

Usefulness of ultrasonography for rapidly diagnosing cutaneous sinus tracts  
of dental origin

A short title: Diagnosis of cutaneous sinus tracts of dental origin by ultrasonography

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## Abstracts

*Background* Cutaneous sinus tracts of dental origin are frequently misdiagnosed and incorrectly treated. Intraoral roentgenograms are valuable for diagnosing such tracts. Since these lesions are usually not accompanied by dental symptoms, patients tend to initially consult dermatologists or general physicians, who are not familiar with oral diseases or intraoral X-rays.

*Objectives* We sought to determine the usefulness of ultrasonography for detecting cutaneous sinus tracts of dental origin.

*Materials & Methods* Three patients who had skin lesions that were suspected of being cutaneous sinus tracts based on the findings of clinical and histological examinations were enrolled in this study. B mode and color Doppler ultrasonography were used to image the skin lesions in their entirety and to assess the associations between the subcutaneous lesions and any alveolar bone defects.

*Results* In each case, ultrasonography depicted a hypoechoic band that originated from the cutaneous lesion and extended through the subcutaneous tissue to the alveolar bone. Bone loss was also observed, and color Doppler ultrasonography detected increased blood flow in the peripheral regions of the tracts.

*Conclusions* In the present study, the patients' sinus tracts were rapidly detected using

ultrasonography, which enabled appropriate treatment. Thus, ultrasonography is a convenient tool for diagnosing cutaneous sinus tracts of dental origin.

Key words: alveolar bone, cutaneous sinus tract, dental abscess, dental origin, ultrasonography, X-ray examination

## Introduction

Cutaneous sinus tracts of dental origin are channels that develop as a means of draining dental abscesses. They appear as pathways through the alveolar bone that typically begin at the apex of an infected tooth and drain pus through holes in the skin on the face or neck. The eradication of the source of the original infection with appropriate dental therapy such as root canal treatment or dental extraction results in rapid and complete healing of the cutaneous lesion [1,2].

Cutaneous sinus tracts of dental origin continue to be a diagnostic challenge [1,3]. They are often misdiagnosed, and therefore, treated inappropriately. One of the main reasons for this is that most patients are often unaware that they have any dental problems, and thus, tend to initially consult dermatologists, general physicians, or plastic surgeons, who are not familiar with intraoral disease entities [1,3,4]. Delays in establishing the correct diagnosis often lead to needless antibiotic treatment, surgical excision, and/or biopsy procedures [3,5]. Awareness of this condition and appropriate diagnostic evaluation are essential for differentiating it from conditions with similar symptoms and enabling the initiation of appropriate therapy [2]. It also has to be kept in mind that a dental inflammation (apical periodontitis) is the cause of the fistula and dental treatment (endodontic treatment or extraction of the tooth) instead of surgical excision is needed.

[6, 7]

Intraoral X-rays are essential for obtaining a correct diagnosis [4,5]; however, dermatologists, general physicians, and plastic surgeons are not familiar with them. In addition, many institutions do not have intraoral X-ray systems, and hence, patients have to be referred to dentists to obtain a final diagnosis.

In recent years, the availability of high-resolution ultrasonography (US) probes has enabled clinicians to evaluate skin lesions in detail. In this paper, we report three cases of cutaneous sinus tract of dental origin that were rapidly diagnosed by US. In these cases, we used US to trace the channels between the skin and alveolar bone, which appeared as hypoechoic bands running from the dermis to the subcutaneous tissue, and to detect bone defects. US is a convenient tool for rapidly diagnosing cutaneous sinus tracts, and its use enables appropriate treatment to be delivered in a timely manner.

## Materials & Method

A Logic E9 (GE Healthcare, Hino, Japan) diagnostic ultrasound device was used in each examination together with a high frequency linear probe (ML 6-15).

A grayscale examination of each lesion was performed, followed by a color or power

Doppler imaging examination.

## Results

Case 1 A 38-year-old female had noticed a nodulocystic cutaneous lesion on her chin six months previously. It had been excised on six occasions, but these procedures were unsuccessful so she was referred to our department. Clinically, the lesion consisted of a reddish crusty nodule that exhibited dimpling (Fig. 1A). Gray scale ultrasonography depicted a hypoechoic area with an irregular margin extending from the nodule to the subcutaneous tissue. Color Doppler imaging showed some color signals around the lesion (Fig. 1B). A diagnosis of cutaneous sinus tract was considered so the patient was referred to oral and maxillofacial surgeons. A periapical dental radiograph detected an area of periapical radiolucency around the apex of the lower left second premolar, which was consistent with a dental abscess (Fig. 1C). Thus, a diagnosis of cutaneous sinus tract of dental origin was made. Root canal therapy and the elimination of the source of the infection were performed, and the cutaneous lesion subsequently spontaneously disappeared. Two months later, only a faint scar remained on the patient's face.

Case 2 A 74-year-old female presented with a 2-month history of a draining cutaneous lesion on her lower right jaw. The lesion was excised, but the discharge persisted.

Subsequently, she was given antibiotics, but they were ineffective. Thus, she was referred to our hospital. On examination, an ulcerated nodule was found on her lower right jaw, and an opening in the patient's skin discharged copious yellow pus (Fig. 2A). As an infected granuloma was suspected, the lesion was excised again. A histological examination showed that the sinus was lined with granulation tissue that exhibited non-specific chronic inflammation (Fig. 2B). US revealed a hypoechoic band originating from the cutaneous lesion that passed through the subcutaneous tissue and extended to the alveolar bone (Fig. 2C). An alveolar bone defect was also noted (Fig. 2D). A cutaneous sinus tract was suspected. Periapical radiographs revealed a region of periapical radiolucency involving the distal root of the mandibular right first premolar. Using a gutta-percha cone, the sinus tract was radiographically traced from its opening on the patient's face to the periapical abscess (Fig. 2E). Root canal therapy was performed, and the lesion has not recurred since.

Case 3 A 27-year-old male was referred to our department with a chief complaint of an ulcerated nodule measuring 4×5mm in his nasal region, which had been present for the past three months (Fig. 3A). Since basal cell carcinoma was suspected, a skin biopsy was performed. A histological examination revealed chronic inflammation in

the patient's sinus (Fig. 3B). On US, a hypoechoic band running from the nodule to the subcutaneous tissue and passing through the bone was detected. A bone defect was also clearly depicted (Fig. 3C). Color Doppler imaging showed rich color signals at the periphery of the hypoechoic band (Fig. 3D), and a panoramic radiograph demonstrated a region of periapical radiolucency associated with the distal root of the maxillary right canine (Fig. 3E). A diagnosis of cutaneous sinus tract of dental origin was made. Conservative root canal therapy was performed, which led to prompt healing.

## Discussion

Three cases of cutaneous sinus tract of dental origin, in which US helped us to make the correct diagnosis, are presented. All of the patients underwent unnecessary surgical excision, biopsies, or antibiotic therapy before an accurate diagnosis was made, as has been reported in many other cases in the literature [3,8,9]. Cases 1 and 2 underwent six and two surgical excisions, respectively. Case 2 received antibiotic therapy as well, and Case 3 underwent a skin biopsy. US allowed the patients' sinus tracts to be rapidly detected, which enabled us to refer the patients to dentists for appropriate treatment. In agreement with previous reports of similar cases, the cutaneous lesions in the present cases healed promptly after the removal of the source of the infection.

Cutaneous sinus tracts of dental origin are relatively uncommon, but have been well documented in the medical literature since the 1930s [7, 10-18]. The disease is called Partsch's chronic granulomatous inflammation and is well known by maxillo-facial-surgeons. [16, 18] The disease is named after the famous surgeon Carl Partsch (\*1855 - 1932) born in Breslau. It is diagnosed by the clinical presentation of a dermal fistula in the face with dermal epithelioma completed with a panoramic radiograph or single-tooth radiograph with an apical region of radiolucency showing the osteolysis. Clinically the tooth is avital. The granulation tissue spreads from the apex of

the tooth through the alveolar bone and periostium resulting in a cutaneous fistula. [18]

They are often difficult to diagnose for many reasons. First, in many cases the cutaneous lesions do not seem to be associated with dental infections because extraoral/intraoral swelling and pain are usually absent, and only around 50% of patients can recall having had a toothache [1,3,4]. Second, as most cases involve a persistent facial nodule without dental symptoms patients often present to dermatologists, general physicians, or plastic surgeons, who are not familiar with intraoral disease entities [4,9,19]. Third, there is paucity of detailed information in the dermatological literature that clinicians can refer to during daily practice. Misdiagnosis can result in needless antibiotic treatment and unsuitable surgical interventions [3,5]. In fact, one case was only correctly diagnosed after 32 years [8]. Thus, awareness of this disorder is key to a correct diagnosis being made.

The most common causes of periapical abscesses include dental caries followed by trauma and periodontal infections [20]. Most periapical abscesses become acute, and therefore, patients with such lesions tend to seek treatment [1, 20]. However, in cases involving chronic abscesses, local inflammation might spread slowly through the alveolar bone along the path of least resistance [1, 2, 19, 20]. The relationships between posterior tooth apices and the buccinator and mylohyoid muscle attachments are the

primary determinants of whether sinus tracts will erupt intraorally or cutaneously [1,5,19]. If the apices of teeth are located superior to the maxillary attachment of the buccinator muscle or inferior to the mandibular attachments of the mylohyoid or buccinator muscle, the infection might spread in an extraoral manner [1].

The treatment of sinus tracts of dental origin involves the elimination of the dental source of infection through dental therapy such as root canal treatment or surgical extraction. The eradication of the source of infection typically results in the resolution of the cutaneous lesion within a few weeks [1-4]. Cioffi et al. reviewed 137 cases from the literature and showed that most cutaneous sinus tracts are associated with mandibular teeth, whilst the remaining 20% are associated with maxillary teeth [1]. Therefore, the most common sites of sinus tract development include the chin or the submandibular region, where mandibular abscesses drain into. Cutaneous sinus tracts can also involve the nose, nasolabial folds, and inner canthi of the eyes [1,2].

Clinically, cutaneous sinus tracts present as erythematous nodulocystic, sometimes ulcerated, suppurative lesions. A sinus opening with a central punctum might also be present. Cutaneous retraction or dimpling is sometimes observed because of the attachment of the tract to the underlying tissues [2,3]. Palpation of the tissues surrounding a sinus tract should reveal a cord-like tract that connects the skin lesion to

deeper regions of the maxilla or mandible. After applying pressure to the cord, a purulent discharge might be pushed out of the skin lesion, which would confirm the presence of a tract [2]. Examinations of the oral cavity can reveal carious teeth or healthy-looking teeth with intact crowns.

Cutaneous sinus tracts of dental origin have been described in both children and adults [2]. The youngest reported patient was a 10-month-old boy [21], and the oldest was 110-years-old [1].

Histologically, cutaneous sinus tracts usually consist of granulation tissue that is focally lined by epithelial tissue or exhibits chronic inflammatory reactions in the dermis [2,3].

The differential diagnoses of cutaneous sinus tracts include infected cysts, mycotic infections, salivary gland fistulas, osteomyelitis, pyogenic granulomas, basal cell carcinoma, and other skin or bone tumors [1-4,14,21].

Intraoral X-ray examinations of the teeth are useful for diagnosing sinus tracts [4,5]. In addition, panoramic or periapical radiographs are useful for detecting regions of periapical radiolucency involving the distal root of the suspect tooth [1,3]. However, some authors have argued that panoramic films are unsuitable for evaluating the anterior segments of the maxilla and mandible because of inter-patient variability in the plane of focus [9]. Occasionally, sinus tract pathways might be detected radiographically after

the injection or insertion of a radiopaque material such as a lacrimal probe or a gutta-percha cone, which can aid the tracing of the tract from its cutaneous orifice to its point of origin [1,4,22].

Collectively, the diagnosis of cutaneous sinus tracts of dental origin is based on the appearance of the cutaneous lesion, a careful intraoral examination and palpation that detects a cord-like sinus tract, and radiographic evidence of an alveolar dental abscess [2,4]. However, physicians such as dermatologists, general physicians, and plastic and general surgeons are not familiar with oral examinations or X-ray examinations of the teeth. Thus, cooperative diagnostic referrals between physicians and dentists are necessary, but this might also contribute to the frequent delays in diagnosis. In this report, we demonstrated that ultrasonography is useful for making a quick and correct diagnosis. On transverse ultrasonography, homogeneously hypoechoic regions with irregular margins that ran from the patients' facial lesions to their subcutaneous tissue were detected in all three cases. In addition, color Doppler imaging depicted rich color signals around the lesions, which indicated that inflammation was present. These imaging findings are similar to those of abscesses. In addition, in two cases the defects observed in the underlying alveolar bone were considered to be important findings for indicating the existence of communication between the cutaneous lesion and the oral

cavity. The pathways between cutaneous lesions and subcutaneous tissue, which are depicted as hypoechoic bands on US, can not be detected on X-ray examinations. Occasionally, a lacrimal probe or gutta-percha cone can be used to radiographically trace the source of an infection, but dermatologists and general physicians are not usually familiar with these tools. Therefore, US might be more useful because it can be used to view sinus tracts of dental origin in their entirety and is much more widely known by physicians. We emphasize that US is an effective tool for quickly detecting sinus tracts and results in patients being immediately referred to dentists for early appropriate treatment. We further suggest that US should be considered to be the first-line diagnostic tool for evaluating suspected cutaneous sinus tracts of dental origin due to its safety, high sensitivity, diagnostic accuracy, ease of use, and low cost.

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## Legends for Figures

### **Figure 1**

(A) Nodulocystic cutaneous lesion in the chin of a 38-year-old female, which had been present for six months.

(B) Sonographic examination revealing a hypoechoic region (black arrows) with irregular margins extending from the nodule to the subcutaneous tissue as well as color signals around the hypoechoic region.

(C) Diagnostic radiograph of the lower left second premolar showing a region of periapical radiolucency (black arrows).

### **Figure 2**

(A) Discharging sinus in the lower right jaw of a 74-year-old-female, which had been present for two months.

(B) Histological examination showing granulation tissue that exhibited non-specific chronic inflammation.

(C,D) Sonographic examination revealing a hypoechoic band (white arrows) extending from the lesion to the subcutaneous tissue together with an alveolar bone defect (white arrowhead).

**(E)** Periapical radiograph revealing a region of radiolucency involving the distal root of the mandibular right first premolar with a gutta-percha cone in situ (black arrow).

**Figure 3**

**(A)** Ulcerated nodule measuring 4×5mm on the nose of a 27-year-old male, which had lasted for three months.

**(B)** Histological examination showing granulation tissue that exhibited non-specific chronic inflammation.

**(C)** Sonographic examination revealing a hypoechoic lesion (white arrows) extending from the nodule to the subcutaneous tissue together with a bone defect (white arrowhead).

**(D)** Color Doppler imaging showing rich color signals in the periphery of the hypoechoic band.

**(E)** Panoramic radiograph demonstrating a region of radiolucency around the apex of the maxillary right canine (black arrows).

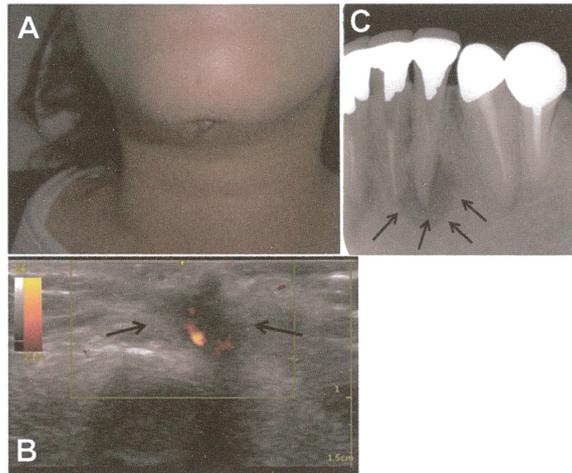
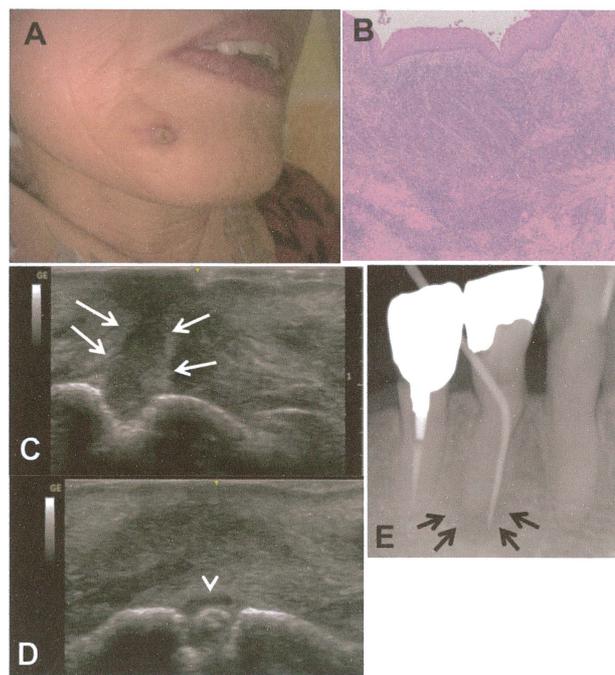
**Figure 1.**

Figure 2.



**Figure 3.**