

Comprehensive evaluation of previous root-canal therapy

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_I recently received an e-mail from a general dentist with the image of tooth #15 (Fig. 1). The e-mail read: "I have an X-ray of our son's #15 root-canal treatment done five years ago by an endodontist. He has pain. I would like your opinion on the re-treatment?" There was no additional information.

The e-mail gives rise to several additional questions. It directly and indirectly addresses several important clinical and treatment-planning principles. These questions include:

Fig. 1_Clinical case (tooth #15).



1. Which teeth with previous root-canal treatment can and should be re-treated or have endodontic surgery, and which should be extracted?
2. If re-treatment is the best option, how should this be accomplished?
3. If surgery is the immediate best option, is it also the best long-term option?
4. What clinical and radiographic features of the root canal pictured are needed to decide the answers to Questions 2 and 3 above?
5. What additional subjective and objective information is needed to address fully the question asked by the clinician in the e-mail?

This article was written to answer these questions in a clinically relevant manner, addressing the needed treatment-planning concerns and strategies for clinical management.

There is vital information that has a direct bearing on the management of this case that is not provided. For example, it would be helpful to know the reason this tooth was not restored after the root canal. The answer is unknown. Valid questions include whether the patient may have had significant pain after the procedure that led to the delay in coronal restoration. Is the patient non-compliant? Did the patient move and neglect the coronal restoration for that reason? Is there another possible reason for failure besides coronal leakage? Could another tooth be involved? These questions (and a host of others) have implications for clinical management. These include knowing whether the patient will follow up with the restorative recommendations of the general dentist if this tooth is re-treated. As an aside, if the patient is non-compliant, given all of the other considerations, extraction is indicated. It is wholly unproductive to retreat the tooth to later find out that the patient did not have the tooth restored a second time.

It would also be ideal to have more digital radiographs from different angles and ideally, a Cone-beam Computed Tomography scan of the tooth to determine whether there is a vertical root fracture and/or possibly a perforation. It is reckless to make judgments about clinical situations without a comprehensive understanding of the situation from multiple radiographic angles and without correlating the clinical examination with the symptoms. A correct diagnosis involves blending the findings with regard to percussion, palpation, mobility, probing and radiographic interpretation with the subjective examination in order



Fig. 2

Fig. 2_Twisted Files (0.12/25, 0.10/25, 0.08/25, 0.06/25, 0.04/25; SybronEndo).

to determine a diagnosis. Such diligence can ensure that should treatment be undertaken, the patient would understand the procedure, alternatives and risks, and have his questions answered in a way that gives him a realistic expectation of probable success or failure. Based on this standard, it is not possible to judge the treatment as a failure and make decisions based on this one image without a clinical history and subjective and objective examination.

The above notwithstanding, the provided image yields significant information. The radiographic interpretation of this film demonstrates the following:

1. There is no coronal seal. In the endodontic literature, coronal leakage is highly correlated with failure of root-canal treatment. The tooth has not been crowned nor has the pulp chamber been restored. This radiographic appearance is diagnostic of coronal leakage. If accessed, the canals would almost certainly show overt evidence of such leakage, manifested as odour, discoloured gutta-percha, moisture and possible purulence, amongst other signs. Microbiologically, it is virtually certain that evidence of bacterial biofilm would be located alongside the existing gutta-percha in fins, cul de sacs and other inaccessible areas of the root-canal space.
2. There is a lack of continuity in the preparation and obturation in the taper from the crown to the apex of all three roots. The coronal halves of the disto-buccal (DB), mesio-buccal (MB) and palatal canals have greater taper than the apical halves do. It appears that the prepared shape in the coronal halves was made with Gates Glidden drills.

A more predictable canal shape could have been prepared using an instrument like the Twisted File (TF; SybronEndo). For this particular tooth, TF would have prepared the palatal canal in approximately two to three insertions to a 0.10/25 after the creation of a

glide path. The MB and DB canals (and MB2 if present) could also have been prepared to a 0.08/25 in three to four insertions after the creation of a glide path. While a comprehensive discussion of TF is beyond the scope of this article, using TF in this clinical case would have provided an optimal taper with relatively few insertions and preserved root structure. It would also have minimised the possibility of vertical root fracture and strip perforation. The degree of dentine removal at the distal aspect of the MB root and the mesial aspect of the DB root indicates that the remaining root wall is very thin. While it does not appear that a strip perforation has occurred, the radiographic information at hand is limited and it is not possible to determine whether there is a perforation. Such excessive dentine removal is correlated with long-term risk of vertical fracture.

3. There is a radiographic lesion at the apex of the palatal root. It is unknown from this one radiographic view whether additional lesions are present at the apex of the MB and the DB roots.
4. There are obturation voids in the palatal and MB root. The root-canal spaces have not been filled three-dimensionally. Such voids in obturation (aside from a lack of coronal seal) would give rise to questions about the quality of the cleaning and shaping.
5. Although not based on an empirical radiographic observation, the working length of the cleaning, shaping and obturation appears to be appropriate as does the master apical diameter, but this may have little to do with the clinical reality, ideal true working length and/or master apical diameter.

Clinical considerations

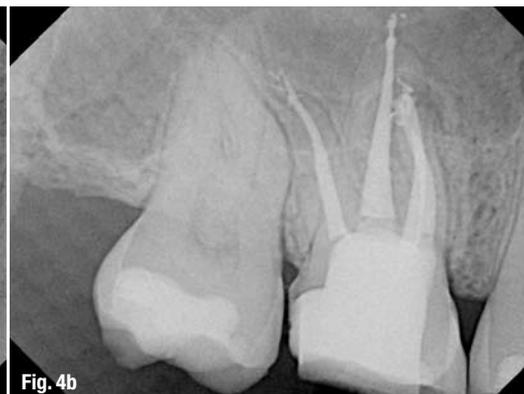
Clinically, that the patient has pain—assuming that #15 is the offending tooth—would demand treatment. Treatment options include extraction, root resection and root filling, or re-treatment. Part of the missing clinical history is a confirmation that #15 is the offending tooth, but it may not be. As mentioned, it is imperative that the patient have percussion, palpation, mobility and probing determined for teeth #14 and #15 (amongst other teeth) in order to reproduce the patient's symptoms. Clinically, this means that that if there is pain (for example, in reaction to chewing in the upper left), tooth #15 would be expected



Fig. 3_Elements Obturation Unit (SybronEndo).

Fig. 3

Figs. 4a & b Re-treatment of a failed root-canal treatment using the concepts and strategies discussed in the article.



(based on the radiographic appearance) to be sensitive to percussion and tooth #14 would be within normal limits. In essence, before a determination of a failed root canal on tooth #15 could be made, symptoms arising from tooth #14 would have to be ruled out. Testing tooth #14 with regard to percussion, palpation, mobility and probing, as well as performing a cold test could alert the clinician to any symptoms arising from tooth #14.

In essence, the clinician must reproduce the patient's chief complaint to assure him that the clinician has the correct tooth before making a diagnosis. Knowing whether the patient has pain in reaction to hot or cold would be a vital piece of information. Unfortunately, this information has not been given to us. If the patient's chief complaint is a sharp, lingering pain to hot or cold, it is most likely that a vital tooth is the offender and not pain from a failed root canal. Knowing also whether the pain was localised to tooth #15 would be valuable. Localised pain to tooth #15 that is reproduced by a positive percussion test would go a long way towards confirming the diagnosis.

_Clinical management

While limited to one radiographic view, given what appears to be coronal leakage as the primary source of failure, re-treatment would be the most practical, efficient and economical solution. The tooth appears to have adequate bone support. With a lack of coronal seal, assuming that a proper pre-operative radiographic and clinical examination did not suggest another diagnosis or treatment modality, re-treatment is favoured. Clinically, re-treatment would require that unnecessary dentine removal be avoided in order to minimise the risk of strip perforation. Aggressively removing the existing gutta-percha could easily cause strip perforation and/or remove excessive dentine, and as a result lead to long-term vertical root fracture. Using a heat source such as the Elements Obturation Unit (SybronEndo) as a first line of gutta-percha removal would minimise the risk of unnecessary dentine removal and provide

a passive means to eliminate the obturation before solvents and/or mechanical means are used. While not directly related to re-treatment, this case is a strong argument for the use of bonded obturation. Relative to gutta-percha, in vitro and in vivo bonded obturation has been shown to either decrease the movement of bacteria in a coronal to apical direction and/or reduce apical inflammation and infection that results from a loss of coronal seal. In this clinical case, it could be argued that if the obturation had been bonded that it could have provided some additional defence against the evident loss of coronal seal. RealSeal (SybronEndo) master cones and/or RealSeal 1 Bonded Obturator (SybronEndo) would both have been excellent choices to provide this bonded obturation clinically.

Finally, apical surgery is contra-indicated in this case for several reasons:

1. The crown-to-root ratio is unfavourable. Removing several millimetres of the apex of each root would make a short tooth (#15) even shorter and risk long-term vertical fracture.
2. The endodontic literature states that endodontic surgery is more successful in the short term than the long term. One of the reasons for this is due to coronal leakage, as evident here. Removing the apices and placing an apical filling might heal in the short term, but the long-term assault by coronal leakage would remain unabated, reducing the probabilities of clinical success.
3. The tooth should be re-treated first (if it is to be retained) and if necessary, apical surgery would be one option for the long term, amongst others.

A clinically relevant look at a failed root canal with regard to treatment planning and several clinical considerations has been presented. Emphasis has been placed on a comprehensive examination that combines both the subjective and objective findings in order to determine the correct clinical diagnosis and the most predictable treatment alternatives. I welcome your feedback.

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