International Endodontic Journal

CASE REPORT

The Use of a Novel 3D Printed Surgical Decompression Device to Induce Healing of Large Periapical Lesions: A Case Report

Yogesh Patel | Nahal Razaghi | Mitul Patel | Mital Patel

Restorative Department, Barts Health NHS Trust, London, UK

Correspondence: Yogesh Patel (y.patel9@nhs.net)

Received: 8 July 2025 | **Revised:** 23 September 2025 | **Accepted:** 3 October 2025

Funding: The authors received no specific funding for this work.

Keywords: CAD/CAM | cyst | decompression | endodontic surgery

ABSTRACT

Aim: A case report to describe the use of a novel 3D printed surgical decompression device to induce healing of large periapical lesions.

Summary: The development of periapical pathology is influenced by a variety of factors including local microbiology and pathophysiology. In large lesions, lone orthograde endodontic treatment is often insufficient in promoting healing of the periapical tissues and therefore is followed by apical surgery to reduce inflammation. While traditional surgical treatments often involve enucleation for cystic lesions, decompression techniques have shown to provide a less invasive alternative when combined with non-surgical and/or surgical endodontic treatment.

The case presented here is a 21-year-old male with a large periapical lesion involving a root canal-treated right maxillary central incisor and nasopalatine canal; extending from the maxillary right lateral incisor to the maxillary left central incisor and having perforated buccal and lingual cortical plates. Clinically, the patient reported an associated fluctuant, non-tender buccal swelling. CBCT confirmed a well-condensed root canal filling; hence, it was decided to first treat the lesion conservatively using only the surgical decompression technique. Following a discussion about treatment options, the patient consented to surgical decompression. CBCT imaging alongside digital software was used to fabricate a customised decompression device that was sutured in situ for 4 weeks. Nine months following the removal of the device, CBCT showed evidence of osseous deposition, with a significant reduction of the periapical radiolucency and separation from the nasopalatine canal, thus portraying the use of decompression in its own right as a treatment option.

Surgical decompression is not a novel technique, and the literature describes the use of various dental equipment such as suction tubing, needle hub, or dental dam material to facilitate decompression of a lesion. These devices have, however, shown to cause irritation, discomfort, and instability and are therefore not always effective in inducing healing. This case report describes the use of a novel digital workflow to fabricate a customised decompression device in the management of a large periapical lesion. The reduction of intra-cystic pressure alongside active irrigation reduced inflammatory compounds, contributing to a reduction in the lesion size and promoting osseous healing.

1 | Introduction

Microorganisms, either primarily or secondarily, induce apical lesions. Apical lesions act as barriers to prevent the spread of microorganisms into the surrounding tissues. The majority of these lesions can be categorised as dental granulomas, cysts, or abscesses (Karamifar et al. 2020). The development of an inflammatory cyst, such as a radicular cyst, within an apical periodontitis lesion is dependent on a complex inter-relation between otherwise independent factors, including the local microbiology, pathophysiology, and epithelium-stromal interactions. Literature suggests that around half of all apical lesions are epithelialized; however, less than 20% of these are cystic (Nair et al. 2008). Without a biopsy, clinical and radiographic examinations are unable to definitively diagnose these lesions; nevertheless, differentiation is important in evaluating treatment options.

In cases where these lesions are large, orthograde endodontic treatment is often combined with apical surgery to facilitate a reduction in inflammation which promotes healing of the periapical tissues. Apical surgery, which involves surgical removal of the lesion, generally has a high success rate, but the surgery can be complicated by the size of the lesion and the anatomical structures involved. In many cases, the lesion can present with perforated buccal and palatal/lingual bone, involvement of vital structures such as the nasopalatine canal, and thinning/perforation of the bone between the nasal cavity and the lesion. These large lesions can be difficult to manage and can result in unwanted complications. Decompression techniques have shown to be a less invasive treatment option or can be used in combination with retrograde endodontic treatment to reduce the extent and/or complexity of apical surgery, thereby reducing associated risks and unwanted post-operative complications.

Decompression aims at reducing intra-lesional pressure and therefore allows healing to take place. On the other hand, marsupialisation refers to the creation of a stoma, establishing an opening for the lesion to drain and facilitating pressure reduction within it without using a device. Although the terms are often used interchangeably within the literature, marsupialisation is a means by which one can decompress a lesion (Pogrel and Jordan 2004). Several articles have reported either decompression or marsupialisation as treatment modalities for periapical lesions.

Decompression as a technique is not a novel concept and there are several case reports in the literature documenting this as a successful technique (Neaverth and Burg 1982). However, in these reports, there is no consensus on the decompression devices, and various pieces of dental equipment such as suction tubing, dental dam material, or nasopharyngeal airway tubes have been used to decompress lesions (Patterson 1964; Tian et al. 2019). In order to facilitate structural changes within the lesion, decompression requires the cavity to remain patent. One relatively straightforward technique to ensure this is the use of 3.0 silk sutures to secure a nasopharyngeal airway tube to the mucosa. However, it has been shown to cause significant irritation, instability, and discomfort to the patient. Another technique involves the use of stainless-steel wires to fix the tube to the adjacent teeth. Although this reduces soft tissue trauma, it would be unsuitable for edentulous patients and there is a risk of the device being dislodged or displaced (Liu et al. 2024). In the literature, there is no perfect decompression device that has been described so far. The ideal properties desired in a decompression device are outlined in Table 1.

Recently, Kivovics et al. (2022) proposed the use of a custom-made removable dental supported cyst plug which introduced the use of a digital workflow for their cases; however, the device they used still had the drawback of requiring tooth support and possible disruption of the occlusion (Kivovics et al. 2022). Through the use of modern technologies and a digital workflow, we aimed to create a custom-made patient-specific decompression device which would incorporate many of the ideal properties outlined in Table 1 and easily facilitate the reduction of intra-lesional pressure. In doing so, we anticipated that there would be a reduction in inflammatory mediators and promotion of healing. This report describes the use of a digital computer-aided design and computer-aided manufacturing (CAD/CAM) technology in the design and manufacture of a dedicated decompression device that could be easily sutured in situ and would permit easy irrigation, something the currently described items used for decompression struggle with.

The patient provided valid, informed consent for all treatment and for the case to be described in a scientific publication for educational and research purposes, including clinical photographs, radiographs, and other diagnostic images.

2 | Report

This case report has been written according to Preferred Reporting Items for Case reports in Endodontics (PRICE) 2020 guidelines.

A 21-year-old male was seen following a road traffic accident occurring in September 2019 that resulted in a lateral luxation injury of the maxillary right central incisor (Tooth #8). The patient had no relevant medical history, allergies, or current medications. Endodontic treatment was carried out on the maxillary right central incisor (Tooth #8) over two appointments in October 2020.

TABLE 1 | A table to describe the ideal properties of a custom-made decompression device (Liu et al. 2024).

Biocompatible
Prevents clot formation
Can be sutured in place
Moderate stiffness
Large lumen to facilitate drainage
Radio-opaque
Sterilisable
Maintains patent opening to lesion
Not easily dislodged/displaced

Sixteen months later, the patient presented with a fluctuant, non-tender buccal swelling associated with the tooth. CBCT of the concerned region confirmed a well-condensed root canal filling in the maxillary right central incisor, associated with a moderately defined, unilocular radiolucency extending from the maxillary right lateral incisor (Tooth #7) to the maxillary left central incisor (Tooth #9). The lesion also involved the nasopalatine canal with evidence of buccal and palatal cortical plate dehiscence (Figures 1 and 2). It was decided to treat the lesion conservatively using only a surgical decompression technique without attempting a root canal re-treatment in the previously treated maxillary central incisor as the tooth appeared to be well obturated. Following a discussion about other treatment options like apical surgery, the patient consented to surgical decompression.

The raw data from CBCT was segmented and used in conjunction with Netfabb software (Autodesk Inc.) to design a decompression device to the ideal proportions required to facilitate decompression of the lesion (Figure 3). The decompression site was identified from the CBCT, and an intra-oral scan was layered over CBCT imaging, providing soft tissue landmarks. A soft acrylic device was 3D printed using Straumann p Pro gingiva masks (Straumann Group) with three through-and-through tags to facilitate suturing. The design of the base of the device was round to reduce irritation to the mucosa, and the lumen itself was large enough to allow passive insertion of an irrigation tube. This was then converted into STL format for 3D printing.

A 4 mm vertical incision was made into the area to access the site, and the soft acrylic device was placed into the lesion and sutured in place (Figure 4a,b). The lesion was irrigated with saline (0.9% sodium chloride) through the device lumen, and the patient was given post-operative instructions alongside an irrigation protocol (Figure 4c). The protocol included demonstrating the irrigation technique using a saline-filled syringe. The patient received hands-on instructions and was instructed to perform irrigation three times daily using a full syringe of saline solution on each occasion. The patient reported some discomfort from the area for 2 days post-operatively; however, the device remained stable throughout the treatment period, with no further discomfort affecting daily activities, nor any episodes of displacement.

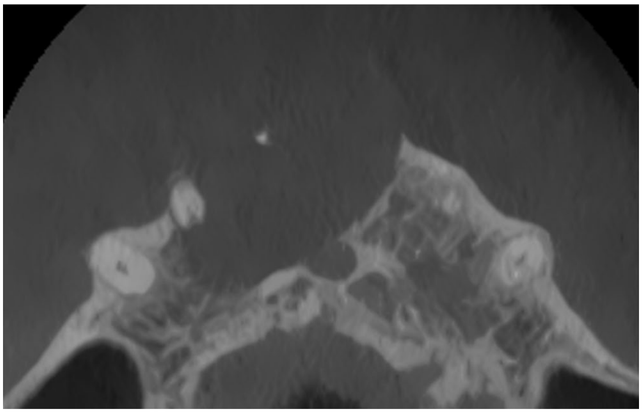

FIGURE 1 | Axial slice of CBCT of Tooth #8 showing unilocular radiolucency extending from Teeth #7 to #9 prior to decompression.

The device was removed after 4 weeks, and a periapical radiograph showed evidence of reduction in the size of the periapical radiolucency alongside osseous healing (Figure 5). The patient was reviewed at one, four, and 9 months post-operatively. At 9 months, a CBCT showed osseous deposition. The radiolucency had significantly reduced in size compared to previous radiographs. Furthermore, the radiolucency had separated from the maxillary right lateral incisor (Tooth #7) and maxillary left central incisor (Tooth #9) as well as the nasopalatine canal (Figures 6–8). Upon review, the mucosa appeared to have healed well, with no evidence of ulceration or discomfort (Figure 9).

3 | Discussion

Surgical decompression in the management of large periapical lesions is often used as an adjunct modality to endodontic treatment and/or surgical interventions such as enucleation. It is thought that the reduction in intra-lesional pressure through decompression helps lower the inflammatory infiltrate, thereby favouring osseous repair. Rodrigues et al. (2017), concluded

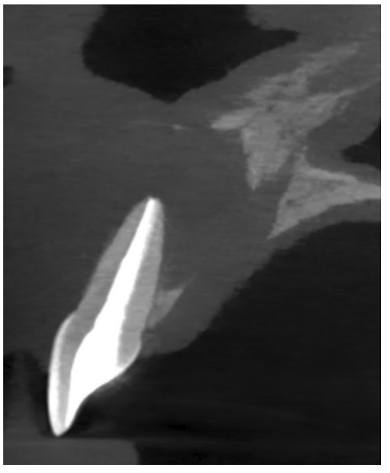

FIGURE 2 | Sagittal slice of CBCT of Tooth #8 showing buccal and palatal cortical dehiscence prior to decompression.

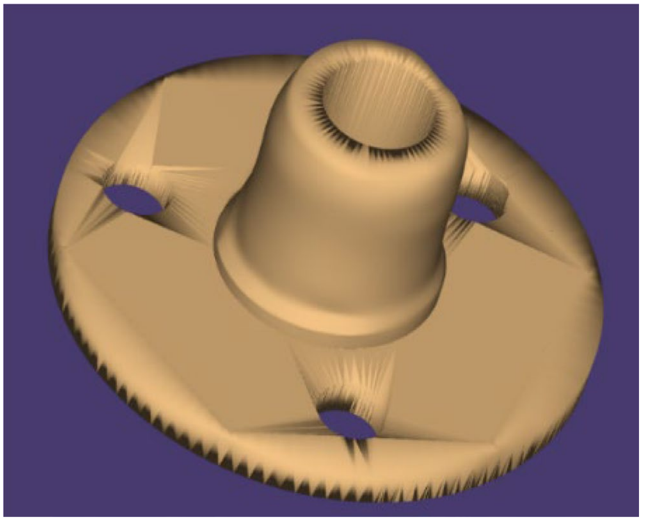

FIGURE 3 | STL file of custom decompression device used with through-and-through tags and round base.

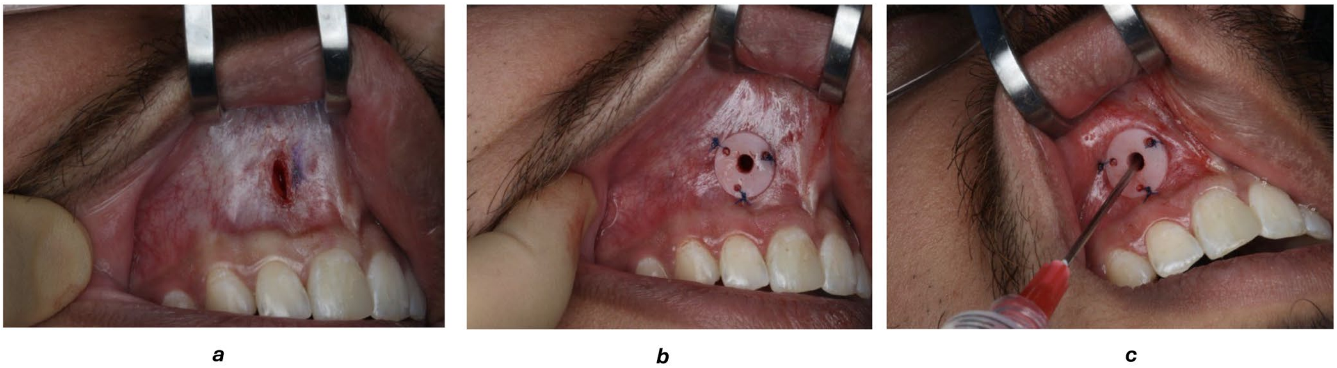

FIGURE 4 | (a) Clinical photograph of vertical incision into lesion. (b) Clinical photograph of custom decompression device sutured in situ. (c) Clinical photograph of irrigation into lesion using saline.

FIGURE 5 | Periapical radiograph taken following 4 weeks of decompression.

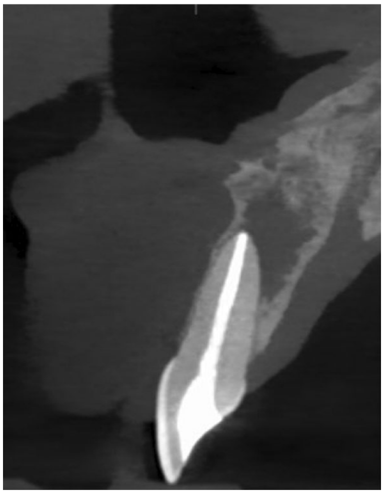

FIGURE 6 | Sagittal slice of CBCT of Tooth #8 9 months after decompression device removed showing osseous deposition and reduction in size of radiolucency.

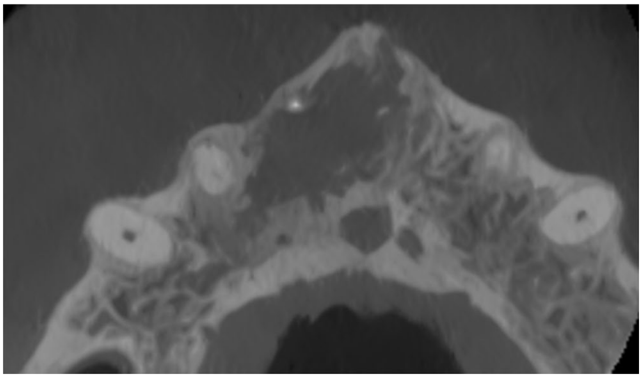

FIGURE 7 | Axial slice of CBCT of Tooth #8 9 months after decompression device removed showing radiolucency separating from Teeth #7 and #9.

from their study that surgical decompression was quite effective in reducing the volume of the lesion, while immunohistochemical analyses showed that immune expression of inflammatory tissue repair and proliferative biomarkers was similar before and after decompression and when compared to enucleation. Decompression, therefore, may create an immunological environment that is conducive to healing of the site and may be successful in treating large periapical lesions when concurrent with endodontic treatment (Rodrigues et al. 2017). Furthermore, removal of intra-lesional fluids through decompression can prevent them from weeping into the root canal system, allowing the root canal system to be dried and obturated, which are key determinants of the success of the root canal treatment (Cho and Jung 2019). Decompression additionally helps overcome the increased risk of undesirable complications such as devitalised teeth, patient discomfort, loss of bony support, damage to critical anatomic structures, and paraesthesia associated with enucleation procedures in extensive periapical lesions (Bernardi et al. 2015).

A systematic review by Silva et al. (2024), found that although several types of decompression devices are reported in the literature, there is no ideal device. However, the most effective are those that are comfortable, cleansable, and remain in place (Silva et al. 2024). We prioritized stability and comfort in our device by incorporating customisation, thus allowing for longer and more effective decompression. Overall, the custom device

FIGURE 8 | Periapical radiograph taken 9 months after decompression device was removed.

FIGURE 9 | Clinical photograph of mucosa 3 months following device removal with no evidence of ulceration or irritation.

that was used fulfilled the ideal properties outlined in Table 1. In particular, its stiffness and novel suture holes allowed the device to remain stable throughout the period of irrigation. Furthermore, by securing the device with sutures, there was a decrease in the need for patient compliance, unlike some devices that have been used in the past (Bitto et al. 2025). The decision to fabricate a smooth, round base for the device allowed for improved comfort since it did not impede activities such as eating and speaking. The central tube was wide enough to ensure that the lesion remained patent and long enough to reach the centre of the lesion, facilitating active and prolonged irrigation and decompression. Furthermore, the smoothening of the external and internal structure of the device was thought to further reduce inflammation while reducing the surface area for biofilm adherence. When considering improvements for the device, we may suggest reducing the mucosal coverage, which may reduce the inflammation/ulceration at the decompression site while also being more comfortable for the patient.

Within dentistry, there are no studies directly comparing the specific materials available; however, Chen et al. (2025) in their review article, have described the use of 3D printing to create customised surgical guides aiding in the precision of localising the decompression site, the ability to create patient-specific scaffolds using various 3D printed materials, and the possibility of incorporating bioactive coatings to ensure vascularisation (Chen et al. 2025). This speaks to the possibility for the development of these decompression devices in improving outcomes; however, further research is required. We found anecdotal evidence for the use of the Straumann p Pro gingiva masks (Straumann Group) material when fabricating the device. It is known to be generally well tolerated, with limited mucosal irritation and overall discomfort.

The incorporation of CAD/CAM techniques allowed us to use radiographic imaging to fabricate a custom-made patient-specific device for our patient. The use of digital software (Netfabb, Autodesk Inc.) allowed the clinician to modify the design in terms of the size, shape, and length of the tube based on the patient's anatomy. The clinician was able to prescribe the exact dimensions of the device based on CBCT imaging and ensure the device extended into the centre of the lesion. To account for the soft tissues, CBCT imaging must be combined with an intra-oral scan of the mucosa/dentition. This allows the device to seat well on the mucosa while also facilitating decompression of the lesion. Compared to devices or materials used in the past, including dental dam material, nasopharyngeal airway tubing, or removable devices, we feel that this technique has better outcomes due to improved comfort, stability, and predictability of decompression and irrigation from the device. The most similar device in the literature is described by Kivovics et al. (2022), who assessed the feasibility of a custom-made decompression appliance fabricated using digital workflow for decompression of odontogenic cysts.

Within this case, an active and a regular irrigation protocol was employed whereby the patient was instructed and shown how to effectively irrigate the lesion through the decompression device. As aforementioned, Suzuki (1985) showed that repeated irrigation of inflamed cysts has been shown to reduce prostaglandin-like substances, particularly prostaglandin E2, which has been associated with osteoclastic activity and lesion growth (Suzuki 1985). We believe that incorporating the ability to deliver irrigant into the lesion within the design of the decompression device was favourable to the outcome of the treatment. Saline was used as an irrigant to facilitate haemolysis, allow active destruction of the lesion walls, and encourage removal of inflammatory markers. Some reports describe the use of chlorhexidine gluconate or a combination of saline with chlorhexidine due to its antiseptic nature (Oliveros-Lopez et al. 2017), (AboulHosn et al. 2019). However, there are no studies to compare the effectiveness of the two irrigants for decompression of periapical lesions, and given the risk of an allergic reaction to chlorhexidine gluconate, we decided to avoid it (Bahal et al. 2017). The combination of a reduction in cavity inflammation alongside the decrease in intra-lesional pressure suggested that irrigation alongside decompression was key to the success of the treatment (Suzuki 1985).

The positive clinical and radiographic outcomes seen in this case portray the advantage of decompression in cases where the lesions are very large, spanning around several teeth that clinically give positive sensibility testing, invade vital structures like the floor of the nose and nasopalatine canal, and have breached more than one osseous wall, e.g., through and through defect where the buccal and palatal cortices have both been perforated. In such instances, apical surgery (including enucleation) can be invasive and damaging to critical anatomic structures. Decompression helps overcome the need for extensive surgical procedures or at least reduces the size of the lesion before enucleation to minimize complications and morbidities such as devitalisation of teeth, patient discomfort, loss of bony support, and paraesthesia (Bernardi et al. 2015).

Conversely, decompression may also lead to complications. Silva et al. (2024) found that the majority of these were due to device obstruction leading to device occlusion, device displacement, device loss, device fracture, mucosal irritation, and need for further treatment (Silva et al. 2024). Suturing the device in situ in our case prevented several of these complications; however, mucosal irritation may have been a drawback given the area was covered for 4 weeks.

Our case study showed osseous deposition 9 months following decompression, which meant that further treatment was not necessary. However, in cases where, for example, there is a true odontogenic cyst that has developed, further surgical intervention may not be avoidable due to the presence of a complete epithelium. Nair et al. (2008) have provided experimental evidence to show that inflammatory cysts are likely formed through the initiation of an acute inflammatory focus, which later becomes enclosed by a proliferative epithelium (Nair et al. 2008). As the mass enlarges, the innermost cells necrose since these cells are unable to obtain nutrition or eliminate waste along diffusion gradients. The osmotic pressure within the lumen of the cyst increases due to the creation of an imbalance within its centre, thus attracting fluid into the lumen of the cyst. When this pressure becomes larger than the surrounding tissue fluid, expansion of the cyst takes place. Since cystic spaces do not communicate with the lymphatic system, the excess fluid cannot be controlled, and drainage becomes impossible, facilitating its growth (Neaverth and Burg 1982). Disappearance of this epithelium is directly related to the success of treatment and dependent on several factors that are not fully understood. Nevertheless, several articles have reported either decompression or marsupialisation as treatment modalities for periapical lesions within the jaws, including radicular cysts, odontogenic keratocysts, and cystic ameloblastomas, leading to clinical and radiographic resolution (Hou and Zhou 2013).

The use of this relatively straightforward method for decompression of the lesion showed promising results and aided in reducing the need for further, more complex surgical interventions while contributing to the broader discourse on alternative management strategies for large inflammatory odontogenic lesions. However, we appreciate that this was an individual case report with a relatively short follow-up time, and therefore there are several limitations to the extrapolation of the results. We believe that there is a need to confirm the effectiveness of this technique with a larger sample size and extended follow-up period through further research within this field (Figure 10).

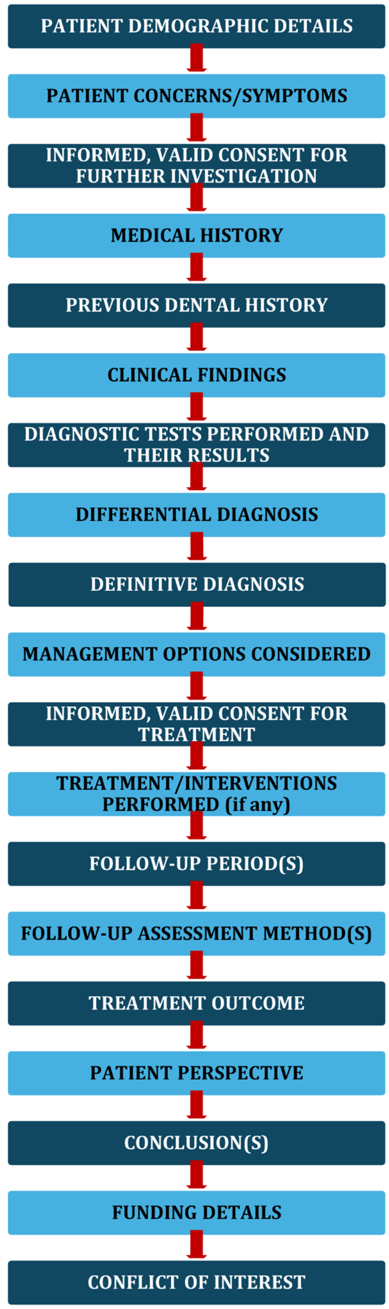

FIGURE 10 | PRICE 2020 Flow chart (Nagendrababu et al. 2020).

4 | Conclusion

In conclusion, surgical decompression alone, or in combination with enucleation, is a promising technique that can be used to treat large periapical lesions as a means to reduce the associated risks of more invasive procedures or completely eliminate the need for them. Furthermore, the use of digital workflows allows for the fabrication of custom-made devices that may effectively manage these lesions and no longer rely on the use of various medical and dental items to maintain a patent opening. Alongside endodontic treatment, we believe that this technique can be effective in conservatively managing large periapical lesions with the potential for a good long-term prognosis.

By using information from CBCT imaging, it is possible to measure the dimensions of the lesion and fabricate a device that will facilitate comfort and thorough irrigation of the contents of the lesion. Nevertheless, regular monitoring is required to ensure that the device remains in the correct position and does not cause further mucosal irritation.

As a concept, we feel there is scope for this technique to be successful based on the outcomes of this case report.

Author Contributions

Yogesh Patel: Conceptualisation, writing – original draft preparation, review and editing. **Nahal Razaghi:** Conceptualisation, supervision, writing – review and editing. **Mitul Patel:** Conceptualisation, supervision, writing – review and editing. **Mital Patel:** Conceptualisation, supervision, writing – review and editing.

Disclosure

Ethics and Integrity Policies: The authors believe they have complied with the ethics and integrity policies.

Ethics Statement

The authors have nothing to report.

Consent

The patient consented for their case to be described in a scientific publication for educational and research purposes, including clinical photographs, radiographs, and other diagnostic images.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

References

AboulHosn, M., Z. Noujeim, N. Nader, and A. Berberi. 2019. "Decompression and Enucleation of a Mandibular Radicular Cyst, Followed by Bone Regeneration and Implant-Supported Dental Restoration." *Case Reports in Dentistry* 2019: 9584235.

Bahal, S., S. Sharma, L. H. Garvey, and V. Nagendran. 2017. "Anaphylaxis After Disinfection With 2% Chlorhexidine Wand Applicator." *BMJ Case Reports* 2017: 219794.

Bernardi, L., F. Visioli, C. Nör, and P. V. Rados. 2015. "Radicular Cyst: An Update of the Biological Factors Related to Lining Epithelium." *Journal of Endodontics* 41, no. 12: 1951–1961.

Bitto, M., A. Marcianò, A. Pagliaro, L. Cavallo, M. Cicciù, and G. Oteri. 2025. "Digitally Designed Decompression Device for Treatment of Odontogenic Cysts: Technical Note." *Journal of Craniofacial Surgery* 36, no. 4: 1355–1358.

Chen, T., L. Luo, J. Li, et al. 2025. "Advancements in 3D Printing Technologies for Personalized Treatment of Osteonecrosis of the Femoral Head." *Materials Today Bio* 31: 101531.

Cho, Y. S., and I. Y. Jung. 2019. "Complete Healing of a Large Cystic Lesion Following Root Canal Treatment With Concurrent Surgical Drainage: A Case Report With 14-Year Follow-Up." *Journal of Endodontics* 45, no. 3: 343–348.

Hou, R., and H. Zhou. 2013. "Articles of Marsupialization and Decompression on Cystic Lesions of the Jaws: A Literature Review." *Journal of Oral and Maxillofacial Surgery, Medicine, and Pathology* 25, no. 4: 299–304.

Karamifar, K., A. Tondari, and M. A. Saghiri. 2020. "Endodontic Periapical Lesion: An Overview on the Etiology, Diagnosis and Current Treatment Modalities." *European Endodontic Journal* 5, no. 2: 54–67.

Kivovics, M., D. Pénzes, J. Moldvai, E. Mijiritsky, and O. Németh. 2022. "A Custom-Made Removable Appliance for the Decompression of Odontogenic Cysts Fabricated Using a Digital Workflow." *Journal of Dentistry* 126: 104295.

Liu, H., N. Zhou, and X. Huang. 2024. "The Application of Wing-Shaped Window Decompression Device in the Treatment of Large Odontogenic Keratocyst: An Observational Study." *Medicine (Baltimore)* 103, no. 36: e39601.

Nagendrababu, V., B. S. Chong, P. McCabe, et al. 2020. "PRICE 2020 Guidelines for Reporting Case Reports in Endodontics: A Consensus-Based Development." *International Endodontic Journal* 53, no. 5: 619–626. https://doi.org/10.1111/iej.13285.

Nair, P. N., G. Sundqvist, and U. Sjögren. 2008. "Experimental Evidence Supports the Abscess Theory of Development of Radicular Cysts." *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology* 106, no. 2: 294–303.

Neaverth, E. J., and H. A. Burg. 1982. "Decompression of Large Periapical Cystic Lesions." *Journal of Endodontics* 8, no. 4: 175–182.

Oliveros-Lopez, L., A. Fernandez-Olavarria, D. Torres-Lagares, et al. 2017. "Reduction Rate by Decompression as a Treatment of Odontogenic Cysts." *Medicina Oral, Patología Oral y Cirugia Bucal* 22, no. 5: e643–e650.

Patterson, S. S. 1964. "Endodontic Therapy: Use of a Polyethylene Tube and Stint for Drainage." *Journal of the American Dental Association* 69, no. 6: 710–714.

Pogrel, M. A., and R. C. Jordan. 2004. "Marsupialization as a Definitive Treatment for the Odontogenic Keratocyst." *Journal of Oral and Maxillofacial Surgery* 62, no. 6: 651–655; discussion 655-6.

Rodrigues, J. T., H. Dos Santos Antunes, L. Armada, and F. R. Pires. 2017. "Influence of Surgical Decompression on the Expression of Inflammatory and Tissue Repair Biomarkers in Periapical Cysts." *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology* 124, no. 6: 561–567.

Silva, V. T., W. G. de Campos, C. Leone, F. Abreu Alves, and C. A. Lemos. 2024. "Which Devices Can Be Used to Decompress Odontogenic Cystic Lesions in the Oral Cavity? A Systematic Review." *British Journal of Oral and Maxillofacial Surgery* 62, no. 3: 252–258.

Suzuki, M. 1985. "Treatment of Jaw Cysts With an Irrigational Method (II): The Effect on the Nature of Cyst Walls and Surrounding Bone." *International Journal of Oral Surgery* 14, no. 5: 408–415.

Tian, F., B. Bergeron, S. Kalathingal, et al. 2019. "Management of Large Radicular Lesions Using Decompression: A Case Series and Review of the Literature." *Journal of Endodontics* 45, no. 5: 651–659.

Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** iej70053-sup-0001-DataS1.pdf.