The future of endodontics: pulp revascularisation

Author_Dr Philippe Sleiman, Lebanon

Fig. 1

_The conventional way to treat immature teeth with peri-radicular abscesses is to resort to the apexification method in which calcium hydroxide is used as intra-canal medication after instrumentation of the thin canal walls.[1,2] Calcium hydroxide has proven to be an effective intra-canal medication, as it creates an environment conducive to the formation of a hard-tissue bridge at the apex.[3,4] However, it has one main disadvantage owing to its high pH: it will digest tissues within immediate contact with it and thereby destroy tissues with the potential to differentiate into new pulp, which altogether results in teeth with thin and weak roots that are susceptible to fracture.[5]

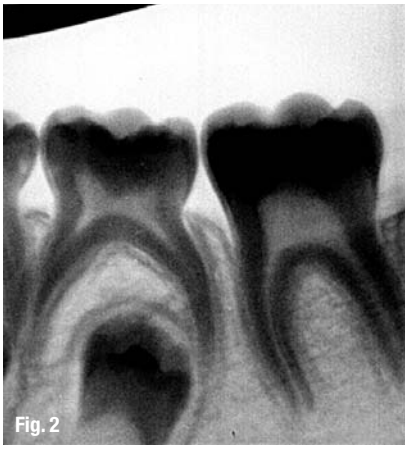

Fig. 2

Pulp tissue regeneration has been recognised as a new method for treatment of teeth with irritated, inflamed or necrotic pulp. Its main advantage lies in the possibility of further root development and reinforcement of dentinal walls by deposition of hard tissue, strengthening the root against fracture.[6]

This method depends mainly on pulp re-growing over the remaining pulp tissue. It is based on the presence of undifferentiated mesenchymal cells in the pulp and in the dentine that will give rise to stem cells, which upon injury differentiate into odontoblastoid cells that are later responsible for the formation of dentine bridges. The novelty of the clinical case presented here is that it is one of the few published thus far that demonstrates the use of a dual antibiotic paste and tissue engineering for apexification.

_Clinical case

A young female patient was referred to the office, suffering from pain in her lower molar. The X-ray revealed a lesion on both roots, with the mesial canals not yet in full formation regarding length and diameter (Fig. 1).

After discussing the case with the patient's parents and explaining the new technique, I opened the molar in very clean conditions. The distal root showed signs of light bleeding, so the pulp was relatively vital. The mesial roots did not show signs of bleeding, but the remaining pulp was clearly visible under the microscope. After copious irrigation using chlorhexidine in both the mesial and distal roots, SmearClear solution (SybronEndo) was placed and a passive activation with a #10 K-file

was performed in the mesial canals, with only some bleeding. Distilled water was used to flush out all the chemicals and a dual antibiotic paste was placed. Thereafter, glass ionomer was placed as an intermediate and composite was placed over this (Fig. 2). The patient did not report any pain, only mild discomfort.

I contacted the patient's parents on several occasions to invite them for a check-up but, unfortunately, they did not respond. After 18 months, I received a call from them, saying that the patient was feeling some discomfort. I immediately scheduled them and was surprised to see from the X-ray a complete formation of the mesial roots and the closure of the distal root (Fig. 3). The reason for the discomfort was a coronal crack with part of the composite lost, so coronal leakage was the main problem. A conventional root canal treatment was performed as the roots were then completely mature, using the TF (twisted files) for crown-down and apical enlargement up to size 45 in the mesial and size 50 in the distal using K3 files with .04 taper, and the root canals were sealed using RealSeal (SybronEndo; Fig. 4). The patient was sent to her dentist for molar restoration.


Fig. 3

_Discussion

Attempts to regenerate pulp tissue under conditions of inflammation or pulp necrosis have proven to be unsuccessful.[7] In the presence of an infection, the pulp stem cells seem to be incapable of mineralisation and deposition of tertiary dentine bridge. It is therefore necessary to disinfect the root canal system in a fashion that does not impede the healing and integration of tissue-engineered pulp with the root canal walls.[8]

Disinfection of the root canal system is realised by abundant irrigation, followed by application of a mixture of antibiotics for several weeks. The antibiotic paste is to be renewed only when clinical signs show, such as pain and discomfort, which generally happens in the few weeks after the treatment. In order to preserve the pulp connective tissue that appears to act as a scaffold for further development of the stem cells, chlorhexidine gluconate is used for intra-canal irrigation instead of NaOCl because the latter is well known for its dissolution of the soft tissues.[9,10] Removal of the smear layer is essential for intimate contact between the stem cells and the nutrients coming from the scaffold.

The placement of the antibiotics is necessary following a particular procedure and in this case a mixture of two antibiotics (Curam, amoxicillin associated with clavulanic acid, and metronidazole) was used. Amoxicillin is a broad-spectrum antibiotic that has bactericidal activity and is capable of inhibiting the synthesis of the bacterial cellular membrane during its growth phase owing to the competitive inhibition of transpeptidase. The clavulanic acid has low antibacterial activity but it irreversibly incorporates to the beta-lactamase, inhibiting the decomposition of amoxicillin. The tooth is sealed hermetically with a composite restoration with a glass ionomer as intermediate.


Fig. 4

The author would like to thank Phd Yulia Vorobyeva, interpreter and translator, for her help with this article._

Editorial note: A complete list of references is available from the publisher.

_about the author roots

Dr Philippe Sleiman is an endodontist and instructor at the Lebanese University Dental School. He lectures and conducts hands-on endodontics courses worldwide and has contributed to several endodontic publications. His line of endodontic instruments is distributed by Hu-Friedy. Dr Sleiman can be contacted at phil@cyberia.net.lb.