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CASE REPORT

P.E.A.R.L. Technique (Periapical Exudate Aspiration via Root canal Lumen): presentation of a case report

ABSTRACT

Aim: *This study aimed to introduce and clinically validate a novel conservative technique, P.E.A.R.L. (Periapical Exudate Aspiration via Root canal Lumen), designed to manage acute periapical abscesses with associated facial swelling. The technique allows for direct aspiration of periapical exudate via the root canal system, potentially eliminating the need for surgical drainage or systemic antibiotic therapy.*

Materials and Methods: *A clinical case involving a necrotic mandibular second premolar (tooth 4.5) presenting with acute facial swelling was treated using the P.E.A.R.L. technique. After establishing the working length, the canal was gently instrumented and irrigated. Apical patency was achieved with a small manual file to stimulate periapical exudate release. When exudate was not initially present within the canal, a fine endodontic suction tip (Ø 0.30 mm) was connected to high-vacuum suction and positioned slightly beyond the apical foramen to allow negative pressure drainage. No systemic antibiotics were administered. Root canal obturation was performed in the same session.*

Results: *Facial swelling and associated symptoms resolved within 36 hours following treatment. No postoperative complications occurred, and clinical and radiographic follow-up confirmed the infection's resolution. The case demonstrated successful management of an acute periapical abscess in a single visit without surgical incision or pharmacological support.*

Conclusions: *The P.E.A.R.L. technique offers a conservative, efficient, and minimally invasive approach for managing periapical abscesses. It may reduce or eliminate the need for mucosal incision and antibiotic therapy, shorten treatment duration, and allow definitive root canal therapy to be completed in a single session. Further clinical studies are recommended to validate its broader applicability and long-term outcomes.*

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Introduction

Endodontic therapy is a fundamental component of modern dental practice, aiming to preserve teeth affected by pulpal and periapical pathologies (1). The success of root canal treatment depends on several critical factors, including accurate diagnosis, effective microbial control through chemomechanical instrumentation, disinfection, and hermetic three-dimensional obturation of the canal system (2). When executed properly, endodontic treatment can yield high long-term success rates (3). However, treatment failures occur and may be attributed to various causes such as missed canals, inadequate disinfection, persistent or secondary microbial contamination, or procedural errors (4).
One of the most common clinical outcomes of pulp necrosis is the development of periapical lesions, which represent the body's immune response to bacterial invasion and byproducts exiting through the apical foramen (5). These lesions can manifest in a spectrum of clinical presentations ranging from chronic, asymptomatic apical periodontitis to acute apical abscesses with systemic involvement (6). While chronic lesions may remain clinically silent for long periods, acute infections can progress rapidly and present with severe pain, purulent discharge, and, in some cases, significant facial swelling due to the spread of the infection to adjacent fascial spaces (7).
Facial swelling associated with endodontic infections is both a clinical challenge and an emergency, often causing considerable patient discomfort, aesthetic concern, and functional impairment (8). The standard management protocol typically involves systemic antibiotic administration to reduce inflammation, followed by incision and drainage procedures when indicated, and delayed completion of endodontic therapy once the acute phase has subsided (9). Although effective in many cases, this approach has notable limitations (9). The reliance on antibiotics contributes to global concerns regarding antimicrobial resistance (10), while surgical drainage procedures are invasive, may lead to postoperative complications such as scarring, and can cause patient apprehension (11, 12).
In this context, there is a growing need for minimally invasive and more efficient strategies to manage acute endodontic infections presenting with facial swelling. Recent advances in endodontic techniques and instrumentation have opened new possibilities for conservative management of exudative periapical lesions directly through the root canal system.
This article introduces and describes a novel approach termed the P.E.A.R.L. Technique (Periapical Exudate Aspiration via Root canal Lumen), which facilitates the aspiration of periapical exudate through the root canal using negative pressure. This technique aimed to achieve effective drainage and symptom resolution without the need for mucosal incision or systemic antibiotics, thereby enabling the completion of endodontic therapy in a single visit.
A clinical case involving a necrotic mandibular second premolar (tooth 4.5) with associated facial swelling is presented to demonstrate this technique's application, advantages, and outcomes in a real-world setting.

Materials and Methods

This case report was prepared and reported in accordance with the PRICE 2020 guidelines (Preferred Reporting Items for Case reports in Endodontics) to ensure transparency, completeness, and clinical relevance

Case presentation

A 19-year-old male patient in good general health with no relevant medical history presented to our dental centre with a chief complaint of facial swell-

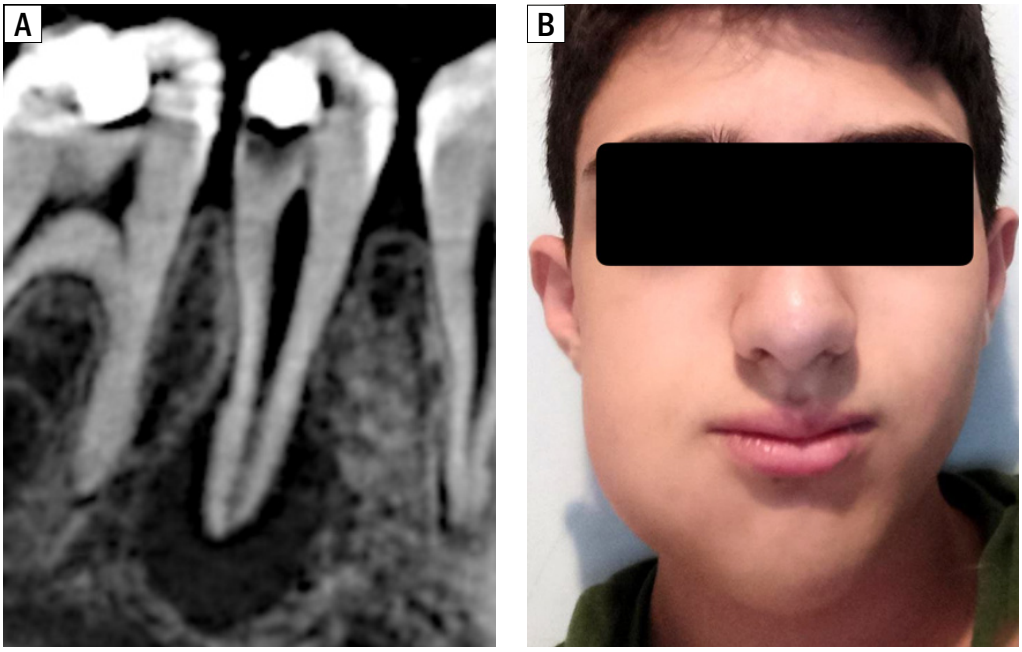

Figure 1
A: CBCT image showing the periapical lesion of tooth 4.5, **B:** Swelling on the lower right side of the face.

ing localized to the lower right side associated with spontaneous throbbing pain. Clinical examination revealed composite restorations on teeth 4.5 and 4.6, with no evidence of recurrent caries, pathological tooth mobility, or periodontal pocketing. Pulp sensibility testing (cold test) was physiologic on teeth 4.4 and 4.6 but negative on 4.5. Percussion testing elicited a positive response only on tooth 4.5.

The patient independently underwent a cone beam computed tomography (CBCT) scan one day prior to presentation. Radiographic analysis revealed a defective composite restoration on tooth 4.5 with carious infiltration approaching the pulp chamber and an extensive periapical radiolucency. A diagnosis of pulpal necrosis with symptomatic apical periodontitis and acute facial swelling was established. After informed consent was obtained, orthograde root canal treatment was initiated immediately (Figure 1).

Due to the pulp's necrotic status, local anaesthesia was not required. Rubber dam isolation was applied, and a conservative access cavity was prepared through the existing restoration under an operating microscope. Carious tissue was removed, and the root canal was located. Irrigation was initially performed with 5.25% sodium hypochlorite (NaOCl) (Canal Pro, Coltene/Whaledent AG, Switzerland). Coronal flaring was accomplished, and working length was established with a size 10 K-file (MicroMega, Coltene/Whaledent AG, Switzerland) using an electronic apex locator (Morita, Japan).

At this stage, the canal was dry with no apparent purulent exudate. Therefore, the P.E.A.R.L. Technique (Periapical Exudate Aspiration via Root canal Lumen) was employed. This technique stimulates periapical exudate by enlarging the apical diameter without visible drainage within the canal. Apical enlargement was performed using the HyFlex EDM rotary system (Coltene/Whaledent AG, Switzerland), with final instrumentation achieved using a 30/0.04 file to full working length.

A 0.30 mm diameter endodontic suction tip (30G NaviTip needle, Ultradent Products, Inc., South Jordan, UT, USA), connected to high-vacuum suction (Luer Vacuum Adapter, Ultradent, Salt Lake City, UT, USA), was carefully positioned slightly beyond the apical foramen. Negative-pressure aspiration

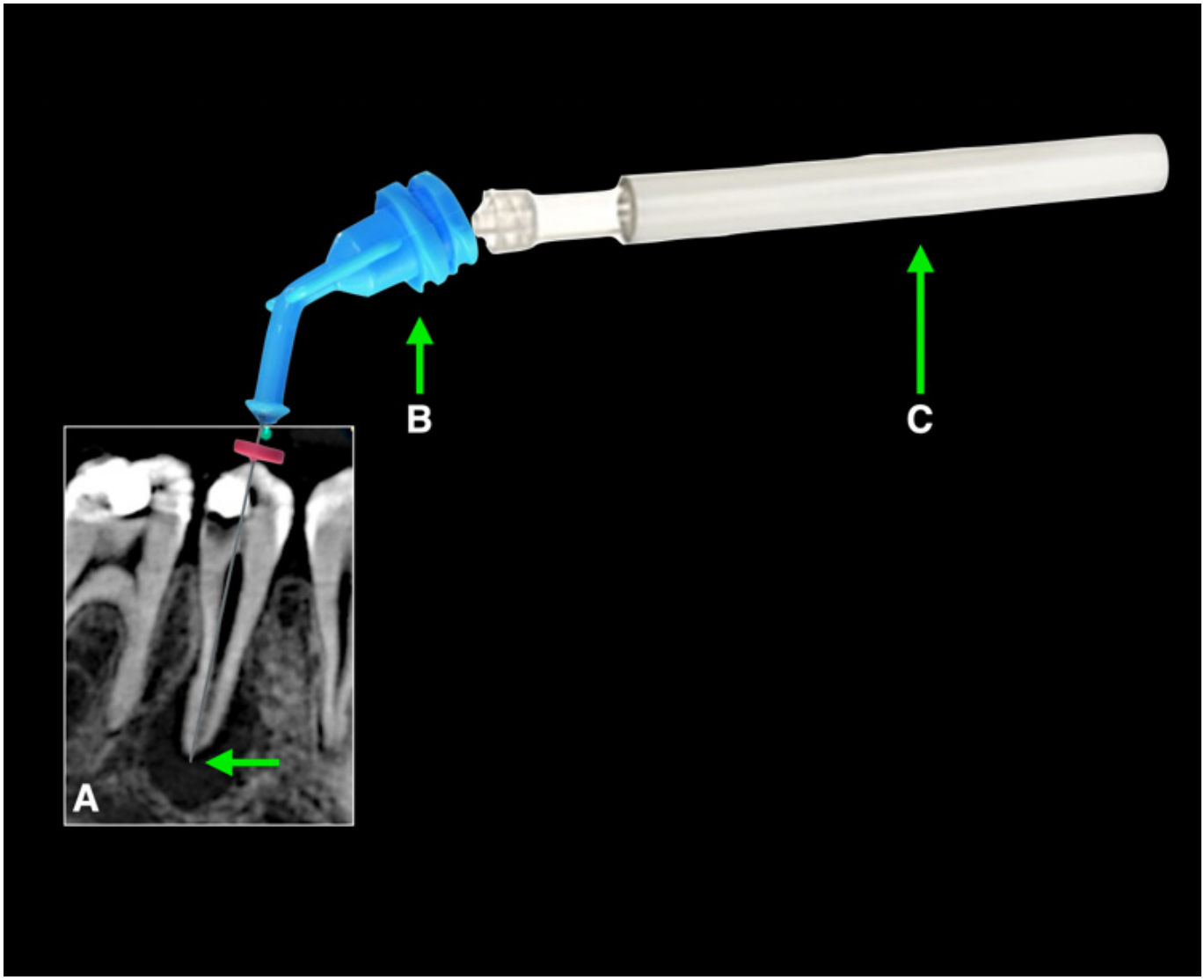

Figure 2
P.E.A.R.L. Technique:
A: Needle positioned beyond the apex,
B: Endodontic needle,
C: Luer vacuum adapter.

of the periapical exudate was initiated and maintained for approximately 20 minutes. Exudate flow was monitored visually through the transparent connector of the aspiration needle. Once no further exudate was observed, canal disinfection and cleaning protocols were initiated (Figure 2).

The canal was irrigated with 17% EDTA (Canal Pro, Coltene/Whaledent AG, Switzerland) for one minute to remove the smear layer, followed by a 5.25% NaOCl (Canal Pro, Coltene/Whaledent AG, Switzerland) rinse to inactivate any residual chelating agent. Final irrigation was carried out using the 3D Cleaning Technique, including controlled internal heating of sodium hypochlorite with a thermal plugger and a 20-second ultrasonic activation (13). This activation cycle was repeated three times, each with fresh NaOCl.

Following final irrigation, the canal was dried with sterile paper points (Coltene/Whaledent AG, Switzerland) and obturated using a single-cone gutta-percha (Coltene/Whaledent AG, Switzerland) technique with bioceramic sealer (Bioseal, Coltene/Whaledent AG, Switzerland). The tooth was then definitively restored with composite resin and a postoperative periapical

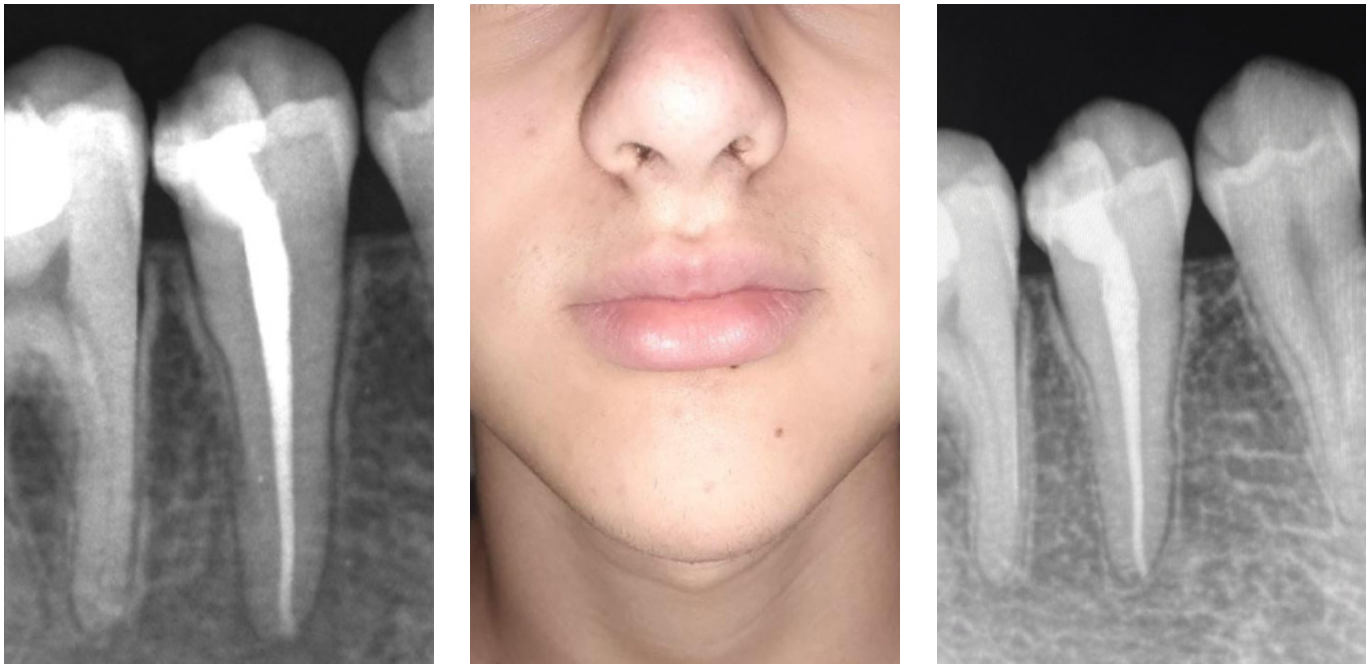

Figure 3
A: Postoperative radiograph
B: Absence of facial swelling after 36 hours
C: One-year follow-up radiograph showing periapical healing.

radiograph was obtained to confirm the quality of the obturation (Figure 3A). The patient reported a marked reduction in discomfort within hours of treatment. At 36 hours, the facial swelling had completely resolved (Figure 3B). At the 12-month follow-up, the patient remained asymptomatic, and radiographic evaluation demonstrated substantial periapical healing (Figure 3C).

Description of the P.E.A.R.L. Technique

The P.E.A.R.L. Technique (Periapical Exudate Aspiration via Root canal Lumen) is a conservative, nonsurgical approach designed to manage periapical abscesses and associated facial swelling by applying negative pressure within or just beyond the root canal system. This technique can be adapted to two primary clinical scenarios:

1. When purulent exudate is present within the root canal:

Negative-pressure aspiration is initially performed using a high-vacuum suction tip (e.g., Surgi Tip Endo) introduced into the canal. However, the procedure should also include aspiration beyond the apical foramen to ensure complete and effective drainage. A fine endodontic aspiration needle (Ø 0.28 mm or Ø 0.30 mm) is gently inserted slightly beyond the apex to evacuate any residual periapical exudate that has not yet entered the canal. During this phase, manual external massage of the swollen facial area is recommended to facilitate the directional flow of the exudate toward the apical foramen, enhancing the efficacy of suction.

2. When the canal appears dry, but facial swelling is evident:

Apical patency is confirmed, and the foramen is enlarged—typically to at least size 30 with a 0.04 taper. A fine suction needle (Ø 0.28 mm or Ø 0.30 mm) is then advanced slightly beyond the apex and connected to high-vacuum suction. Negative-pressure drainage is applied while simultaneously massaging the extraoral swollen region to mobilize trapped exudate and promote its evacuation through the apical path-

way. This technique eliminates the need for surgical incision and systemic antibiotics in both scenarios, facilitates effective canal drying, and enables definitive root canal obturation in a single visit. The addition of external facial massage serves as a mechanical aid to promote fluid mobilization and optimize drainage, especially in cases of soft-tissue accumulation and limited canal exudate flow.

Discussion

Endodontic therapy remains the cornerstone of conservative dental treatment aimed at preserving natural dentition in the presence of irreversible pulpal damage or periapical pathology (14). The primary goal is to eliminate intracanal infection and prevent reinfection using thorough biomechanical debridement, disinfection, and three-dimensional obturation of the root canal system (15,16). When executed correctly, these procedures demonstrate high success rates (17). Nevertheless, treatment failures still occur due to anatomical complexities, missed canals, biofilm persistence, or procedural deficiencies such as inadequate irrigation or incomplete obturation (18).
In cases where primary root canal therapy fails, retreatment becomes necessary. Nonsurgical orthograde retreatment is typically the first choice and can effectively resolve persistent periapical inflammation or infection, provided the canal system can be fully re-instrumented and disinfected (19). Surgical intervention may be required in more complex cases, although this introduces higher morbidity and patient discomfort (20).
One of the most critical complications of untreated or unsuccessfully managed necrotic pulps is the development of periapical lesions (5). These lesions vary from chronic granulomas or cysts to acute apical abscesses characterized by suppurative inflammation (21, 22). Acute abscesses may rapidly expand into adjacent fascial planes, leading to localized or diffuse facial swelling, a clinical situation requiring prompt attention due to the risk of systemic involvement and compromised airway function (23).
Standard clinical protocols for managing facial swelling secondary to periapical infection often include systemic antibiotic therapy to control infection and reduce inflammation before proceeding with definitive endodontic treatment (9). Surgical incision and drainage are also performed in severe cases to evacuate purulent exudate (9). While these measures are generally effective, they are not without drawbacks (10,11). Systemic antibiotics, although essential in certain medical risk categories (such as patients with cardiac conditions, endocarditis history, or prosthetic heart valves), are often overprescribed in otherwise healthy individuals (24). This practice contributes to the global crisis of antibiotic resistance (9). Furthermore, incision and drainage can result in postoperative scarring, increased patient morbidity, and psychological discomfort (11, 12).
In this context, the P.E.A.R.L. Technique (Periapical Exudate Aspiration via Root Canal Lumen) offers a novel, minimally invasive alternative. By enabling the drainage of periapical exudate directly through the root canal using negative pressure, either within the canal or just beyond the apical foramen this technique addresses the pathophysiological cause of facial swelling without needing systemic pharmacologic or surgical intervention.

The advantages of the P.E.A.R.L. Technique are significant

Avoidance of surgical incision: The technique allows for the evacuation of exudate without soft tissue trauma, reducing the risk of postoperative scarring and improving patient comfort.
No preoperative antibiotic therapy is required. In healthy patients, eliminating the infection source through me-

chanical and negative-pressure drainage may be sufficient to resolve the inflammatory response.
Single-visit treatment: By achieving effective drainage and allowing thorough drying of the canal system, definitive endodontic therapy can be completed in the same session, streamlining clinical workflow and improving patient compliance.
Precise and conservative approach: The use of fine endodontic aspiration needles beyond the apex allows targeted intervention without compromising periapical tissues or anatomical structures.
Clinical efficiency: As demonstrated in the presented case, facial swelling resolved within 36 hours, and long-term radiographic follow-up confirmed periapical healing, highlighting the therapeutic potential of this protocol.
However, it is important to underline that antibiotic therapy remains essential for certain patient populations. These include children with systemic involvement, immunocompromised individuals, elderly patients with cardiac comorbidities, and those at risk for infective endocarditis. Antibiotic prophylaxis or adjunctive therapy must be considered according to current clinical guidelines in these scenarios.
Nevertheless, for otherwise healthy patients presenting with localized abscesses and extraoral swelling, the P.E.A.R.L. Technique may offer a safer, faster, and more comfortable alternative to traditional protocols.
The routine prescription of systemic antibiotics for the management of endodontic infections particularly those without signs of systemic involvement has been extensively debated in the endodontic literature (24). Current evidence-based guidelines emphasize that antibiotics do not significantly contribute to pain relief or the resolution of swelling in cases of localized apical pathosis in otherwise healthy patients (24). Systematic reviews have concluded that antibiotic therapy should not be prescribed solely for symptomatic irreversible pulpitis or localized acute apical abscesses unless systemic symptoms are present (25, 26).
A Cochrane review found no significant benefit of antibiotics in reducing pain in irreversible pulpitis (25). Similar conclusions were drawn by Matthews et al. and Aminoshariae & Kulild (27, 28), who emphasized that systemic infection, fever, or compromised immunity are prerequisites for considering antibiotic use. In practice, this means that most endodontic infections, particularly those with localized swelling or drainage should be managed through mechanical means alone, such as drainage, debridement, and disinfection of the root canal system (24).
The overprescription of antibiotics, particularly in dental settings, contributes to the alarming rise in antimicrobial resistance, a concern recognized globally by health authorities (10). Dental and endodontic infections are typically polymicrobial and often managed empirically, which may lead to the indiscriminate use of broad-spectrum antibiotics even when not clinically indicated (24). This misuse exposes patients to unnecessary side effects and contributes to developing resistant strains within the oral microbiome (10).
In the context of localized odontogenic infections without systemic signs, the primary therapeutic goal should be the mechanical removal or drainage of the infectious source (24). The P.E.A.R.L. technique enables direct periapical exudate aspiration via the root canal and addresses this condition efficiently and conservatively. As demonstrated in the presented case, the technique permitted complete drainage and resolution of swelling without systemic pharmacologic intervention.
However, it is crucial to recognize the patient groups in whom systemic antibiotic therapy remains essential. Immunocompromised individuals, pediatric patients, elderly individuals with chronic conditions, and patients with specific cardiovascular risks (e.g., pros-

thetic heart valves, history of infective endocarditis, recent joint prostheses) may require prophylactic or adjunctive antibiotics to prevent systemic complications (24). The clinician must follow current medical guidelines to determine the appropriate regimen. First-line options often include amoxicillin alone or with clavulanic acid due to its effective absorption and favourable safety profile (24). In patients with a confirmed penicillin allergy, clindamycin remains the antibiotic of choice (24). In summary, antibiotics should be reserved for cases where the infection is not self-limited, there is systemic spread, or when host defences are compromised. The P.E.A.R.L. Technique reinforces this therapeutic philosophy by offering an evidence-based, mechanical alternative to pharmacologic overreliance, consistent with modern principles of antimicrobial stewardship and patient-centred care. Recent perspectives in endodontics are progressively embracing regenerative and non-obturation-based concepts for managing apical pathosis, highlighting the evolving understanding of apical healing mechanisms (29)
Further research, including larger case series and controlled studies, is warranted to assess this approach's reproducibility and standardize clinical parameters such as aspiration duration, apical diameter preparation, and suction device specifications.

Conclusions

The P.E.A.R.L. Technique (Periapical Exudate Aspiration via Root canal Lumen) represents a significant step forward in the conservative management of acute periapical abscesses with facial swelling. This minimally invasive protocol enables rapid symptom resolution, reduces or eliminates the need for antibiotics and surgical intervention, and allows for single-visit endodontic treatment in appropriately selected patients. As antibiotic stewardship and patient-centred care gain increasing importance in clinical practice, the P.E.A.R.L. Technique may offer a valuable addition to the therapeutic arsenal of modern endodontics.

Conflict of interest
The authors declare no conflicts of interest related to the materials, methods, or findings presented in this case report.

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