

CASE SERIES

Management of necrotic teeth with apical periodontitis using sonically activated irrigation

ABSTRACT

Aim: To present root canal treatment using sonically activated sodium hypochlorite for cases with necrotic pulp and apical periodontitis.

Summary: Four patients were scheduled for root canal treatment diagnosed with periapical pathosis and bone resorption with a periapical index (PAI) score not less than 3. After access cavity preparation and working length determination, the cleaning procedure was performed using sodium hypochlorite (NaOCl) 2.5% irrigation activated by EndoActivator; then, teeth were filled with gutta-percha. After a follow-up period with an average of four years, clinical and radiographic findings showed complete healing and bone reformation.

Key learning points:

- Clinicians must appreciate the information gained from scouting about the average root canal size; based on that; we can determine the shaping & disinfection strategy.
- Sonically activated irrigation can be a predictable approach for cleaning infected teeth with ample root canal space without apical instrumentation.
- Activating irrigation can help to preserve dentine meanwhile achieving a successful outcome.

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Introduction

Microorganisms and their byproducts are the leading cause of inflammation of the pulp and periapical tissues (1).

Therefore, the primary objective of root canal treatment is to eliminate microorganisms and pathologic debris from the pulp space (2) and prevent its reinfection (3).

Optimal apical preparation diameter still has been a subject of controversy (4); some authors suggested a pre-determined size beyond 35 or 40 (5), while others recommended enlarging the canal three sizes larger than the first apical binding file would be adequate (6). On the other hand, others reported that large apical sizes remove more significant amounts of the root dentine that, could weaken the root and lead to fractures (7). Besides, Literature showed that more than half of the root canal walls remain untouched (8).

Previous years have witnessed several developments in the irrigation activation procedures such as sonic or ultrasonic

activation, negative pressure, and laser technologies (9). These devices dramatically improve the antimicrobial and cleaning abilities of the irrigants, in addition to preserving the root dentine and maintaining a high fracture resistance (10, 11).

The EndoActivator® (Advanced Endodontics, Santa Barbara, CA) is an electrically driven unit operating at stated frequencies of 33, 100, and 167 Hz (12). It employs polymer tips of different sizes (size 15, .02 taper, size 25, .04 taper, size 35, .04 taper) to activate the irrigants sonically (12).

This report presents a case series in which a root canal cleaning procedure was performed using sonic activation of irrigation without apical instrumentation, leading to a successful radiographic & clinical outcome.

Report

A total number of four male patients with an age range from 15 to 41 years old were scheduled for root canal treatment. Clinical and radiographic examination revealed that all teeth had ne-

Table 1
Preoperative evaluation and Diagnosis

Case no.	Tooth no.	Sex /age	Symptoms	Sinus tract	Swelling	Percussion	Palpation	Mobility	Diagnosis	Preop. PAI score	Initial binding file
1	15	M/15	No	Yes	Intraoral	No	No	Within normal limit	Chronic apical abscess	5	#55
2	24	M/17	Pain	No	Extraoral /intraoral	Yes	Yes	Grade I	Facial cellulitis	3	B #25 P #30
3	41	M/30	No	No	No	No	No	Within normal limit	Asymptomatic apical periodontitis	4	#30
4	12	M/41	No	No	No	No	No	Within normal limit	Asymptomatic apical periodontitis	4	#35

crotic pulp and periapical pathosis with bone resorption. Diagnosis for each case is recorded in Table 1.

All cases had a clinical evaluation of mobility, soft tissue lesions, percussion, and palpation (Table 1). Radiographic evaluation was done by periapical radiograph using a film holder for parallel technique (Rinn Dentsply Sirona, Weybridge, UK). Bone resorption with PAI score (13) not less than 3 was recorded for all cases. The patient's medical and family history was noncontributory. After explaining the treatment procedure, written informed consent was obtained from the patient or guardian. The local anesthetic solution 2% lidocaine containing 1:100,000 epinephrine (Dentsply Sirona, York, PA) was administered, and all teeth were isolated with a dental dam (Crosstex, New York, USA), followed by removal of caries and defective restorations (if present). Conventional straight-line access cavity preparation after building the missing proximal wall using chemical cure glass ionomer (Dentsply Detrey, Konstanz, Germany). A stainless-steel K file size #10 (Dentsply Maillefer, Ballagues, Switzerland) was

used to scout root canals to evaluate internal canal anatomy, dimension, and geometry. Then the canals were irrigated using 5 ccs of NaOCl 2.5% (Chloraxid, CerkaMed, Stalowa Wola, Poland). The size of the scouting file was increased until it binds at the provisional working length. The initial binding file was #25 or larger for all cases.

An electronic apex locator (X-SMART DUAL, Dentsply Sirona, Ballaigues, Switzerland) was used to measure the final working length and confirmed by a periapical radiographic image (VixWin™ Platinum, Gendex Dental Systems, Illinois, USA) with parallel technique.

5 ccs of (NaOCl) 2.5% were delivered by needle with gauge 30 (Prorinse Maillefer, Ballaigues, Switzerland) at insertion depth 1 mm from full working length (FWL). The irrigation was activated by Endoactivator tip size (15/.02) at 10000 CPM (cycles per minute) for 1 minute while moving the tip up & down with a vertical amplitude of about 2 mm with maximum insertion of 1 mm from FWL. The irrigation cycle was repeated 3 times for each canal, and the canal was irrigated with 5

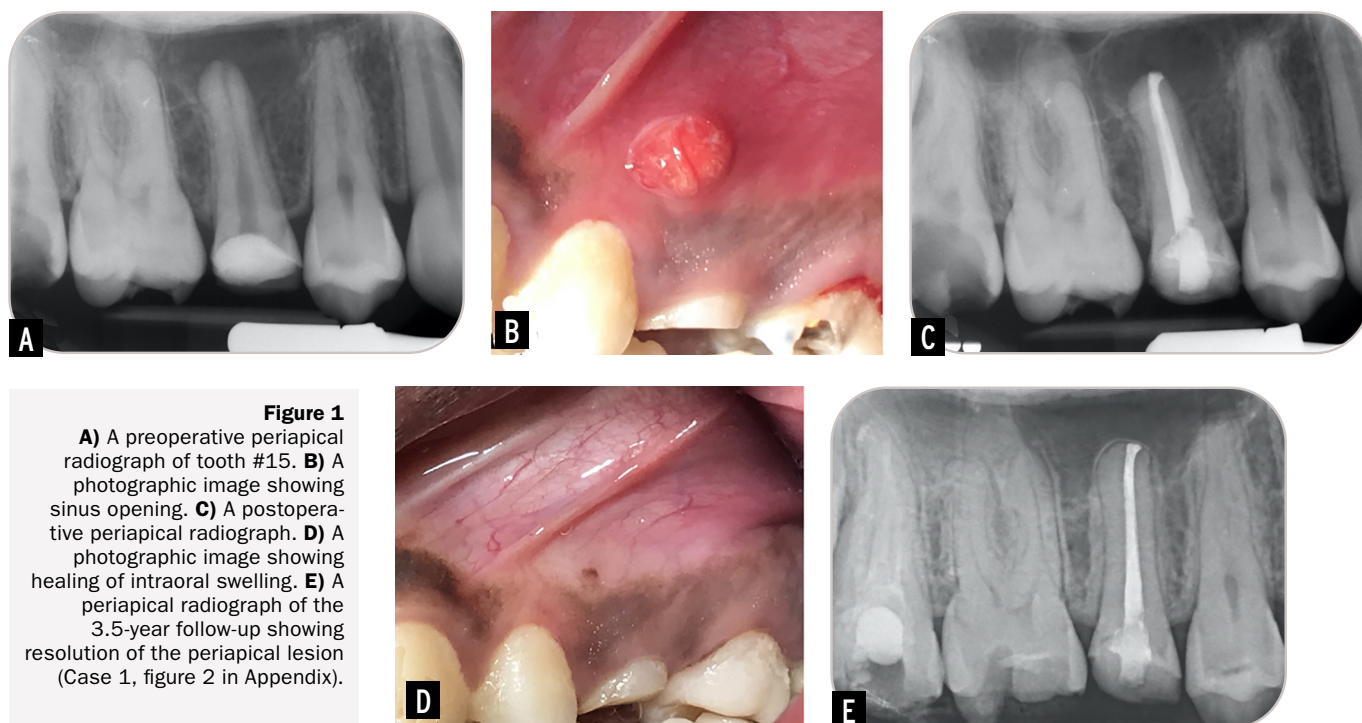


Figure 1

A) A preoperative periapical radiograph of tooth #15. **B)** A photographic image showing sinus opening. **C)** A postoperative periapical radiograph. **D)** A photographic image showing healing of intraoral swelling. **E)** A periapical radiograph of the 3.5-year follow-up showing resolution of the periapical lesion (Case 1, figure 2 in Appendix).



Figure 3 **A)** A preoperative periapical radiograph of tooth #24. **B)** A photographic image showing intraoral swelling. **C)** A postoperative periapical radiograph. **D)** A photographic image showing healing of intraoral swelling. **E)** A periapical radiograph of the 4-year follow-up showing bone reformation (Case 2, figure 4 in appendix).

ccs of NaOCl 2.5% to replenish the irrigant and flush out debris after each cycle. Antibacterial medication (amoxicillin-clavulanate, 1000 mg twice daily for five days) was given only for one case with facial cellulitis (Table 2).

Based on the initial binding file size master gutta-percha cone was selected. A tug

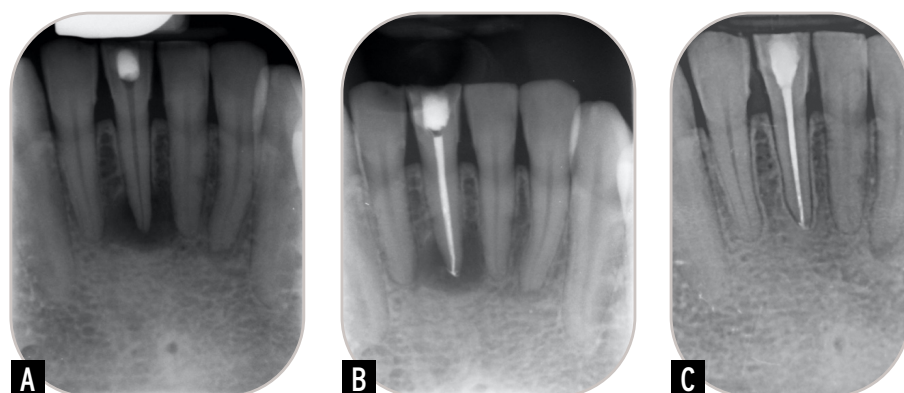
back (resistance while pulling) was felt and confirmed radiographically. In case of no tug back, the cone is trimmed by surgical steel blade #15 (Swann-Morton, Sheffield, England) and gutta-percha gauge (Dentsply Sirona, Ballaigues, Switzerland) till it was achieved. The warm vertical compaction technique was selected for filling root canal space and AH26 silver-free sealer (Dentsply Detrey, Konstanz, Germany). The tooth was restored with glass ionomer (Dentsply Detrey, Konstanz, Germany), then referred to the general dentist for a final restoration.

The patients were evaluated clinically and radiographically in the follow-up visits. The clinical examination assessed mobility, any remaining soft tissue lesions, swelling (if present), percussion, and palpation. The radiographic examination comprises independent (PAI) scoring using periapical radiographic images by parallel technique.

After an average follow-up duration of four years (Table 2), all cases were asymptomatic clinically; furthermore, radiographic examination showed complete healing of peri-radicular radiolucency with a PAI

Table 2
Treatment outcome

Case no.	Tooth no.	Prescribed antibiotic	Postop. PAI score	Years of final review	Outcome
1	15	No	1	3.5	Healed
2	24	Yes	1	4	Healed
3	41	No	1	3.5	Healed
4	12	No	1	4	Healed

**Figure 5**

A) A preoperative periapical radiograph of tooth #41. **B)** A postoperative periapical radiograph of tooth #41. **C)** A periapical radiograph of the 3.5-year follow-up showing bone reformation (Case 3, figure 6 in appendix).

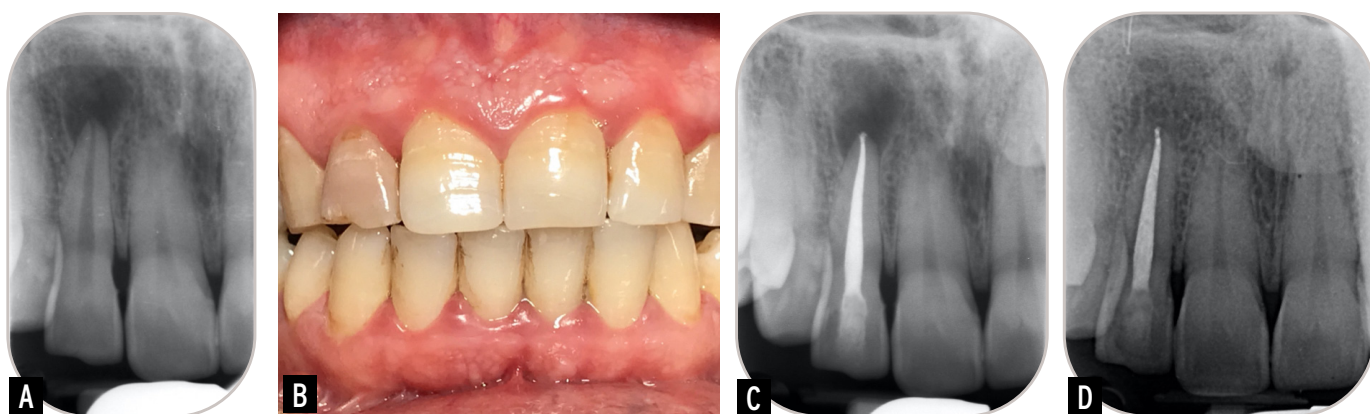
score of 1, which is normal. Concerning final restoration, all cases had direct adhesive restoration except one case (case 1, figure 2 in appendix) that did not comply with the recommended treatment.

Discussion

Bacteria is the main reason for pulpal and periapical infection (1, 14, 15), so eliminating microorganisms is the main target of root canal treatment to achieve healing (16). In this report, complete healing of four cases with necrotic pulp & apical periodontitis was achieved by sonic activation of (NaOCl) 2.5% using EndoActivator to disinfect the root canal space. EndoActivator enhances depletion of bacteria and biofilm severance (17-19). The tip oscillation creates a

powerful hydrodynamic phenomenon (18), leading to effective cleaning of the root canal space (20). Additionally, irrigant replenishment after each activation cycle increases the antibacterial effect of NaOCl (21).

The conjectural relation between an irrigant or irrigation technique with a clinical outcome is often deficient (22). A well-known drawback in root canal irrigation research is the rareness of clinical studies, mainly those addressing the long-term treatment result. Moreover, depending on laboratory studies to recommend solutions or techniques is considered the lowest evidence level (23). To date there is no clinical study correlated between apical preparation size & clinical outcome. In this way, the present case series is trying to

**Figure 7**

A) Preoperative periapical radiograph for tooth #12. **B)** A photographic image showing a discoloration of tooth #12. **C)** A postoperative periapical radiograph. **D)** A periapical radiograph of the 4-year follow-up showing bone reformation (Case 4, figure 8 in appendix).

bridge the gap between laboratory studies & clinical application by presenting the treatment outcome of cases treated with sonically activated irrigation without apical preparation after an average of 4 years of follow-up. So, we can adopt more conservative approach in root canal treatment based on both research & clinical evidences.

Nowadays, the primary role of instrumentation is to provide a way to the apical third for the irrigants to carry out the main bulk of cleaning and disinfection (24). Accordingly, large canals may not require this shaping action as long as the irrigant could be delivered to the apical third & efficiently activated to remove the remaining pulp tissues and microorganisms (25).

The optimal apical preparation diameter is a never-ending issue and one of the most debatable topics in endodontics, acknowledging the needed balance between microbial reduction and preserving tooth structure (26). Aminoshariae & Kulild recommended enlarging the apical size for patients with necrotic pulps and periapical lesions to increase healing outcome in terms of clinical and radiographic evaluations (27). However, the current case series showed a successful outcome without apical preparation.

Boosting root canal disinfection could be achieved using more effective irrigation activation methods (28). Therefore, it may be recommended to keep the apical size as minimal as possible, provided that sufficient irrigation is feasible (29), and so this will preserve root dentine (30).

The limitation of this case series is the restricted application to large canals with an initial binding file not less than size #25.

Conclusion

In this case series, teeth with necrotic pulp & apical periodontitis were treated with non-instrumentation technique by sonic activation of NaOCl 2.5% showed favorable clinical and radiographic outcome. So, if the average apical diameter is equal to or

greater than #25 and irrigation needle can reach easily up to 1 or 2 mm from the full working length, we can adopt more conservative approach like sonic activation of irrigation to achieve efficient disinfection meanwhile preserving the root canal dentine. Further clinical trials focusing on the clinical outcome in relation to the irrigation activation and apical preparation size are recommended.

Clinical Relevance

Clinical and radiographic outcomes were adequate after an average of 4 years of endodontic treatment using activated irrigation. We can rely on the irrigant for cleaning the root canal space if there is sufficient space for proper activation. So, we can successfully treat root canals without or with minimal instrumentation and preserve the root dentine.

Conflict of Interest

The authors deny any conflicts of interest related to this study.

Acknowledgment

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Appendix

Flow charts for all cases follows after references.

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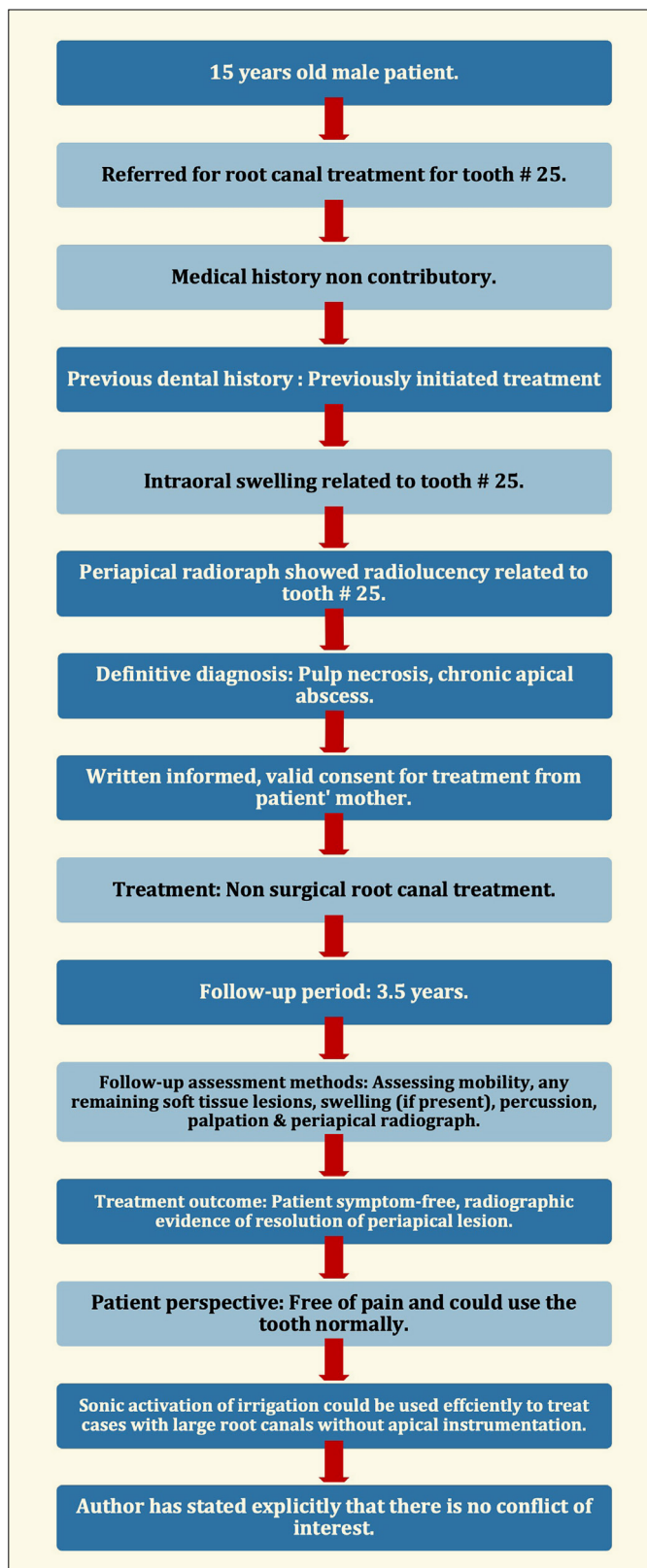


Figure 2
Price 2020 flow chart for case 1.

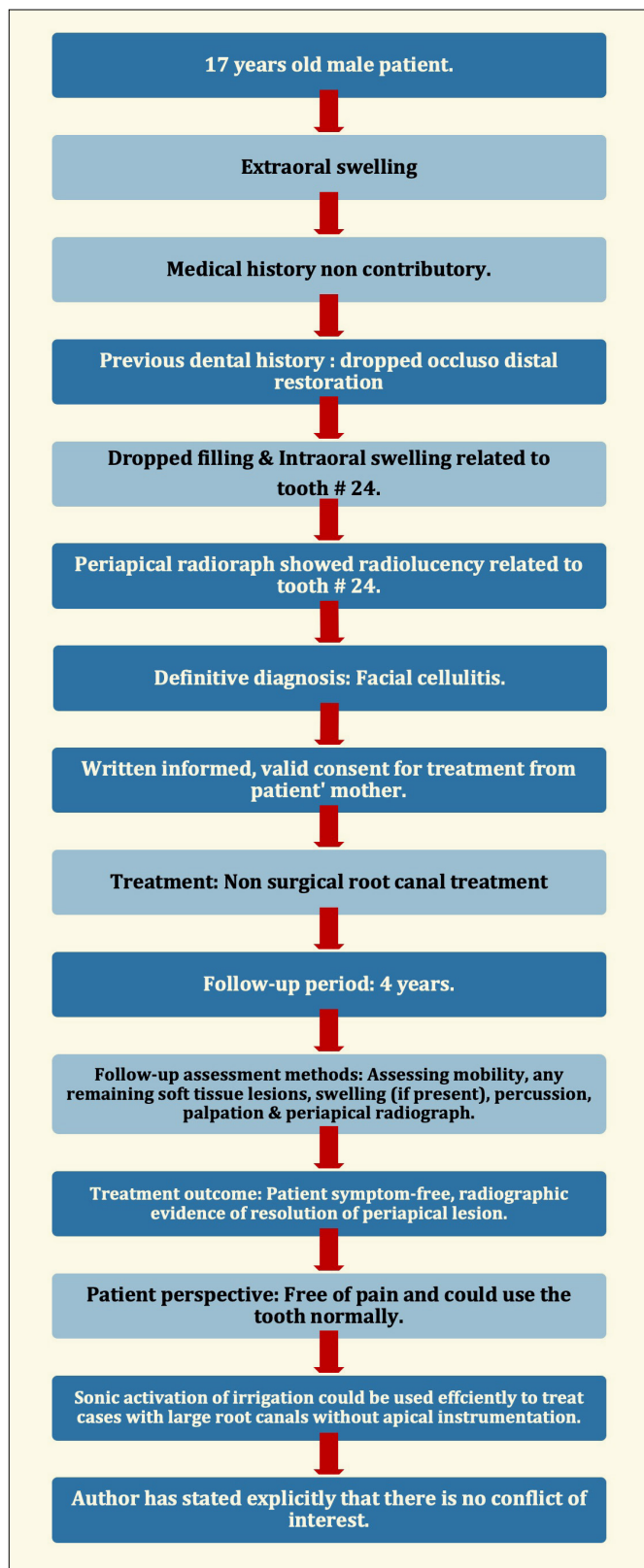


Figure 4
Price 2020 flow chart for case 2.

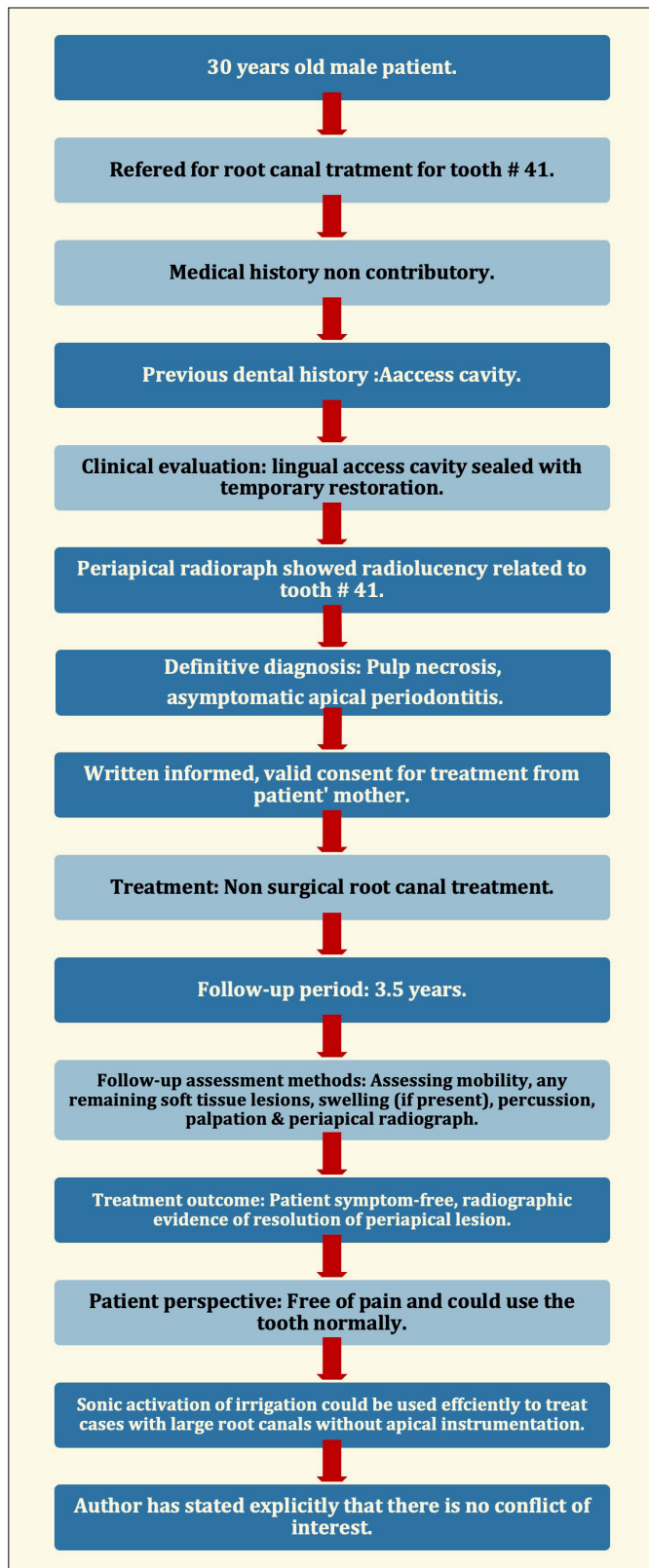


Figure 6
Price 2020 flow chart for case 3.

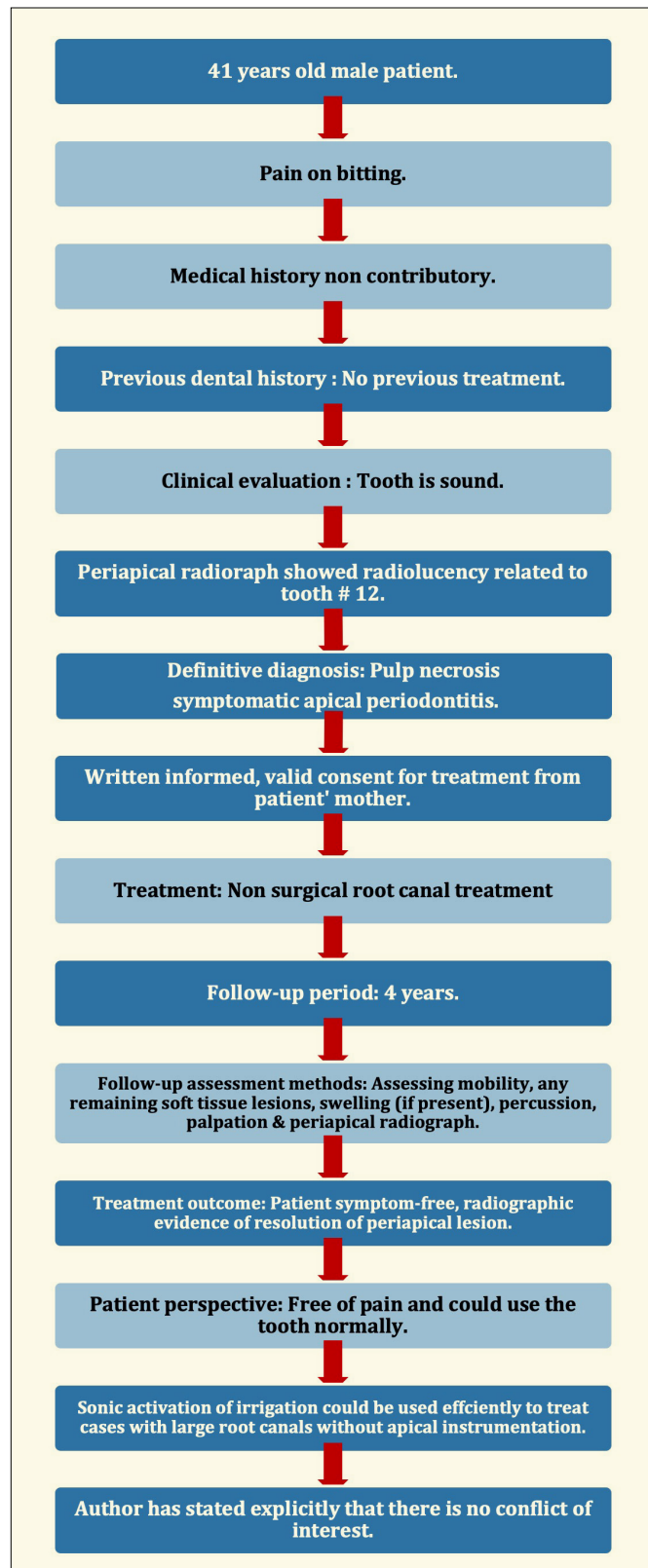


Figure 8
Price 2020 flow chart for case 4.