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## Case Report

## A radicular cyst potentially associated with unsupervised home bleaching: A multidisciplinary case report

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## ABSTRACT

Radicular cysts are common odontogenic cysts typically resulting from pulp necrosis secondary to caries or trauma. However, their possible association with the use of household bleaching agents is extremely rare. This report describes a unique case of a radicular cyst potentially induced by self-administered home bleaching, highlighting the need to recognize unconventional causes of pulpal injury. A 21-year-old female presented with a recurrent cutaneous fistula on the chin that persisted despite prior surgical and antibiotic management. Radiographic and histopathological examinations confirmed an odontogenic cyst in the mandibular anterior region (teeth 31–42). Further history revealed unsupervised use of a hydrogen peroxide-based household bleaching agent for tooth whitening prior to the onset of symptoms, with both teeth exhibiting pulp necrosis on clinical examination. The patient was treated through a multidisciplinary approach involving cyst enucleation, root canal therapy, apicoectomy of teeth 41 and 42, and fistula reconstruction under general anaesthesia. Botulinum toxin was also administered to the masseter muscle to manage concomitant bruxism as a potential contributing factor. This rare case underscores the potential risks of unsupervised dental bleaching and the importance of comprehensive etiological evaluation in recurrent oro-cutaneous fistulas. A multidisciplinary approach is essential for optimal functional and esthetic outcomes.

## 1. Introduction

The unsupervised use of home bleaching agents presents an emerging and significant risk for severe iatrogenic dental complications, including chemical-induced pulpitis and necrosis. While the link between bleaching and pulp sensitivity is well-documented, a direct progression from chemical-induced necrosis to the formation of a radicular cyst has not yet been established in the literature.

Radicular cysts are the most prevalent odontogenic cysts, occurring more frequently in the maxilla than in the mandible [1–3]. Their pathogenesis involves the inflammatory proliferation of Malassez epithelial rests, a process triggered secondary to pulp necrosis

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[4,5]. The etiology is overwhelmingly attributed to chronic inflammation from bacterial infection or as a sequela of dental trauma (Table 1). Consequently, these cysts are often asymptomatic and discovered incidentally during routine radiographic examinations [3, 6,7].

This report presents a unique case of a large radicular cyst in which the etiology was not clearly attributable to bacterial infection or documented physical trauma, but was potentially associated with pulp necrosis following the improper, unsupervised use of a household bleaching agent. Although a definitive causal relationship cannot be established, this case highlights a rare and previously underreported potential risk related to self-administered dental bleaching. We describe the diagnostic challenge and the complex multidisciplinary management required for this patient. Treatment was provided collaboratively by an oral surgeon and an endodontist, including cyst enucleation, apicoectomy of the affected teeth, and surgical reconstruction under general anaesthesia. Concomitant patient-related factors, such as parafunctional bruxism, were also addressed using botulinum toxin (Botox®) as an adjunctive therapy to reduce mechanical loading and support comprehensive treatment and healing.

## 2. Case report

A 21-year-old female patient presented to the Oral and Maxillofacial Surgery Polyclinic with a wound in the chin area that had been present for five months. The wound originated from a small pimple that burst, bled and drained pus four months prior. Initially, the patient consulted a dermatologist via an online platform, and was prescribed antibiotic ointment. Due to a lack of improvement, the patient attended an in-person dermatologist appointment, and was subsequently treated using curettage and antibiotic therapy. However, two weeks following the curettage, the previously dry surgical area began to emit pus, which was comparable with the initial presentation. At this point, the patient consulted the Oral and Maxillofacial Surgery Polyclinic, and presented with a history of bruxism. Extraoral examination revealed a fistula in the submental area measuring 1.5x1x0.5 cm, without hyperaemia, pain on

**Table 1**  
Recent literature radicular cyst in anterior permanent mandibular teeth.

No.	Author	Gender and Age (y.o)	Chief complaint	Etiology	Imaging features	Intervention	Outcome
1.	Kim & Min (2021) [8]	Female (42)	Gingival soreness in the mandibular anterior region	Necrotic pulp (post endodontic treatment)	Panoramic X-Ray: A large radiolucent lesion in the anterior region tooth 31, 32, 33, and 41	Cystic enucleation, endodontic surgery with apicoectomy	Complete bone healing (4.5 years follow-up)
2.	Mrad et al. (2020) [9]	Female (39)	A dark red chin nodule and the erythematous appearance of the chin with no pain or pus discharge	Implant	Panoramic X-Ray: Bilateral mandibular cysts, one of which was fistulation with the implant pocket	Implant removal and curettage	No recurrence (3 months follow-up)
3.	Ghorbanzadeh et al. (2017) [10]	Female (16)	A periodic swelling and pus drainage from mandibular anterior region	Necrotic pulp	Periapical X-Ray: A large unilocular well-defined radiolucency surrounding mandibular incisors with a single tracing gutta-percha	Root canal treatment	Healing (18-month follow-up)
4.	Salaria et al. (2016) [11]	Male (28)	Swelling and severe pain on biting from anterior mandibular teeth	Trauma	A pear-shaped radiolucency circumscribing the roots of anterior mandibular teeth with thin radiopaque border	Root Canal Treatment	Healing (1 year follow-up)
5.	Borkar et al. (2016) [12]	Male (38)		Necrotic pulp (post endodontic treatment)	Periapical X-Ray: A large periapical lesion in mandibular anterior region overlapping the apices of mandibular incisors having well-defined radiopaque border. CBCT: A large radiolucency in the mandibular anterior region extending from the mesial aspect of root of the lower right canine to the distal aspect of the root of the lower left canine and from the apices of lower anterior incisors to the inferior border of the mandible involving the border of mandible on the right half of the lesion. There were two canals in 31, 32, 41, and 42.	Non-surgical endodontic treatment and cystic enucleation	Healing (1 year follow-up)

<sup>a</sup> Orocutaneous fistula is seen.

palpation or pus discharge (Fig. 1A). Examination of the right and left lymph nodes revealed that they were both non-palpable and painless. Intraoral examination revealed attrition of teeth 32–42, without pain on palpation or percussion (Fig. 1B and C). The patient presented with good oral hygiene, had no history of systemic diseases, and no drug or food allergies. A panoramic X-Ray revealed no caries in the mandibular anterior teeth, while the maxillary and mandibular bones appeared healthy (Fig. 1D).

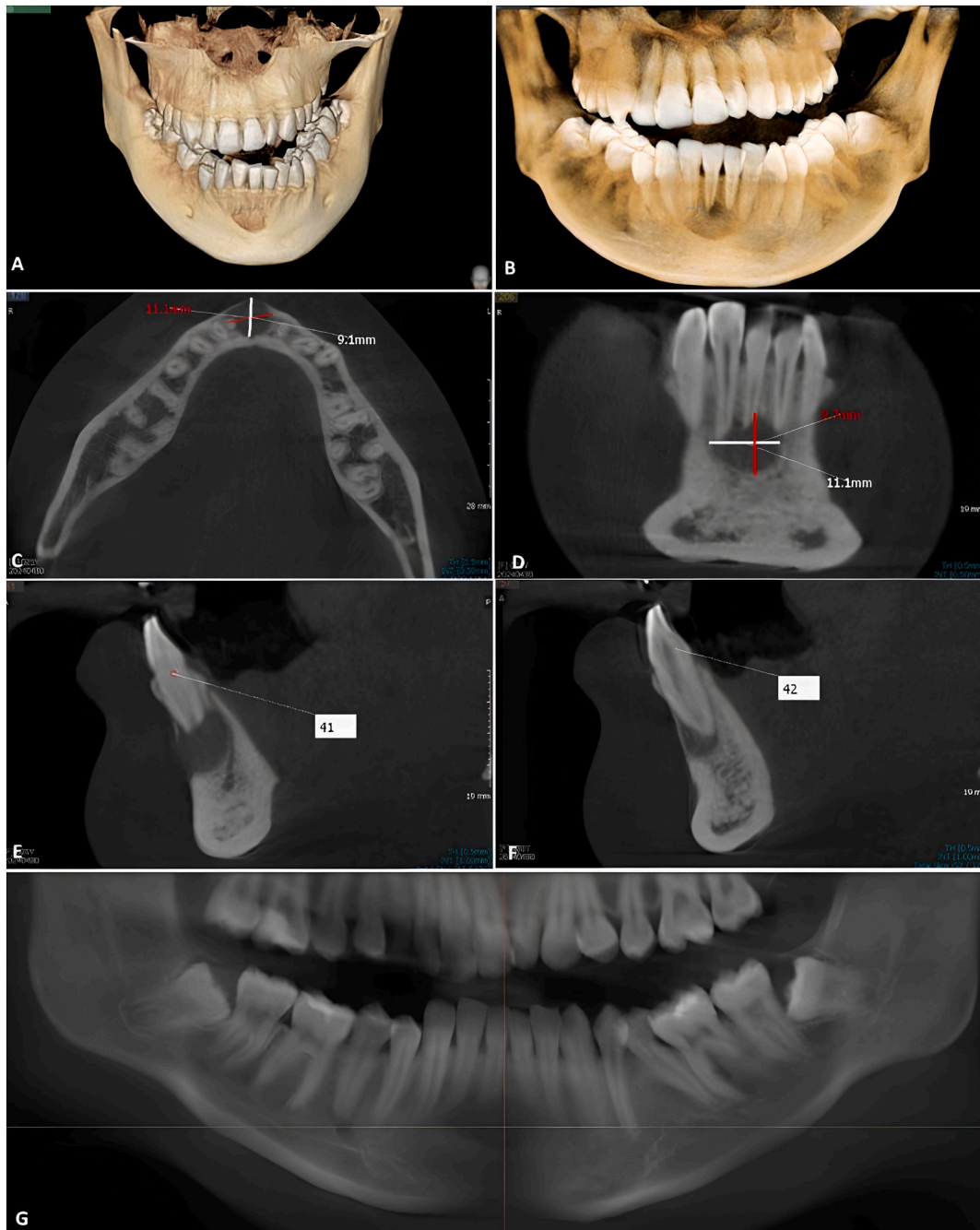
The patient was diagnosed with a cutaneous fistula in the submental region, attributed to a non-odontogenic infection. Initially, wound debridement and fistulectomy were planned under general anaesthesia. Laboratory examinations revealed leukopenia, with a leukocyte count of  $3.07 \times 10^3/\text{mm}^3$ . Notably, the healthy reference range for white blood cells is  $4.79\text{--}11.34 \times 10^3/\text{mm}^3$ . Results of additional laboratory examinations, including routine blood tests, and tests for blood sugar, clotting time, bleeding time and Hepatitis B surface antigen, demonstrated levels within healthy reference ranges. Results of a chest X-ray revealed no abnormalities. The patient subsequently underwent wound debridement and fistulectomy under general anaesthesia, and the excised fistula tissue was stored for subsequent histopathological examination. Results of the histopathological analysis suggested the presence of a radicular cyst. In addition, analysis of a bacterial culture collected from the patient revealed the absence of microorganisms.

Due to the observation of cortical bone resorption in the intraoperative mandibular incisive area, a cone-beam computed tomography (CBCT) examination was performed, focusing on the aforementioned region. Results of the CBCT examination revealed an osteolytic lesion in the anterior mandibular area, located in the region of teeth 32–42 (Fig. 2A and B). In addition, the osteolytic lesion was 11.1 mm mesiodistally and 9.1 mm labiolingually in size, and was further characterized by fascial cortical bone destruction and root resorption of tooth 41 (Fig. 2C–F). Based on these findings, numerous differential diagnoses were proposed: 1) long-standing chronic inflammation of undetermined origin leading to bone destruction and root resorption; and 2) an odontogenic cyst with a non-inflammatory origin (developmental cyst). Notably, the development cyst may have been impacted by secondary infections, with differential diagnoses highlighting an odontogenic keratocyst (OKC), and an infected simple or traumatic bone cyst.

At one-month post-surgery, bruxism was treated via administration of botulinum toxin. Subsequently, the patient was referred to an endodontist for treatment of teeth 41 and 42, and these were suspected to be nonvital. On clinical examination of tooth 41, crack lines were evident on the labial surface. The tooth did not respond to the vitality test; thus, the patient was diagnosed with pulp necrosis. In addition, necrosis in teeth 41 and 42 was further confirmed by an endodontist. The patient reported the use of household teeth whitening agents containing hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) for four months prior to admission, and these had not been reported to a dentist. Following one month, root canal treatment of tooth 41 was carried out by an endodontist; however, pus was emitted from the previously dry surgical area. The patient was again referred to the Oral and Maxillofacial Surgery Department, where an extraoral examination revealed a scar in the submental area, measuring 1.5x1 cm. This was accompanied with pus discharge; however, the right and left lymph nodes were non-palpable and painless. Intraoral examination indicated that tooth 41 had undergone root canal treatment, with no hyperaemia and no pain on percussion. Notably, the patient maintained good levels of oral hygiene. The patient was diagnosed with an odontogenic cyst in the region of teeth 31–42, with differential diagnoses, including a radicular cyst and an odontogenic keratocyst. Cyst enucleation, apicoectomy of tooth 41, root canal treatment and apicoectomy of tooth 42, and fistula reconstruction were performed under general anaesthesia (Fig. 3A and B). The tissue excised during the fistulectomy was stored for

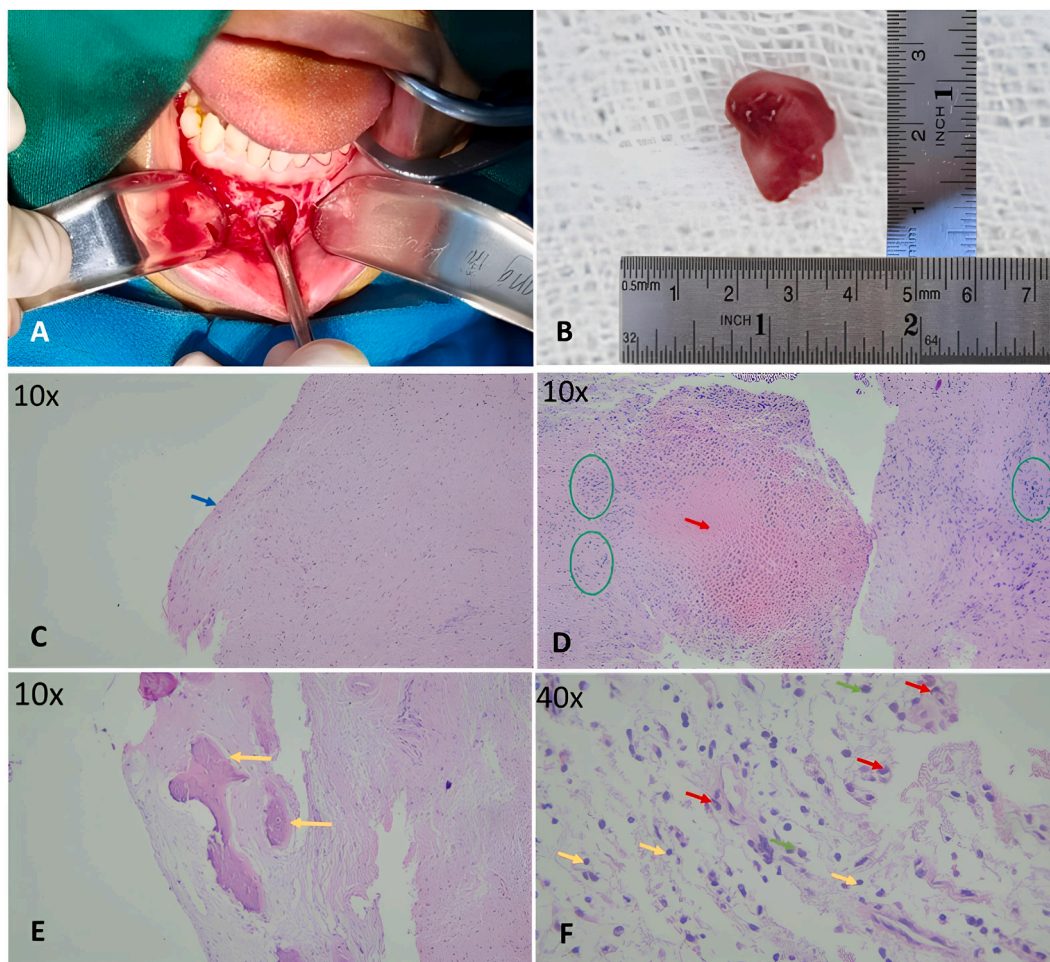


**Fig. 1.** Pre operative examination. (A) Extraoral Examination, a fistula in the submental area. (B,C) Intraoral Examination, no swelling and attrition of teeth 32–42. (D) Panoramic X-Ray, dentin caries in teeth 11, 12 and no abnormalities in the maxillary and mandibular bones.



**Fig. 2.** CBCT Examination. (A,B) 3D images highlighting the mandibular anterior focus. (C) The axial section shows a demarcated, rounded unilocular hypodense osteolytic lesion in the anterior part of the mandible, located in the region of teeth 32–42. The epicentre of the lesion is at the apex of tooth 41, extending mediolaterally to involve teeth 42 and 31 with extension in the fascial/labial direction leading to the destruction of the mandibular facial cortical bone. (D) Coronal section depicting the lesion extending mesiodistally, with the epicentre at the apex of tooth 41 and involvement of the mesial side of tooth 42, with visible root resorption of tooth 41. (E,F) The sagittal section shows root resorption of tooth 41 caused by the lesion, indicating a loss of the mandibular facial cortical bone. (G) Panoramic X-Ray focusing on the mandibular anterior lesion area.

subsequent histopathological examination. Results of the present study highlighted that the cyst wall was partially coated with thin squamous epithelium. Moreover, inflammatory cells, including lymphocytes, dense neutrophils, histiocytes, woven bone trabeculae and erythrocyte extravasation, had infiltrated. Collectively, results of the present study highlighted the presence of a radicular cyst (Fig. 3C–F).



**Fig. 3.** Intraoperative, macroscopic, and microscopic features of the lesion. (A) Cyst wall. (B) Result of surgery. (C) The cyst wall structure has a surface partially lined with thin squamous epithelium (blue arrow) (H&E staining,  $\times 10$ ). (D) Underneath, there is an infiltration of inflammatory cells lymphocytes, dense neutrophils, histiocytes (green circle), and erythrocyte extravasation is also visible (red arrow) (H&E staining,  $\times 10$ ). (E) Woven bone trabeculae are also visible (yellow arrow) (H&E staining,  $\times 40$ ). (F) Underneath, there is infiltration of inflammatory cells lymphocytes (yellow arrow), dense neutrophils (red arrow), histiocytes (green arrow) (H&E staining,  $\times 10$ ).

### 3. Discussion

In the present case, the cutaneous fistula in the submental region was initially considered to be of non-odontogenic origin, as the patient reported no history of tooth pain or trauma, and the initial panoramic radiograph revealed no obvious dental or mandibular abnormalities. These factors contributed to the initial misdiagnosis, consistent with previous reports indicating that misdiagnosis at first presentation is common in patients with orocutaneous fistulas [13–15]. The absence of dental pain frequently leads clinicians to suspect non-odontogenic etiologies. However, recurrent facial skin infections after treatment should prompt investigation for an underlying odontogenic source. Kumar et al. [16] reported that approximately 80 % of facial cutaneous fistulas are ultimately odontogenic in origin. Typically, chronic infection from necrotic pulp spreads through cancellous bone, perforates the cortical plate, and drains through the skin, forming an orocutaneous fistula. In contrast, no clinical or microbiological evidence of active bacterial odontogenic infection was identified in the present case.

During intraoperative wound debridement and fistulectomy, resorption of the labial cortical bone in the anterior mandible was observed, raising suspicion of an underlying odontogenic cyst. Subsequent CBCT examination confirmed osteolytic lesions involving teeth 31–42, with features consistent with an odontogenic cyst and external root resorption of tooth 41. These findings underscore the diagnostic value of three-dimensional imaging in recurrent orocutaneous fistulas unresponsive to treatment. Cone-beam computed tomography enables detailed visualization of apical pathology and accurate assessment of bone destruction and root resorption that may be overlooked on panoramic radiographs [17,18].

Histopathological examination confirmed the diagnosis of an odontogenic cyst. Clinical examination revealed enamel crack lines on teeth 41 and 42 with no response to vitality testing, leading to a diagnosis of pulp necrosis in both teeth. The patient also reported

the unsupervised use of a household bleaching agent containing hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) for four months prior to presentation. Based on these findings, it was hypothesized that exposure to H<sub>2</sub>O<sub>2</sub> may have contributed to pulpal irritation and subsequent pulp necrosis, which could have played a role in the development of the radicular cyst. Previous studies have demonstrated that even low concentrations of H<sub>2</sub>O<sub>2</sub> may induce pulp inflammation, promote apoptosis, and potentially lead to pulp necrosis [19,20].

Hydrogen peroxide is generally not recommended for unsupervised household bleaching due to its known adverse effects on dental tissues. Chronic pulpal inflammation associated with chemical irritation may predispose to pulp necrosis and subsequent periapical inflammation. This inflammatory process may stimulate the proliferation of epithelial rests of Malassez, potentially contributing to radicular cyst formation [17,21]. Progressive cyst enlargement may lead to cortical bone perforation and formation of an orocutaneous fistula, accompanied by periapical bone resorption and granulation tissue formation [7,20]. Chronic inflammation within the periodontal ligament may activate clastic cells, causing tooth root resorption [3,6].

Microbial culture in this case was negative, suggesting the absence of active bacterial infection. However, this finding does not exclude a bacterial etiology, as prior antibiotic exposure and sampling limitations may affect culture sensitivity. Accordingly, this case is best interpreted as demonstrating a possible association, rather than a confirmed causal relationship, between household bleaching containing H<sub>2</sub>O<sub>2</sub> and radicular cyst formation.

The patient exhibited parafunctional bruxism, and the presence of enamel crack lines on teeth 41 and 42 may reflect repeated microtrauma associated with this habit. Such microstructural defects could potentially facilitate deeper penetration of bleaching agents, thereby increasing pulpal exposure to chemical irritants and susceptibility to injury. However, this proposed mechanism remains speculative and should be interpreted as a hypothesis rather than a proven causal pathway. The absence of pain or dentinal sensitivity despite four months of bleaching use may be compatible with rapid pulpal damage, although interindividual variability in pain perception must be taken into account.

Importantly, a definitive causal relationship cannot be established on the basis of a single case. Although no caries was detected in the affected teeth, prior dental trauma—one of the most common etiologies of pulp necrosis—cannot be entirely excluded, as minor traumatic events are frequently unrecognized or forgotten by patients. Accordingly, the pulp necrosis observed in this case is most plausibly multifactorial, with chemical irritation from hydrogen peroxide-containing bleaching agents and possible repeated microtrauma related to bruxism acting as contributing factors rather than a single proven cause.

In the present case, the masseter muscle was specifically targeted, as this is the primary muscle involved in teeth grinding in patients with bruxism, rather than the temporalis or medial pterygoid muscles. Previous studies highlighted that the effects of botulinum toxin on masseter muscle activity were evident within two weeks, with a significant reduction in activity three months post-injection [22–25]. In the majority of cases, muscle function returns to normal around six months post-injection; however, new functional habits may form within three to six months following treatment [23,24]. Therefore, botulinum toxin injections are recommended for patients with nocturnal bruxism. In the present case, relatives of the patient reported a notable reduction in cheek muscle fatigue during the day, with no further episodes of sleep bruxism, as previously observed.

Definitive management of the present case included cyst enucleation, root canal treatment, apicoectomy of teeth 41 and 42, and fistula reconstruction to prevent recurrence. This combined approach was selected due to the large size of the cyst involving teeth 31–42 and the presence of external root resorption. When nonsurgical endodontic therapy alone is insufficient, adjunctive surgical management such as decompression through marsupialization or cyst enucleation is recommended [8,26]. At the 11-week post-operative follow-up, no signs of recurrence were observed.

Household bleaching products containing H<sub>2</sub>O<sub>2</sub> are widely accessible and may cause pulpal injury without producing significant pain. Such asymptomatic progression may delay diagnosis and treatment. This case highlights the importance of considering all potential causative and predisposing factors, including unsupervised chemical exposure and parafunctional habits. Nevertheless, this report is limited by its single-patient design and relatively short follow-up period, which restricts conclusions regarding long-term prognosis and causation.

#### 4. Conclusion

This case describes a rare presentation of a radicular cyst potentially associated with the unsupervised use of a hydrogen peroxide-based household bleaching agent. Although a direct causal relationship cannot be definitively established, the findings highlight the potential risk of self-administered dental whitening and emphasize the importance of professional supervision to prevent chemical injury to the pulp. Comprehensive diagnostic evaluation, including careful history taking and advanced radiographic assessment, is essential for identifying atypical presentations of odontogenic pathology. Successful management requires a multidisciplinary approach combining surgical, endodontic, and behavioural interventions to achieve optimal healing and prevent recurrence. Public education regarding the safe use of bleaching products is also essential to reduce the risk of similar adverse outcomes.

#### CRediT authorship contribution statement

**Michael Andreas Leman:** Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Data curation, Conceptualization. **Yossy Yoanita Ariestiana:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Afniati Rachmuddin:** Writing – review & editing, Writing – original draft, Validation, Project administration, Formal analysis, Data curation, Conceptualization. **Paolo Boffano:** Writing – review & editing, Data curation. **Tsuyoshi Shimo:** Writing – review & editing, Data curation. **Tymour Forouzanfar:** Writing – review & editing, Data curation. **Muhammad Ruslin:** Writing – review & editing, Writing – original draft,

Supervision, Conceptualization.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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