Cleaning is key

By Aws Alani, UK

Completely disinfecting the canal system is challenging when all factors are considered. If we are looking at the nano level there are approximately 76,000 dentinal tubules per square millimetre of dentine. Each of which can harbour a colony of bacteria. Then there may be inaccessible anatomy such as lateral canals, apical deltas or fins. These are factors that need considering outside of canal curvatures that may or may not be entirely visible in the plane of the radiograph. It is clear that outside of the contact our files make with the walls of the root canal there needs to be chemical disinfection to further reduce bacterial load. Irrigants disinfect as well as lubricate instruments and they dissolve the pulp. Sodium hypochlorite has been the mainstay irrigant for decades.

During the 1980s, Bystrom and colleagues investigated the effect of mechanical instrumentation with and without adjunctive use of hypochlorite. They found, unsurprisingly so, that when compared to pure mechanical instrumentation, the use of hypochlorite in combination with hand filing significantly reduced bacterial load. As such chemomechanical instrumentation was shown to be crucial for endodontic success. They compared irrigation with saline, 0.5 % and 5 % hypochlorite over a sequence of 5 appointments. Interestingly they found no difference in the reduction of bacterial load between 0.5 and 5 % hypochlorite. Despite what was likely to be a comprehensive protocol for these teeth, 7 of the 15 specimens in this study still had bacteria that they could grow at the end of treatment. The presence of cultivable bacteria does not necessarily mean we have failure—it merely means that there may be a cohort of bacteria that have resisted treatment. Mechanical instrumentation does reduce bacterial load by itself—this is by way of physical removal of tissues where bacteria reside, while also facilitating the dispersal of the irrigant into the canal. Siqueira and colleagues found that enlarging the canal from size 30 to 40 resulted in a significant decrease in endodontic pathogens.

It seems that irrigation and instrumentation are both highly interrelated in canal disinfection. Take washing your car for instance, purely covering it with soapy water and rinsing won’t remove the motorway bugs and bird produced projectiles. A good scrubbing with a sponge is needed, or if you are really serious about cleaning, a pressure washer!

This begs a further question—how would your patients feel if they knew that, more or less, the same or very similar liquid they use to clean bathroom suites is the same that we use to clean the inside of their teeth? On recent evidence of a dentist to the “stars” appearance on national TV not much—he advocated using charcoal to whiten teeth, which you may be able to buy from your local pet store for barbecues.

Hypochlorite is an effective bactericidal but does not remove the smear layer. The smear layer is a mix of organic material (protein, pulp remnants, saliva, microorganisms) with an inorganic components consisting of minerals from the dentine. The smear layer prevents bacteria residing in the dentinal tubules from being exposed to the irrigant as well as reducing the contact between the dentine and sealant during obturation.
tion. Hence, utilising EDTA to remove the smear layer prior to obturation but after completion of preparation and drying has been advocated heavily in the literature.

**Bacteria and the biofilms**

Unlike what we once thought, bacteria do not tend to just sit alone and remote from each other. If only they were this antiscalar and could be picked off one by one! Bacteria join forces and create symbiotic groups, share resources and protect each other from external influence. This is commonly known as a "biofilm", which has a thin but robust layer of mucilage that adheres to a solid surface housing the community of microorganisms. They not only share resources, they also share information that promote each other's survival. The major type of bacteria that will be encapsulated in this layer, purely irrigated without disrupting this layer, is known as the "biofilm". This is a thin but robust layer of mucilage that adheres to a solid surface. This is commonly known as a "biofilm". The majority of bacteria will be encapsulated in this layer, purely irrigated without disrupting this layer, is inefficient. The word disrupting is a bit kind really—it needs to be de-stressed to reveal all its contents and expose it to the bleaches for chemical action. It is the method of preparation of the canal biofilm that has seen a lot of development over the last 20 years or so. Much in the same way a pressure washer can clean more quickly and efficiently than a sponge, energising the disinfectant results in improved cleanliness.

**Energising the irrigant**

This can take many forms. The simple and straightforward form ensures appropriate exchange of the fluid and displacement into the recesses where airlocks may reside. This can be achieved through applying a GI point into the prepared canal to displace and disperse. Ultrasonic irrigation transmits energy by an oscillating instrument. This results in two different phenomena. Cavitation is the growth of bubbles and subsequent collapse of small gas bubbles due to a drop in pressure. Acoustic streaming is the bulk movement of fluid when pressure waves are projected, resulting in vortex motion around a fast moving oscillating instrument. This results in shear stress to the biofilm apex.

**Keeping the canal clean**

Once irrigation and chemomechanical debridement has been achieved the clinician has a choice—to obturate or to dress. Some may argue that the canal is clean at the end of instrumentation and that for convenience, obturating in one visit arrange- ment is the option of choice. As we know not all bacteria are removed or killed during treatment. Dressing the canal with calcium hydroxide may continue the process of eradication of the residual microorganisms over a 2-3-week period. However, the two schemes sometimes boil down to the presenting factors of the case. Where a tooth is difficult to instrument, has a large lesion or is quite obviously clinically infected with a history of pain, then dressing may be more of a consideration. If a tooth is treated in a de novo manner and treatment goals are achieved with no history of pain then a single visit treatment could be utilised.

The goal of obturation is to seal the canal system to prevent any reinfection and entomb any bacteria not eradicated by chemomechanical debridement. If the obturation is through the apex, this can have significant implications. If there is a potential for backflow the apex can carry bacteria outwards of the canal and exacerbate symp- toms. Therefore, a methodical reaction could also develop.

We also have to remember that a beautiful obturation of a canal achieved without rubber dam and utilising saline or local anaesthetic irrigation is sub-standard treatment. It can be difficult to assess the "quality" of treatment when a radiograph of a patient's mouth is not obtainable. As to the obturation, there is an old proverb that says: "It's not how you start, it's how you finish that counts."

**Conclusion**

Bacteria are public enemy number one in dentistry. Disinfecting the root canal system by irrigation in conjunction with mechanical instrumentation is key to success in root canal therapy. Preventing further re-infection or persistence of residual bacteria after the formal stages of treatment through dressing initially and a quality coronal seal subsequently is as important as the root canal therapy.

**Fig. 3: Cutting in the canal using a HyFlex EDM 25/.12 Opfice Opener.**

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As usual in the human anatomy, root canals come in all forms and sometimes develop in very random structures. In our endodontic practice, the majority of nickel titanium (NiTi) files allow us to prepare and clean the canal in next to no time. In this article, we will compare three different endodontic nickel-titanium (NiTi) files and in a quick and thorough root canal preparation is easy with the right set of instruments. As we know, nickel titanium files by Swiss den- distry, dental dam was applied on both the nickel and the tooth. The tip of the file was rinsed with distilled water and FGM 25 file with variable taper was applied in the common single length tech- nique. The shapping took only a couple of minutes and were able to navig- ate the whole of the instrument smoothly through the canal system. A lateral canals was radiographed using the EDX 3D imaging motion (Fig. 4). Even when a bit more pressure was put on the file it nei- ther blocked nor got stuck in the dentine. To obtain an ideal form, we root canal therapy had led to a per- forational lesion in the neighboring molar, a deep remaining cavity was clearly visible. Tooth 46 was therefore diag- nosed with a necrotic pulp (Fig. 7). Again, the Hyflex EDM helped us to shape the canal effectively without transporting or changing the natural path of the root canal. After gaining access with the orifice opener, we once again used the Hyflex Onefile to get to the apex. A few finishing touches were provided with the help of a 45 x 45 EDM file.

**Fig. 4: Hyflex EDM at the coronal third.**

Obturating all portals of exit turned out to be particularly challenging in our second case, therefore a modi- fied three-dimensional obturation technique was applied using Gut- taperal silicate. The 3-x obtura- tion material combines fluid gut- tapi-berga with a suitable sealer at room temperature and bioceramics in an automyx system (Fig. 8). This composition results in an easy to handle material with excellent flow properties and working times of 10 to 15 minutes. What we call three-dimensional obturation, in fact, is, in fact, efficient and reliable way to fill even complex root canal structures.

**Fig. 5: Cutting in the canal using a Hyflex EDM 25/12 Opfice Opener.**

**Fig. 6: Contrast view of the root canal system.**

**Fig. 7: Embedding paper points size 25.**

**Fig. 8: Obturating all portals of exit turned out to be particularly challenging in our second case, therefore a modified three-dimensional obturation technique was applied using Gutta-pera silicate. The 3-x obturation material combines fluid gutta-pera with a suitable sealer at room temperature and bioceramics in an automyx system (Fig. 8). This composition results in an easy to handle material with excellent flow properties and working times of 10 to 15 minutes. What we call three-dimensional obturation, in fact, is, in fact, efficient and reliable way to fill even complex root canal structures.**
First, we warn the gutta-percha us-
ing system II heat source. For our purpose, we decrease the tempera-
ture to 130 degrees from the aver-
age 200 degrees, as this totally suf-

cices. Penetration depth is reduced to 3 seconds as well compared to the
usual 5 seconds with a heat carrier to 4 millimetres from working length.
This way the GuttaFlow does not set, but keeps a sticky consistency which
allows us to push it further down the canal with a plunger, if necessary.

Moreover, in the follow-up session,
away from the main canal (Fig. 10).

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and fast penetration. Thanks to 3-D
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