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Persistent Periapical Pathology and Migraine Symptoms: Periradicular Surgery of a Radicular Cyst

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ABSTRACT

This case report describes a rare presentation of a large periapical lesion, suspected to be a radicular cyst, associated with a previously treated maxillary central incisor. The lesion impinged upon the incisive foramen, and the patient presented with persistent pain and worsening migraine episodes unresponsive to pharmacological management. Surgical management of the lesion resulted in significant symptom resolution. This case highlights the need for dental professionals to consider odontogenic sources of chronic facial pain and emphasizes the importance of anatomical relationships in interpreting unusual orofacial symptomatology.

INTRODUCTION

Persistent periapical pathology can be challenging to manage, especially when non-surgical retreatment fails to resolve the infection. This may be caused by factors such as biofilms on the root surface, extraradicular infections, true cysts, or foreign body reactions conditions that often do not respond to non-surgical retreatment (Nair, 2004; Rajesh et al., 2024; Ricucci et al., 2009). These cases may lead to chronic inflammation and require further intervention.

Although the periapical pathology of teeth is well documented in endodontic literature, its potential neurological consequences are underreported. In particular, the clinical implications of lesion-induced irritation to the nasopalatine nerve, especially in cases where pain symptoms mimic neuropathic or

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neurovascular disorders, remain poorly understood. Moreover, while migraine is recognized as a complex neurovascular condition triggered by central and peripheral sensitization mechanisms, there is growing interest in the contribution of chronic peripheral inflammation to migraine pathogenesis (Burstein et al., 2015). Some evidence suggests that persistent odontogenic inflammation may act as a peripheral trigger for the trigeminovascular system, potentially exacerbating or sustaining migraine episodes (Mohammed et al., 2023).

However, despite these theoretical associations, there is a notable lack of clinical reports directly linking radicular cyst impinging on the incisive foramen contributes to persistent pain and worsening migraine, with resolution of symptoms following endodontic surgical intervention. This represents a critical gap in both endodontic and orofacial pain literature, especially given the implications for interdisciplinary diagnosis and management.

CASE REPORT

A 30-year-old Malay lady with ongoing migraine attack was referred to the Endodontic Postgraduate clinic, University Teknologi MARA, for the management of tooth 21 with previously treated; symptomatic apical periodontitis associated with extruded gutta percha (GP). Informed patient consent was obtained prior to proceed with further management. The patient was diagnosed with primary headache (migraine) in July 2022 by the Neurology Department at Hospital Puncak Alam. Current medications included celecoxib 200 mg BD, pantoprazole 40 mg OD, amitriptyline hydrochloride 10 mg OD, sumatriptan succinate 50 mg PRN, and ibuprofen 400 mg PRN. No other systemic illnesses or allergies were reported.

Intraoral examination revealed tooth 21 is tender to percussion with visual analog scale (VAS) of (7/10), apical palpation is tender, no swelling or mobility, normal probing depths, and no periodontal pocket. Pulp sensibility investigation was done on the adjacent teeth (11 and 22) and showed vital and asymptomatic teeth. For the radiographic (Ezy Ray Wall, Vatech, America) and CBCT (CS 8200 3D Access, Carestream DLL, Atlanta) findings of tooth 21 in Fig. 1(a), there is extruded GP and a well-defined periapical radiolucency (10mm x 11mm). Buccal and palatal cortical plates are intact, and lesion is extended into the region of the nasopalatine canal as seen in Fig. 1(b) and Fig. 1(c).

Non-surgical retreatment was selected to manage this case. Under dental dam isolation and dental operating microscope (DOM) (AM-5000, Alltion, Guangxi Province, China), access was gained to tooth 21. The root filling was removed using Hedstroem (H-files) (Dentsply Maillefer, Ballaigues, Switzerland) and GP solvent (Nishika, Yamaguchi, Japan). Canal was shaped up to apical size #40 using F4 Protaper Gold (Dentsply Maillefer, Ballaigues, Switzerland). Canal was irrigated with 3% NaOCl (Coltene, Alt, Switzerland) and medicated with non-setting calcium hydroxide, $Ca(OH)_2$ (UltraCal™ XS, Ultradent, South Jordan). A flare-up occurred after 8 hours of post-treatment with severe throbbing pain with VAS (10/10), swelling sensation, and neurological symptoms including lip numbness, tingling near nostril area and radiating discomfort. In addition, the symptoms increased the frequency and intensity of the migraine. Management after one day post-op, included re-irrigation of 5 ml of 3% NaOCl with Endoactivator (Dentsply Sirona, United States) followed by 5 ml of 17% Ethylene diamine tetraacetic acid (EDTA) (Pulpdent, MA, USA), 5 ml saline (RinsCap Ain Medicare, Malaysia), 5 ml of 2% chlorhexidine (CHX) (RinsCap Ain Medicare, Malaysia), and placement of Odontopaste (Australian Dental Manufacturing, Kenmore Hills, QLD, Australia). Odontopaste contains clindamycin hydrochloride, a broad-spectrum antibiotic, and triamcinolone acetonide, a steroid anti-inflammatory agent, along with calcium hydroxide, which is recommended for post-op pain and to reduce inflammation. Patient was also prescribed with antibiotic and analgesics: Amoxicillin/clavulanic acid 625 mg BD, Diclofenac sodium 50 mg TDS, Paracetamol 1000 mg QID PRN. Despite treatment, after 1-week review, persistent symptoms remained with VAS (5/10) and still exacerbate the migraine attacks. Therefore, obturation was proceed using warm

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vertical compaction technique with bioceramic sealer (Angelus Bio-C sealer, Brazil) and plan for periradicular surgery. Final coronal restoration placed with smart dentine replacement (SDR) (Dentsply, UK) and composite resin shade A3 (3M ESPE Filtek Z350, USA). Post obturation radiograph and pre-surgical radiograph is shown in Fig. 1(d).

Review after 3 weeks obturation demonstrated persistent symptoms remained with intermittent throbbing pain and migraine episodes continued with VAS of (6/10). Surgical intervention was planned and executed 2 days after review. The surgical procedure was as follows: Local anaesthetic with articaine 1:100,000 (Septanest, Septodont, France) administered. The papilla base flap design was selected for soft tissue management as the tooth involved an aesthetically important region. A papilla-based flap conserves interdental papilla height (Velvart, 2002). Full-thickness flap raised involving teeth 11, 21, and 22 as shown in Fig. 2(a). Osteotomy and enucleation of granulation tissue can be seen in Fig. 2(b) and 2(c) and submission for histopathology. Apicoectomy (3.0 mm) was performed to eliminate most apical ramifications and lateral canals (Kim & Kratchman, 2006). Methylene blue staining confirmed absence of cracks (Kim & Kratchman, 2006). Diamond-coated ultrasonic tip was used to do retro-preparation (3.0 mm) as in Fig. 2(d). Retrograde filling with mineral trioxide aggregate (MTA) (Dentsply Sirona, Tulsa, Oklahoma USA) is placed, Fig. 2(e). Flap repositioned and sutured using (Vicryl 5-0), Fig. 2(f). Post surgical instruction and appointment for follow up review was given. Radiograph of post-radicular surgery is shown in Fig. 1(e).

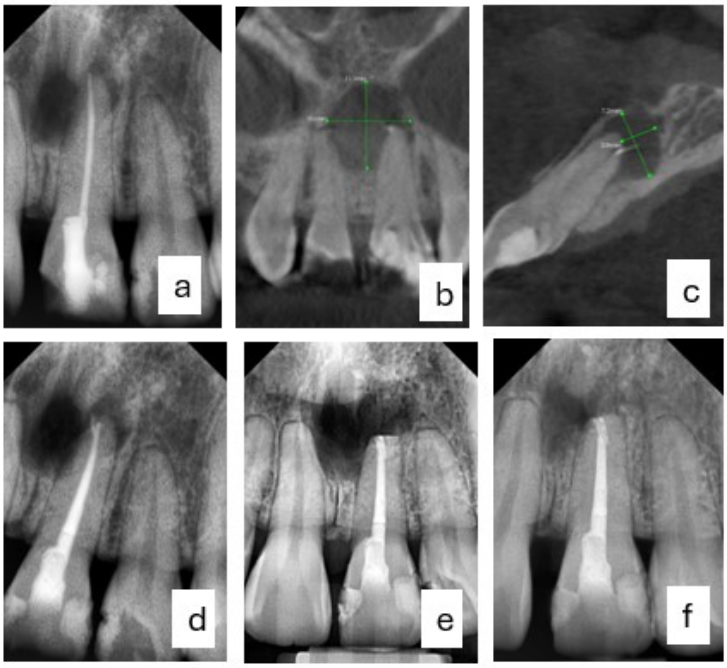

Fig. 1. (a) Pre-operative radiograph of tooth 21 (b) CBCT tooth 21 (frontal view) (c) CBCT tooth 21 sagittal view (d) Post-obturation after retreatment/pre-op periradicular surgery (d) post-periradicular surgery (e) review after 1 year.

Follow-up review after one week, reported significant symptomatic improvement post-surgery. Throbbing pain, swelling sensation and tingling effect ceased, and no further triggering migraine episodes were reported. Histopathological observation revealed multiple strips of fibrous cyst wall with patchy mixed inflammatory infiltrate, lined in parts by non-keratinising stratified squamous epithelium thus

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diagnosed as Radicular cyst. Tooth 21 remained asymptomatic on clinical evaluation and radiograph revealed resolution of periapical lesion after 12 months follow-up, Fig. 1(f).

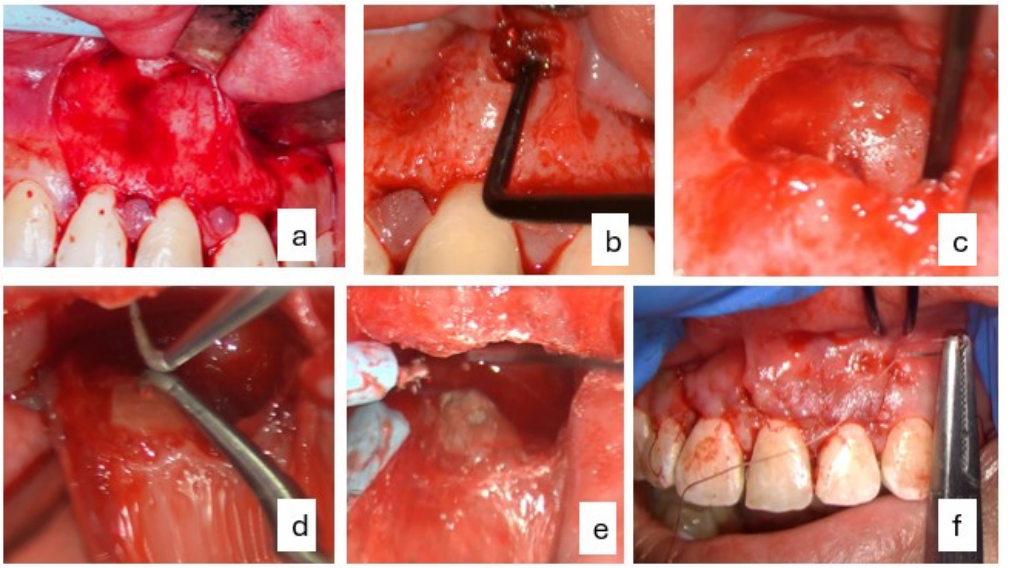

Fig. 2 (a) Interdental papilla flap raised (b) Enucleation of granulation tissue and visible of remnant extruded GP embedded in granulation tissue (c) Osteotomy and post-enucleation of granulation tissue (d) Retro-preparation with diamond ultrasonic tip after apicoectomy (e) MTA placement (f) Closure and suture.

DISCUSSION

In this case report, retreatment of tooth 21 did not resolve the pain, however, contributed to increased frequency and pulsating migraine symptoms. Migraine is a primary headache disorder, in most cases episodic, that usually lasts 4–72 hours (Mier & Dhadwal, 2018). Attacks typically include headache, which is of moderate or severe intensity, one-sided or behind the eye, pulsating in quality, sensitivity to light and sounds, and nausea (Mier & Dhadwal, 2018). Pharmacological management of migraine typically includes abortive therapies such as triptans and non-steroidal anti-inflammatory drugs, as well as preventive agents including tricyclic antidepressants (Goadsby et al., 2017). However, persistent nociceptive input from dental pathology may reduce the effectiveness of these therapies by maintaining a sensitised trigeminovascular system (Goadsby et al., 2017; Nair, 2006). Therefore, the persistent symptoms resulting from the treated teeth, which exacerbate migraine episodes, impact the daily activities of the patient. Thus, timely and appropriate treatment is necessary.

When persistent symptoms persist after nonsurgical retreatment of previously treated teeth, treatment options may include periradicular surgery or tooth extraction. As recent retreatment failed to resolve symptoms, periradicular surgery was selected to address persistent symptoms, potentially linked to dental-related headache/migraine, and to conduct a biopsy for confirmation of any extra-radicular infection or to remove suspected cyst impinging nerve. In our case, the location of periapical lesion is near the incisive foramen.

The incisive foramen is a critical anatomical structure that transmits the nasopalatine nerve and accompanying vessels. The nasopalatine nerve, a branch of the maxillary division of the trigeminal nerve (V2), is responsible for sensory innervation of the anterior palatal mucosa (Langford, 1989) Lesions arising

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in this region, particularly radicular cysts associated with maxillary central incisors, may exert pressure on or irritate the nasopalatine nerve, resulting in atypical or poorly localised pain (Malick & Burstein, 2000; Nair, 2006). This neural involvement may contribute to referred orofacial pain and potentially exacerbate non-odontogenic conditions such as migraine (Goadsby et al., 2017). Furthermore, the close anatomical relationship between the apices of maxillary central incisors and the incisive canal increases the likelihood of neural irritation in the presence of periapical pathology (Patel et al., 2014). Failure to recognise involvement of the incisive foramen may lead to persistence of symptoms despite appropriate endodontic treatment. Therefore, careful radiographic assessment, particularly using cone beam computed tomography (CBCT), is essential to evaluate the extent of lesions and their relationship to adjacent neurovascular structures, facilitating accurate diagnosis and surgical planning (Patel et al., 2014).

The principles of endodontic surgery include preoperative assessment and planning, achieving adequate anaesthesia and haemostasis, appropriate surgical access through overlying soft and hard tissues, periapical curettage with root end preparation, wound closure, and postoperative management of the local surgical site. Evidence showed that each surgical procedure step influences the outcome of periradicular surgery (Kim & Kratchman, 2006; Setzer et al., 2012). Therefore, cone beam computed tomography (CBCT) is essential for pre-surgical assessment to provide three-dimensional imaging (3D), which helps identify the anatomical relationship of the root apices to neighbouring structures (Manjushree & Prasad, 2021), such as large periapical lesions located at the incisive papilla.

A meta-analysis study revealed that micro-endodontic surgery with a dental operating microscope (DOM) and ultrasonic instrument showed a 94% success rate (Setzer et al., 2012). It is believed that micro-endodontic surgery produces predictable outcomes. The prognosis of the current case is good as it falls under class C surgical classification (Kim & Kratchman, 2006), which represents the presence of a large periapical lesion without periodontal pocketing together with clinical symptoms.

Histopathological examination confirmed the presence of a radicular cyst. Persistent apical pathology represents a chronic inflammatory condition capable of generating continuous peripheral nociceptive input through activation of trigeminal afferents. Microbial biofilms and their by-products stimulate the release of pro-inflammatory mediators, including tumour necrosis factor-α (TNF-α), interleukin-1β (IL-1β), and interleukin-6 (IL-6), which sensitise peripheral nociceptors and amplify pain signalling (Nair, 2006; Watkins et al., 2001). This sustained nociceptive drive may contribute to activation of the trigeminovascular system, a key pathway in migraine pathophysiology (Goadsby et al., 2017).

Mechanical compression or irritation of the nasopalatine nerve by the cyst may have contributed to peripheral sensitisation, thereby worsening the migraine symptoms (Malick & Burstein, 2000). Persistent nociceptive input may also induce central sensitisation, characterised by hyperexcitability of second-order neurons within the spinal trigeminal nucleus, resulting in amplification and spread of pain beyond the initial site (Dodick, 2018; Woolf, 2011). This neurophysiological cascade may explain the patient's heightened migraine severity linked to the radicular cyst.

Surgical intervention, specifically apicoectomy and cyst enucleation, eliminated the peripheral source of inflammation and neural irritation. This resulted in a significant reduction in throbbing pain, numbness, and tingling effect on the affected tooth. Furthermore, a reduction on the migraine frequency and intensity, supporting the role of odontogenic lesions as peripheral triggers in susceptible individuals (Tsesis et al., 2013). This case underscores the importance of including dental pathology in the differential diagnosis of refractory or atypical headache presentations, particularly when involving anatomical regions innervated by the trigeminal nerve

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CONCLUSION

Persistent symptomatic apical periodontitis, especially with large periapical lesions and extraradicular components, may exacerbate neurological symptoms such as migraine. Accurate diagnosis, appropriate imaging, and tailored endodontic and surgical approaches are essential for resolution. Multidisciplinary management ensures comprehensive care, particularly in cases where odontogenic pain may mimic or trigger systemic neurological conditions.

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CONFLICT OF INTEREST STATEMENT

The authors agree there is no conflict of interest in this case report.

AUTHORS' CONTRIBUTIONS

Wan Nur Farhana Wan Abdul Rahman carried out this case report, wrote and revised the article. Afzan Adilah Ayoub provided the theoretical framework and supervised clinical progress, and Nurulaqmar Iwani revised the article. Wan Nur Farhana Wan Abdul Rahman anchored the review, revisions and approved the article submission.

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