CT) scans of neck and chest revealing air densities in the soft tissues extending to mediastinum (Lung window set).

speed handpieces during surgical tooth extraction is the most common cause of iatrogenic CSE.[5] On the other hand, the occurrence of CSE after non-surgical dental procedures such as routine dental cleaning is quite rare.

Air-powder polishing removes stains and dental plaque during dental cleaning. Complications such as emphysema and trauma to tissues caused by the use of air-flow have been rarely reported. In 2018, Lee et al. reported only nine cases, including their own, associated with the use of air-powder abrasive devices; however, to the best of our knowledge fourteen cases of CSE due to the use of air-flow in twelve articles have been reported in

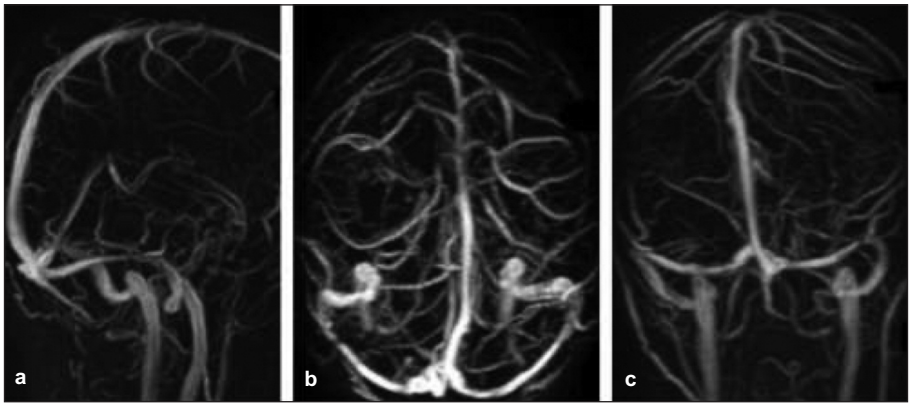

FIGURE 5: Magnetic resonance venography (2D) images of brain demonstrating no thromboembolism or air embolism; a) Lateral view b) Top view a) Posterior view.

the literature to date.[6,8-17] Therefore, here we report the fifteenth case. Interestingly, all reported cases consisted of non-surgical periodontal procedures such as implant and dental cleaning procedures or non-surgical peri-implantitis treatment. Eight of these cases reported CSE following the use of air-flow during tooth cleaning.[9,11-13,15,17] Unlike the others, in the case of Liebenberg et al., CSE developed after the removal of stains on the remaining fissures following composite restoration on occlusal surface of the first mandibular molar, not routine periodontal treatment.[11] Our current case report has also shown that the relatively minor procedure, such as the use of air-flow during tooth cleaning, carries a complication risk.

It is difficult to explain the emergence of emphysema after tooth cleaning. The high pressure in the oral cavity may induce CSE through oral lacerations. While the average pressure in air-flow devices is 40-100 psi, the minimum pressure required for the formation of soft tissue empyema has been reported 15 psi.[9,19] Direct and inappropriate use of such devices in the subgingival region, and especially in deep periodontal pockets can lead to CSE by causing reversible damage of the pocket epithelium.[9,15] Periodontal treatment alone may also cause minimal laceration of the periodontal pockets. In the present case, all of the procedure was performed by an experienced periodontist who had more than 30 years experience in Periodontology. In our case we believe the abrasive effect of the air-flow device spraying sodium bicarbonate with high pressurized air and water may have induced CSE in deep periodontal pockets, which already have low resistance to pressurized air and fluid passage due to periodontal disease. Dentists should pay attention to the angulation and distance between the tip of the device and tooth surface particularly in patients with periodontal diseases.

Cervicofacial subcutaneous emphysema is usually a benign, self-limiting condition. Most cases of CSE do not require specific treatment and usually resolve spontaneously in a short time.[15] The treatment is usually symptomatic. Daily clinical follow-up is required and resolution usually occurs without complications; however, as in our case, especially in the presence of deep periodontal pockets in molar teeth, compressed air may progress directly from the submandibular space through the fascial planes into the retropharyngeal region and mediastinum and pneumomediastinum may arise. Further complications of CSE also include life-threatening problems such as pneumothorax, infection and air-embolism that may affect normal heart and lung function due to air compression. Six of the previously reported cases were associated with pnemomediastinum, no pneumothorax or air-embolism were reported in any of these cases.[7,11,12,14,16,17] Only one case of implant-cleaning related emphysema progressed to mild pneumothorax.[8] We found a pneumomediastinum without pneumothorax and air-embolism. Our case is similar to the others in this respect. Computed tomography of the chest and MR venography were

reported to be normal in the present case. Nevertheless, once we have identified CSE and PM, the patient was admitted to the hospital in order to avoid any possible further complications and to be able to monitor the patient.

When a rapid facial swelling occurs following a dental procedure, subcutaneous emphysema should be considered. Cervicofacial subcutaneous emphysema exhibits common signs and symptoms such as swelling, dysphagia, local discomfort and crepitus that may develop immediately or may develop within a few hours or days. The differential diagnosis of CSE includes allergic reaction, hematoma, and angioedema.[1-3,5] In order to make a correct diagnosis, it is important to have a meticulous palpation of the involved tissue. Crepitus is the most important sign that differentiates cervicofacial emphysema from the other pathologies. In most cases this symptom is immediately detected; however, subsequent emergence of swelling and crepitus, as in the present case, may make the diagnosis difficult. The CT of the affected region can confirm the diagnosis of emphysema by showing the presence of air in the soft tissues. In the present case, emphysema was confined to the subcutaneous tissues of the face and neck. The orbit remained uninvolved. The CT scanning confirmed the extent of spread.

In previous literature on CSE, antibiotic administration has been controversial.[3] Prophylactic antibiotics were usually prescribed to prevent local or systemic infection from oral flora. In our case, there was no case of emphysematous infection after the prophylactic administration of antibiotics, and in this respect the need for prophylactic administration of antibiotics in emphysema cases is supported by our case.

In summary, we report a case of a young female with SCE and PM following tooth cleaning. Physicians and dentists should be aware of this unusual complication that may arise during routine and frequently performed dental procedures. Cervicofacial subcutaneous emphysema can be misdiagnosed. The consequences can be serious and sometimes life-threatening. For this reason, dentists and physicians should be alert to subcutaneous emphysema manifestations from dental procedures. Computed tomography may allow rapid and accurate diagnosis and appropriate treatment.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Hasan Gökhan Açıkgöz;* ***Design:*** *Hasan Gökhan Açıkgöz, Aydan Açıkgöz, Önder Demirbaş;* ***Control/Supervision:*** *Hasan Gökhan Açıkgöz, Burcu Karaduman;* ***Data Collection and/or Processing:*** *Hasan Gökhan Açıkgöz, Aydan Açıkgöz, Burcu Karaduman, Önder Demirbaş;* ***Analysis and/or Interpretation:*** *Hasan Gökhan Açıkgöz, Burcu Karaduman;* ***Literature Review:*** *Burcu Karaduman, Hasan Gökhan Açıkgöz;* ***Writing the Article:*** *Hasan Gökhan Açıkgöz, Burcu Karaduman;* ***Critical Review:*** *Aydan Açıkgöz, Önder Demirbaş;* ***References and Fundings:*** *Burcu Karaduman;* ***Materials:*** *Hasan Gökhan Açıkgöz, Önder Demirbaş.*

REFERENCES

1. Farina R, Zaetta A, Minenna L, Trombelli L. Orbital and periorbital emphysema following maxillary sinus floor elevation: a case report and literature review. J Oral Maxillofac Surg. 2016;74(11):2192.e1-2192.e7. [Crossref] [PubMed]
2. Bilecenoglu B, Onul M, Altay OT, Sakul BU. Cervicofacial emphysema after dental treatment with emphasis on the anatomy of the cervical fascia. J Craniofac Surg. 2012;23(6): e544-8. [Crossref] [PubMed]
3. McKenzie WS, Rosenberg M. Iatrogenic subcutaneous emphysema of dental and surgical origin: a literature review. J Oral Maxillofac Surg. 2009;67(6):1265-8. [Crossref] [PubMed]
4. Patel N, Lazow SK, Berger J. Cervicofacial subcutaneous emphysema: case report and review of literature. J Oral Maxillofac Surg. 2010;68(8):1976-82. [Crossref] [PubMed]
5. Mitsunaga S, Iwai T, Kitajima H, Yajima Y, Ohya T, Hirota M, et al. Cervicofacial subcutaneous emphysema associated with dental laser treatment. Aust Dent J. 2013;58(4):424-7. [Crossref] [PubMed]
6. Bergendal T, Forsgren L, Kvint S, Löwstedt E. The effect of an airbrasive instrument on soft and hard tissues around osseointegrated implants. A case report. Swed Dent J. 1990;14(5):219-23. [PubMed]
7. Bassetti M, Bassetti R, Sculean A, Salvi GE. [Subcutaneous emphysema following non-surgical peri-implantitis therapy using an air abrasive device: a case report]. Swiss Dent J. 2014;124(7-8):807-17. [PubMed]
8. Lee ST, Subu MG, Kwon TG. Emphysema following air-powder abrasive treatment for peri-implantitis. Maxillofac Plast Reconstr Surg. 2018;40(1):12. [Crossref] [PubMed] [PMC]
9. Finlayson RS, Stevens FD. Subcutaneous facial emphysema secondary to use of the Cavi-Jet. J Periodontol. 1988;59(5):315-7. [Crossref] [PubMed]
10. Van de Velde E, Thielens P, Schautteet H, Vanclooster R. [Subcutaneous emphysema of the oral floor during cleaning of a bridge fixed on an IMZ implant. Case report]. Rev Belge Med Dent (1984). 1991;46(3):64-71. [PubMed]
11. Liebenberg WH, Crawford BJ. Subcutaneous, orbital, and mediastinal emphysema secondary to the use of an air-abrasive device. Quintessence Int. 1997;28(1):31-8. [PubMed]
12. Frühauf J, Weinke R, Pilger U, Kerl H, Müllegger RR. Soft tissue cervicofacial emphysema after dental treatment: report of 2 cases with emphasis on the differential diagnosis of angioedema. Arch Dermatol. 2005;141(11): 1437-40. [Crossref] [PubMed]
13. Silva TP, Baptistella E, Rispoli DZ, Nassif Filho ACN, Trotta F, Kanashiro MM, et al. Maxillary sinus odontogenic subcutaneous emphysema: case report and review. Acta Orl. 2010;28(3):107-8.
14. Strassen U, Bas M, Knopf A. [Visit at the dentist with consequences]. HNO. 2011;59(11): 1125-8. [Crossref] [PubMed]
15. Toniollo MB, Terada ASSD, Yamaji MAK. Subcutaneous emphysema after treatment using air-abrasive device: a case report. Braz Dent Sci. 2016;19(3):106-10. [Crossref]
16. Bocchialini G, Ambrosi S, Castellani A. Massive cervicothoracic subcutaneous emphysema and pneumomediastinum developing during a dental hygiene procedure. Case Rep Dent. 2017;2017:7016467. [Crossref] [PubMed] [PMC]
17. Alonso V, García-Caballero L, Couto I, Diniz M, Diz P, Limeres J. Subcutaneous emphysema related to air-powder tooth polishing: a report of three cases. Aust Dent J. 2017;62(4):510-5. [Crossref] [PubMed]
18. Armitage GC. Development of a classification system for periodontal diseases and conditions. Ann Periodontol. 1999;4(1):1-6. [Crossref] [PubMed]
19. Harrel SK, Abraham CM, Rivera-Hidalgo F. Tissue resistance to soft tissue emphysema during minimally invasive periodontal surgery. J Contemp Dent Pract. 2012;13(6):886-91. [Crossref] [PubMed]