Case Report

Endodontic management of unusual extraoral cutaneous sinus tract

Mohammad A. Alshammari, Fahad M. Alzoubi

Department of Kuwait Board of Endodontics, Kuwait Institute for Medical Specializations, Kuwait

Abstract

Chronically, draining cutaneous sinus tracts are a common manifestation of pulpal necrosis with periapical pathosis that requires endodontic treatment to heal. However, it is frequently misdiagnosed with cutaneous lesions and incorrectly treated. A clinical case of an 8-year-old girl presented with an extraoral cutaneous sinus tract of the right submandibular region after long-term pus drainage was misdiagnosed by her dermatologist. The odontogenic origin of the sinus tract was made by tracing an unusual pathway of the sinus tract utilizing cone-beam computed tomography. The clinical and radiographic examination revealed a necrotic pulp, with chronic periapical abscess and cutaneous drainage of the immature mandibular right first molar. Endodontic therapy and mineral trioxide aggregate apexification were performed. The cutaneous sinus tract showed signs of healing after 1 month from treatment initiation and complete radiographic healing was noted after 18th month recall. Cutaneous extraoral sinus tracts of endodontic origin can be easily misdiagnosed and mistreated. Utilizing cone-beam computed tomography to trace the sinus tract revealed an unusual pathway confirming the odontogenic origin of the sinus tract. Correct treatment resulted in regaining the patient her self-confidence, saving the tooth, and healing of the facial sinus tract.

Keywords: Apexification, cone-beam computed tomography, endodontic diagnosis, mineral trioxide aggregate, sinus tract

Address for correspondence: Dr. Mohammad A. Alshammari, Kuwait Institute for Medical Specialization, Kuwait.
E-mail: mohalshammari@moh.gov.kw
Submission: 18-05-22 **Revision:** 26-06-22 **Acceptance:** 29-06-22 **Web Publication:** 11-01-23

INTRODUCTION

Odontogenic infections can spread to fascial spaces, as a sequela is the cutaneous sinus tract.[1-4]

Anatomic variations dictate the pathway of least resistance, allowing for the formation of a sinus tract.[2,5-7]

Odontogenic infections are relatively concentric, however, occasionally, it could break through the closest cortical plate of the alveolar bone and spreads to neighboring tissues with the path of least resistance,[7] while the adjacent muscles and fascia act as a barrier. Most commonly, the penetration is on the labio buccal side proximal to its muscular attachments and erupts into the oral vestibule; however, when the penetration of the cortical plate is beyond the muscle attachment, the infection path deviates from the oral cavity to remote structures such as the facial skin.[5]

The root length and its relationship to the alveolar process are also essential in determining the site of cortical bone

Access this article online	
Quick Response Code:	Website: www.saudiendodj.com
	DOI: 10.4103/sej.sej_94_22

How to cite this article: Alshammari MA, Alzoubi FM. Endodontic management of unusual extraoral cutaneous sinus tract. Saudi Endod J 2023;13:108-15.

penetration, whether proximal or distal to the muscle attachment.

In children and young adolescents, the alveolar process is not fully developed, and the roots are incompletely formed, seated more deeply in the basal bone. There is a greater chance of the odontogenic infection penetrating beyond the muscle attachment and leading to a cutaneous sinus tract.[7]

In the pediatric patient and according to Swales *et al.*,[8] the importance of corrected diagnosis and treatment management of an extra oral cutaneous sinus only occurred when the child attended a specialist dental clinic for consultation.

Our purpose is to present a case of an unusual path of a cutaneous sinus tract of an odontogenic origin.

CASE REPORT

An 8-year-old girl with no medical history contributing to the patient's chief complaint had swelling of the right submandibular region [Figure 1a]. Previously, a discharge started 6 months extraorally, her parents consulted a dermatologist and were prescribed topical and oral antibiotics, but the discharge did not resolve. The parents consulted another dermatologist, so an ultrasound was done. The ultrasound report was inconclusive; finally, the patient was referred to a pediatric dentist; the patient was referred for consultation.

Figure 1: Extraoral photograph showing the extraoral sinus tract located at the right submandibular region (a). A periapical radiograph of the mandibular right first molar, showing a restoration with recurrent caries and open apices of both mesial and distal roots with periapical radiolucency involving both roots (b)

The extraoral sinus tract area was palpated and yellow fluid was drained indicating the presence of pus. On intraoral examination, the mandibular right first molar shows a large composite restoration with recurrent caries, which did not respond to either cold test or electric pulp tester. The lower right mandibular area showed missing primary first and second molar, no intraoral swelling was present. A periapical radiolucency involving distal and mesial roots was evident on radiographic examination [Figure 1b].

An attempt was made to trace the sinus tract on the first visit on September 7th, but the patient was uncooperative.

A diagnosis was made of necrotic pulp, with chronic periapical abscess and cutaneous drainage. The treatment was presented to the patient's father, which consisted of apexification utilizing mineral trioxide aggregate (MTA) of the involved tooth.

The patient's father accepted and consent forms were signed. Anesthesia was achieved by administering 72 mg of 2% Lidocaine with. 036 mg of epinephrine (Novocol Pharmaceutical of Canada). The rubber dam was placed, and the tooth was disinfected with 5.25% sodium hypochlorite (NaOCl). Composite restoration and recurrent caries were removed, the tooth was accessed, and three canals were located. Working length was determined using an apex locator (Root ZX II, J. Morita Corp., Tokyo, Japan). Instrumentation using Protaper next (DENTSPLY Tulsa Dental Specialties) was done to the entire working length. The Canals were irrigated with 20 mL of 2.5% NaOCL and EDTA 17% (Pulpdent, Watertown, MA, USA) 3 ml was used. The canals were dried with paper points. Calcium hydroxide (AH temp, Dentsply, Germany) was packed using a lentulo spiral. The tooth was temporized using teflon and reinforced glass ionomer (Chemfil, Dentsply Sirona, Germany), and one final periapical radiograph was taken. Paracetamol syrup 250 mg was prescribed if needed.

The patient was reviewed on September 13th; the sinus tract was still draining. Another attempt was made to trace the sinus tract after the child's behavior was managed; a 30 0.4 gutta-percha cone was used, and the periapical radiograph was taken. However, unfortunately, the radiograph was inconclusive [Figure 2].

A gutta-percha cone was placed in the opening of the sinus tract to trace it after the patient's behavior was managed at the second visit. With the help of cone-beam computed tomography (CBCT) (Scanora, Soredex Co., Tuusula, Finland), it clearly shows the unusual path of the sinus tract [Figure 3]. The pathway of the infection spread was through the lingual cortical plate below the attachment of the mylohyoid muscle, from there below the body of the mandible and above the platysma muscle finally exteriorization in the submandibular region.

The treatment protocol was done following the same steps as the first visit; calcium hydroxide was placed and packed using a lentulo spiral. The tooth was temporarily restored using teflon and ChemFil. One final periapical radiograph was taken. Paracetamol syrup 250 mg was prescribed if needed.

At the third visit on September 27th, the extraoral sinus tract showed signs of healing with scar tissue and is no longer patent [Figure 4a]. The patient is asymptomatic and the patient's father stated that no discharge was visible since the last visit. The treatment protocol was the same as the previous visits, with copious irrigation. MTA Apical plug (DENTSPLY Tulsa Dental Specialties) was placed using stainless steel hand pluggers that fits 3 mm short from the apex, ultrasonic was used to vibrate the pluggers to minimize voids during MTA packing in all canals. It was temporarily restored using a wet cotton pellet and ChemFil; 1 final periapical radiograph was taken. After reviewing the radiograph, it showed that the MTA plug in the mesial root is short due to not being able to take intraoperative radiographs [Figure 4b]. The MTA apical plug was planned to be corrected at the next visit as the patient was also becoming agitated and less cooperative. Paracetamol syrup 250 mg was prescribed if needed.

At the final visit on October 11th, the sinus tract is healed with scar tissue. The treatment protocol was done the same as in the previous visits, and the MTA in the mesial canals was removed using ultrasonic; the canals were irrigated with 15 mL of 2.5% NaOCL. Patency was achieved in both mesial canals. No bleeding was noticed. Canals were dried with paper points, MTA Apical plug was placed and backfilled with gutta-percha and AH+ sealer (AH plus, Dentsply Sirona, Germany). The tooth was restored with dual-cure core buildup material (Core. X flow, Dentsply Sirona, Germany), and a final periapical radiograph was taken [Figure 4c].

The tooth was finally restored with a stainless-steel crown after 86 days; the pedodontist kindly provided the postoperative radiograph [Figure 4d].

The patient was reviewed 6 months after restoring the tooth, and her dental and medical history was revised; currently, the patient is asymptomatic. Clinical examination revealed no signs and symptoms on endodontic examination [Figure 5a]. A periapical radiograph was taken, which showed the reduction of the periapical lesion [Figure 5b].

The patient was recalled after 18 months. The patient is asymptomatic, with an improvement in her behavior toward dental visits. Clinical examination revealed no signs and symptoms [Figure 6a]. The periapical radiograph showed

Figure 2: A periapical radiograph of the mandibular right first molar, the gutta-percha cone, was not showing in the radiograph; it was deemed inconclusive tracing of the sinus tract

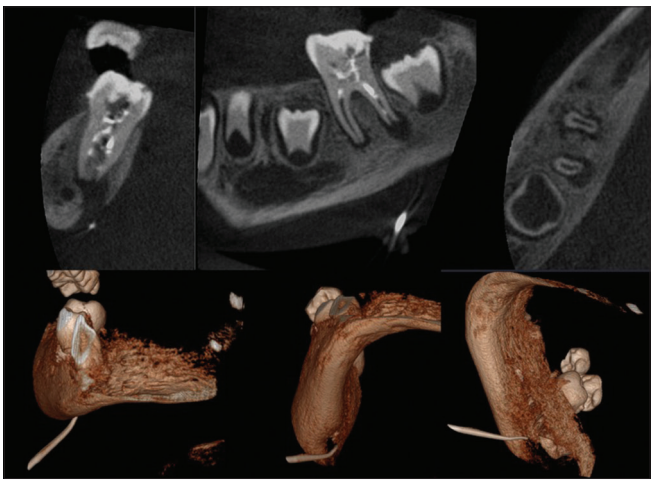

Figure 3: The CBCT clearly shows the unusual path of the sinus tract, and it showed that the pathway of the infection spread was through the lingual cortical plate below the attachment of the mylohyoid muscle, from there below the body of the mandible and above the platysma muscle finally exteriorization in the submandibular region. CBCT: Cone-beam computed tomography

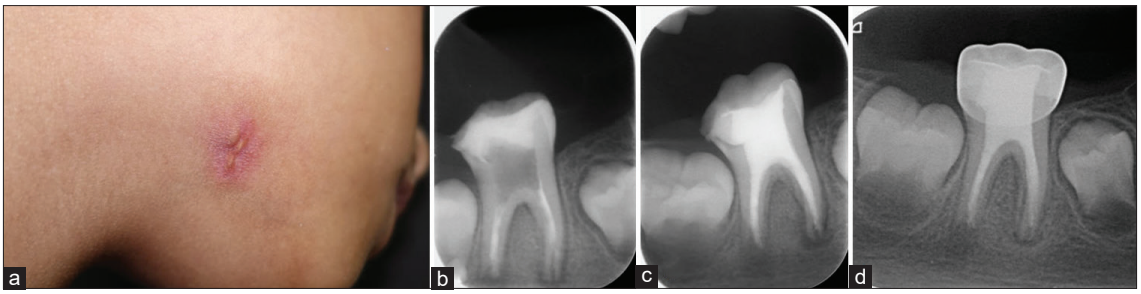

Figure 4: The extraoral sinus tract shows signs of healing and closure (a). Periapical radiograph showing the MTA plug in the mesial root is short (b). The final radiograph, showing the 4 mm of MTA apical plug and backfilled with gutta-percha and AH+ sealer. The tooth was restored with dual-cure core buildup material (c). Postoperative radiograph after the final restoration with stainless steel crown (d). MTA: Mineral trioxide aggregate

Figure 5: Clinical evaluation revealed the extraoral sinus tract healing with scar tissue (a). Six months' follow-up radiograph shows the reduction of the periapical radiolucency (b)

complete resolution of the periapical lesion with normal lamina dura around both roots [Figure 6b].

DISCUSSION

Chronically draining cutaneous sinus tracts are frequently misdiagnosed and incorrectly treated due to the absence of intraoral swelling or pain.[9] However, a dental infection should be suspected as the primary etiology in chronic draining cutaneous sinus tracts of the face and neck;[8,10] it is easily overlooked by physicians but not by dentists; however, many affected patients initially present to a physician for treatment.[11]

The evaluation must begin with a thorough history and awareness that many cutaneous lesions of the face and neck could be of odontogenic origin.[12,13] In the case presented here, the patient had the sinus tract draining for 6 months with unnecessary treatments done before visiting the dental clinic. The incorrect diagnosis can result in multiple surgical biopsies,[14] antibiotic therapy,[15] and even radiation therapy.[16]

The inflammatory process starts in a necrotic pulp and spreads into surrounding periodontal tissue and bone, resulting in osteoclastic bone resorption; fluids accumulating from the immunological process may be confined within the bone or ultimately break through cortical bone periosteum into soft-tissue spaces, following the path of least resistance. The extracellular fluid may produce cellulitis, an abscess, or both.[16]

Suppose the odontogenic infection originates superior to the maxillary muscle attachments or inferior to the mandibular muscle attachments. The infection may follow through the cutaneous barrier and drain through an extraoral sinus tract.[12] The most common sites of described cases have involved mandibular teeth, drainage happens through the chin or the angle of the mandible, while only 20% involved maxillary teeth, and are likely to erupt on the upper lip region, the philtrum, nasolabial fold, nose, or infraorbital region. Conversely, cutaneous sinus tracts involving maxillary teeth might erupt on the cheek.[17-20]

If the sinus tract is patent, a gutta-percha cone may be used to trace the track from the cutaneous orifice to the source of origin.[4,21] A radiograph is then exposed, pointing to the origin of the primary pathosis. The dental etiology can be confirmed in these cases by tracing the sinus tract to its origin during the radiographic examination and using a pulp sensibility test.[20] In the clinical cases described here, the preoperative radiographs revealed periapical radiolucencies associated with a suspected tooth that did not respond to pulp sensibility tests. However, sinus tract

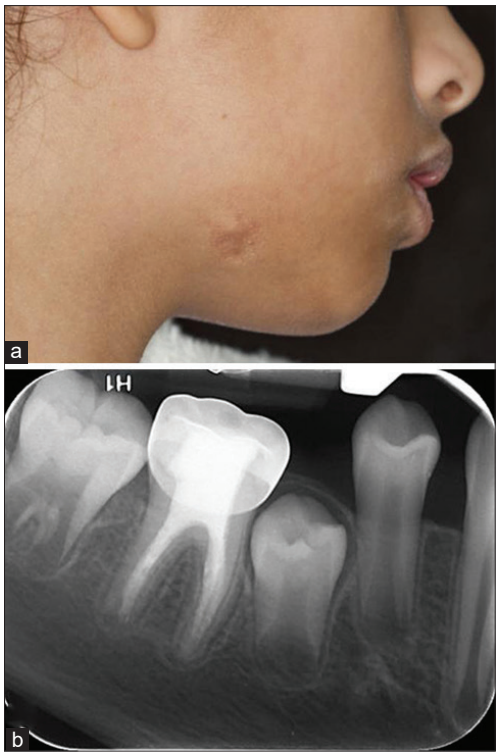

Figure 6: Eighteen months' follow-up.(a) The scar tissue is still visible, and the patient's father was informed that possible laser therapy is needed in the future for esthetic reasons (b) Periapical radiograph shows complete resolution of the periapical radiolucency and normal PDL space around both roots

tracing was not achieved on the first visit due to the patient being uncooperative.

Sinus tracts of dental origin and spontaneous closure of the fistula should be expected within 5–14 days after initial root canal treatment or tooth extraction.[15] However, in this case, the sinus tract was still draining after 2 weeks of initial treatment. The possible explanation was due to the patient being young and anxious at her first visit, proper cleaning and shaping with copious amount of irrigation was not achieved.[22]

As seen in this case, the path of least resistance is unusual because the patient is a child with a small jaw. An attempt was made to trace the sinus tract using gutta-percha with a periapical radiograph. However, it was unsuccessful, so it was decided to take a CBCT with the gutta-percha placed in the sinus tract. CBCT was chosen to confirm the diagnosis.[8,10] In the present case, CBCT revealed the affected tooth, whereas conventional two-dimensional radiography did not demonstrate unusual findings. The ability of CBCT to trace the origin of the cutaneous sinus tract has been shown to be beneficial in diagnosing and aiding in treatment planning toward a better outcome.[23]

Pulp tests also should be performed on the suspected quadrant and adjacent teeth because more than one tooth could be involved with the cutaneous odontogenic sinus tract.[17]

It is also essential to determine the nature of fluid draining from the cutaneous sinus. During palpation, an effort should be made to drain the sinus tract. Any discharge obtained should be examined to determine its nature (saliva, pus, or cystic fluid).[12] The fluid's culture and sensitivity testing should also rule out fungal and syphilitic infections.[4]

Exudate from cutaneous odontogenic sinus tracts has been cultured, and the microbial flora identified; culturing has been used to rule out fungal or syphilitic infections.[4]

Sassone *et al.* performed a microbiologic evaluation of primary endodontic infections in teeth with and without the sinus tract.[24] They discovered the most significant prevalence of such bacteria as *Fusobacterium nucleatum* sp. vincentii, *Porphyromonas gingivalis, Veillonella parvula, Enterococcus faecalis, Campylobacter gracellis,* and *Neisseria mucosa*. The total bacterial counts were similar between lesions with and without sinus tracts. However, *E. faecalis, Streptococcus anginosus, Capnocytophaga sputigena,* and *Capnocytophaga gingivalis* had significantly higher counts in those lesions without sinus tracts. Higher levels of *P. gingivalis* and *F. nucleatum* spp. nucleatum were noted in cases with a sinus tract.

A differential diagnosis should include the presence of a foreign body, local skin infection, actinomycosis, osteomyelitis, traumatic lesions, fungal and bacterial infections, neoplasms, pyogenic granuloma, chronic tuberculosis lesion, and gumma of tertiary syphilis.[12,14,24]

In more rare occasions, to be included in the differential diagnosis is thyroglossal duct cyst, salivary gland fistula, dacryocystitis, and suppurative lymphadenitis.[14]

Local skin infections such as pustules are the most common purulent draining lesions and are recognized by their superficial location and short course.[25] Actinomycosis exhibits many draining lesions and specific fine yellow granules in the purulent discharge. The tooth is often not associated radiographically. If a sinus tract does not heal after appropriately removing the primary cause, the most common alternative cause is actinomycosis.[26] Osteomyelitis of the jaw is usually secondary to some exogenic trauma, acquired infection after extraction of diseased teeth, impacted teeth, or retained roots. It rarely

drains through a cutaneous sinus and is mainly associated with debilitating systemic disease or fracture.[27]

Orocutaneous fistula is a common sequela of trauma to the head-and-neck region and leads to continual leakage of saliva to the lower face or neck. Malignancy usually presents as a fixation to underlying skin with underlying osseous structures.[28]

A salivary gland fistula has a characteristic position and associated patient history. Moreover, the lesion is not through and through as in the orocutaneous fistula.

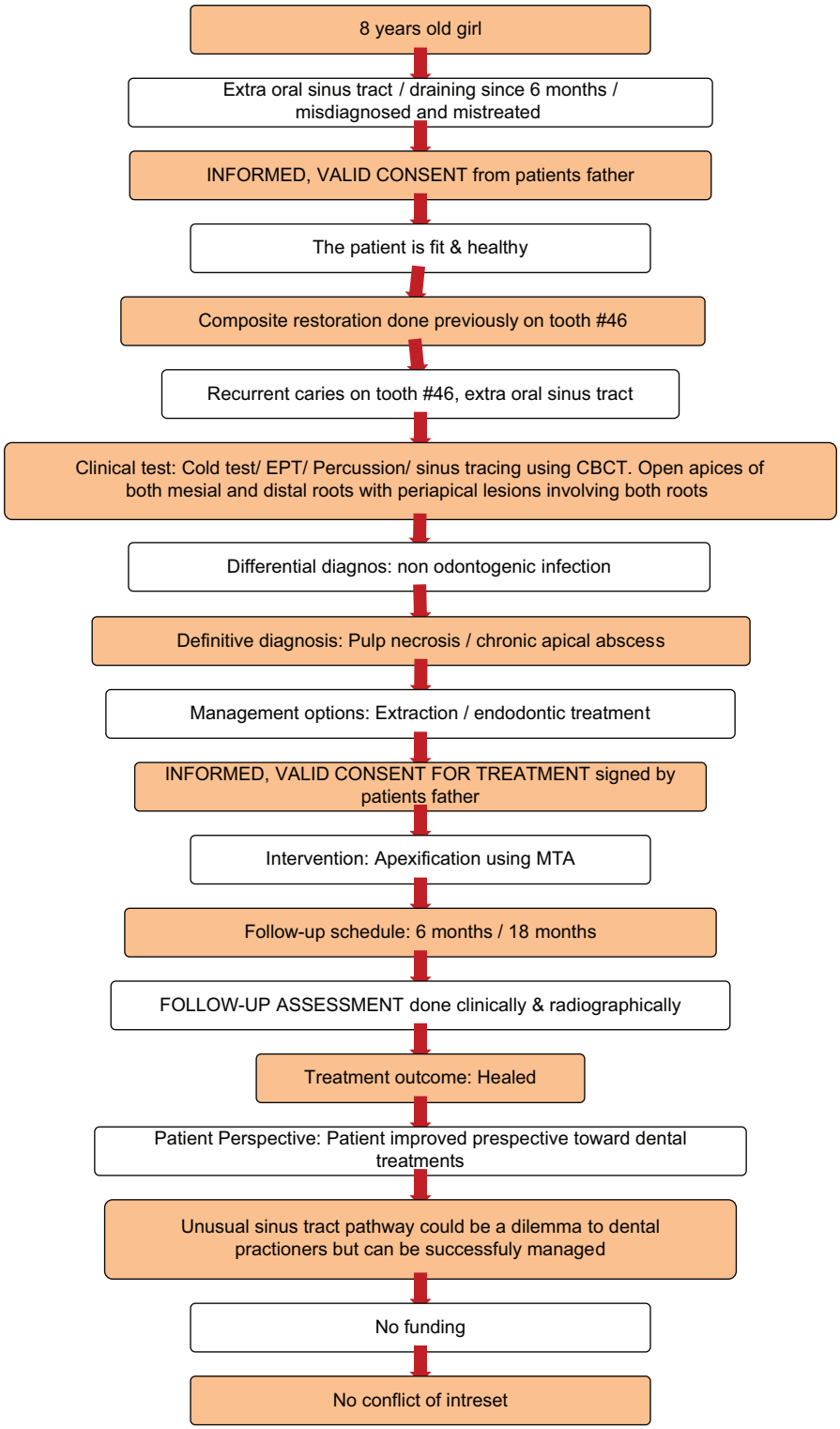

Figure 7: PRICE 2020 flowchart

Probing the duct and performing sialography aid diagnosis.[29] A thyroglossal duct cyst is a developmental lesion observed early in life; however, it is found high in the midline of the neck and protrudes when the tongue protrudes.[29]

The treatment of choice must concentrate on removing the source of the infection, either root canal therapy if the tooth is restorable, or surgical extraction for nonrestorable teeth.[30] After treatment and the primary odontogenic etiology has been adequately eliminated or removed, with no antibiotic therapy, the sinus tract and cutaneous lesion usually resolve in 5–15 days, leaving a small scar that will become almost invisible over the next few months.[31]

Calcium hydroxide was used as the main intracanal medicament since it is a strong base material with high pH between 12.5 and 12.8 and antibacterial properties.[32,33] A previous case series showed successful management of cutaneous extraoral sinus tracts with calcium hydroxide as an intracanal medicament.[34] Although intentional extrusion of calcium hydroxide is not recommended since it may have a toxic effect on surrounding tissues causing necrosis and serious nerve injury.[35,36]

Histologically, these tracts are composed of fragments of granulation tissue, which are often focally lined by stratified squamous epithelium. If the offending tooth is treated successfully, the fluid will be spontaneously drained; usually, healing is by secondary intention. Fibrosis results in undesired dimpling, scarring, or a chronic extraoral draining sinus tract.[4,14,19]

Cosmetic surgical or laser treatment may be required later if the area heals with a residual tract that results in cutaneous retraction or dimpling.[12,26,37] If a sinus tract does not close after appropriate removal of the primary etiology, the most common alternative cause is actinomycosis.[26]

A cutaneous odontogenic sinus tract is a localized entity and is not an indication for antibiotics.[12,15,26] Systemic antibiotic administration is not recommended in patients with cutaneous odontogenic sinus tracts with an intact immune system, no signs or symptoms of systemic involvement, and no other systemic condition requiring a prophylactic antibiotic cover. The use of systemic antibiotics will result only in a temporary reduction of the drainage and pseudo healing.[18] The sinus tract prevents swelling or pain from pressure buildup because it provides drainage of the odontogenic primary site. Thus, the draining sinus tract maintains a localized condition and prevents systemic involvement.

This case report has been prepared according to the PRICE 2020 guidelines [Figure 7].[38]

CONCLUSION

Cutaneous facial sinus tracts of odontogenic origin are more likely to be misdiagnosed and inappropriately treated. After correct diagnosis, apexification was completed, and no antibiotic therapy was instituted during the treatment. The results were favorable, and the extraoral sinus tract healed without any surgical treatment. Clinically, the patient is asymptomatic; although a slight dimpling was evident after healing, the patient may need esthetic laser therapy when she is older.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Brown RS, Jones R, Feimster T, Sam FE. Cutaneous sinus tracts (or emerging sinus tracts) of odontogenic origin: A report of 3 cases. Clin Cosmet Investig Dent 2010;2:63-7.
2. Bai J, Ji AP, Huang MW. Submental cutaneous sinus tract of mandibular second molar origin. Int Endod J 2014;47:1185-91.
3. Kallel I, Moussaoui E, Kharret I, Saad A, Douki N. Management of cutaneous sinus tract of odontogenic origin: Eighteen months follow-up. J Conserv Dent 2021;24:223-7.
4. Sakamoto E, Stratigos GT. Bilateral cutaneous sinus tracts of dental etiology: Report of case. J Oral Surg 1973;31:701-4.
5. Bakathir AA, Moos KF, Ayoub AF, Bagg J. Factors contributing to the spread of odontogenic infections: A prospective pilot study. Sultan Qaboos Univ Med J 2009;9:296-304.
6. Pasternak-Júnior B, Teixeira CS, Silva-Sousa YT, Sousa-Neto MD. Diagnosis and treatment of odontogenic cutaneous sinus tracts of endodontic origin: Three case studies. Int Endod J 2009;42:271-6.
7. Patni PM, Prashanth MB, Jain N, Patni JM. Non-surgical management of an extraoral cutaneous sinus tract of odontogenic origin: An endodontic challenge. Endo (Lond Engl). 2010;4:285-91.
8. Swales KL, Rudralingam M, Gandhi S. Extraoral cutaneous sinus tracts of dental origin in the paediatric patient. A report of three cases and a review of the literature. Int J Paediatr Dent 2016;26:391-400.
9. Rudagi KB, Rudagi BM. Cutaneous Sinus Tract of Odontogenic Origin–A Misdiagnosed Lesion: Report of two cases. Acta stomatologica Croatica: International journal of oral sciences and

dental medicine. 2012;46:317-22.
10. Tian J, Liang G, Qi W, Jiang H. Odontogenic cutaneous sinus tract associated with a mandibular second molar having a rare distolingual root: A case report. Head Face Med 2015;11:13.
11. Giménez-García R, Martinez-Vera F, Fuentes-Vera L. Cutaneous sinus tracts of odontogenic origin: Two case reports. J Am Board Fam Med 2015;28:838-40.
12. Cioffi GA, Terezhalmy GT, Parlette HL. Cutaneous draining sinus tract: An odontogenic etiology. J Am Acad Dermatol 1986;14:94-100.
13. Cohen PR, Eliezri YD. Cutaneous odontogenic sinus simulating a basal cell carcinoma: Case report and literature review. Plast Reconstr Surg 1990;86:123-7.
14. Chang LS. Common pitfall of plastic surgeon for diagnosing cutaneous odontogenic sinus. Arch Craniofac Surg 2018;19:291-5.
15. Spear KL, Sheridan PJ, Perry HO. Sinus tracts to the chin and jaw of dental origin. J Am Acad Dermatol 1983;8:486-92.
16. Gorsky M, Kaffe I, Tamse A. A draining sinus tract of the chin. Report of a case. Oral Surg Oral Med Oral Pathol 1978;46:583-7.
17. Kuo JL, Lin YT. Odontogenic cellulitis in children requiring hospitalization. J Dent Sci 2013;8:129-32.
18. Mittal N, Gupta P. Management of extra oral sinus cases: A clinical dilemma. J Endod 2004;30:541-7.
19. Cantatore JL, Klein PA, Lieblich LM. Cutaneous dental sinus tract, a common misdiagnosis: A case report and review of the literature. Cutis 2002;70:264-7.
20. Johnson BR, Remeikis NA, Van Cura JE. Diagnosis and treatment of cutaneous facial sinus tracts of dental origin. J Am Dent Assoc 1999;130:832-6.
21. Javid B, Barkhordar RA. Chronic extraoral fistulae of dental origin. Compendium 1989;10:8, 11-4.
22. Ruddle CJ. Endodontic disinfection: Tsunami irrigation. Saudi Endod J 2015;5:1-12.
23. Al-Obaida MI, Al-Madi EM. Cutaneous draining sinus tract of odontogenic origin. A case of chronic misdiagnosis. Saudi Med J 2019;40:292-7.
24. Sassone LM, Fidel R, Faveri M, Fidel S, Figueiredo L, Feres M. Microbiological evaluation of primary endodontic infections in teeth with and without sinus tract. Int Endod J 2008;41:508-15.
25. Laureano AC, Schwartz RA, Cohen PJ. Facial bacterial infections: Folliculitis. Clin Dermatol 2014;32:711-4.
26. Braun RJ, Lehman J 3rd. A dermatologic lesion resulting from a mandibular molar with periradicular pathosis. Oral Surg Oral Med Oral Pathol 1981;52:210-2.
27. Andre CV, Khonsari RH, Ernenwein D, Goudot P, Ruhin B. Osteomyelitis of the jaws: A retrospective series of 40 patients. J Stomatol Oral Maxillofac Surg 2017;118:261-4.
28. Chouk C, Litaiem N. Oral Cutaneous Fistula. Treasure Island (FL): StatPearls; 2022.
29. Kishore Kumar RV, Devireddy SK, Gali RS, Chaithanyaa N, Chakravarthy C, Kumarvelu C. Cutaneous sinuses of cervicofacial region: A clinical study of 200 cases. J Maxillofac Oral Surg 2012;11:411-5.
30. Aboalsamh D. Non-Surgical endodontic treatment of extra-oral cutaneous sinus tract: Case reports. J Oral Health Dent Res 2021;1:1-4.
31. Dincol ME, Yilmaz B, Ersev H, Mert Gunduz V, Arslanoglu B, Yalcin TY, *et al.* Treatment of extraoral cutaneous sinus tracts with non-surgical endodontic intervention: Report of six cases. J Istanb Univ Fac Dent 2015;49:35-40.
32. Bystrom A, Claesson R, Sundqvist G. The antibacterial effect of camphorated paramonochlorophenol, camphorated phenol and calcium hydroxide in the treatment of infected root canals. Endod Dent Traumatol 1985;1:170-5.
33. Siqueira JF Jr., Lopes HP. Mechanisms of antimicrobial activity of calcium hydroxide: A critical review. Int Endod J 1999;32:361-9.
34. Calişkan MK, Sen BH, Ozinel MA. Treatment of extraoral sinus tracts from traumatized teeth with apical periodontitis. Endod Dent Traumatol 1995;11:115-20.
35. Montenegro Fonsêca J, Rangel Palmier N, Amaral-Silva GK, Aristizabal Arboleda LP, Affonso Almeida JF, de Goes MF, *et al.* Massive extrusion of calcium hydroxide paste containing barium sulphate during endodontic treatment. Aust Endod J 2020;46:257-62.
36. Sodnom-Ish B, Seo MH, Yang HJ, Kim SM. Legal liability of a dentist: Inferior alveolar nerve damage after calcium hydroxide extrusion. J Craniofac Surg 2022;33:e314-6.
37. Kent RA, Shupp J, Fernandez S, Prindeze N, DeKlotz CMC. Effectiveness of early laser treatment in surgical scar minimization: A systematic review and meta-analysis. Dermatol Surg 2020;46:402-10.
38. Nagendrababu V, Chong BS, McCabe P, Shah PK, Priya E, Jayaraman J, *et al.* PRICE 2020 guidelines for reporting case reports in Endodontics: A consensus-based development. Int Endod J 2020;53:619-26.