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.

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 shop for barbecues.

Sodium 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 component 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 obtura-
tion. Hence, utilizing EDTA to remove the smear layer prior to obturation but after completion of preparation and shaping – the treatment is sensible. A penultimate rinse with EDTA then a final rinse with hypochlorite prior to drying has been advocated heavily in the literature.

**Bacteria and the biofilms**

Unlike what we once thought, bacteria do not tend to sit alone and remain from one another. If only they were this antiscientific 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 majority of bacteria will be encapsulated in this layer, purely irrigating without disrupting this layer is inefficient. The word disrupting is a bit kind really—it needs to be deleted to reveal all its contents and expose it to the bleach for chemical action.

Cavitation is the growth of small cavities 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 shearing stresses to the biofilm apart.

**Keeping the canal clean**

Once irrigated and prepared, the clinician has a choice—to obturate or to dress. Some may argue that the canal is clearest at the end of instrumentation and that for convenience, obturating in one visit is an acceptable option. As we know, not all bacteria are removed or killed during dressing. Dressing the canal with calcium hydroxide may contain the process of eradication of the residual microorganisms over a 2-week period. During this period, 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 chemically 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 utilized.

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. GT and infrared bonding reaction could also develop.

We also have to remember that a beautiful obturation of a canal achieved without rubber dam and utilizing saline or local anesthetic irrigation is substandard treatment. It can be difficult to assess the “quality” of treatment when a radiograph of a patient’s mouth reveals no new infection. Hence, an obturation that is short of the radiographic apex having been treated under rubber dam and with copious amounts of irrigation is more likely to be successful than the latter scenario. Accounting for too much significance to the radiographic appearance of the obturation is short-sighted. Indeed, Kätzelbachers and colleagues in the late 1950s witnessed a strong correlation of the absence of obturation where teeth where instrumented and irrigated optimally under isolation. Sealants are also antibacterial and aid filling the voids between the GP and the canal system. One further option would be to provide a seal to each of the canal orifices. This can be achieved by removal of 1 mm of GP and packing a good thick mix of RM with a plunger.

**Covering the cusps**

The provision of a coronal restora- tion (if provided optimally) can improve the coronal seal while also structurally protecting the underlying tooth tissue due to endodontic treatment, results in reduction of “cusp collapse” and the risk of fracture increases. Where both mesial and distal margins have not been released, when the cavity is confined to the occlusal surface, a crown restoration may not be required. Once a margin is breached the tooth is more likely to fail and result in cracks or fractures. A commonly asked question, “When should the crown be provided?” Soon after the root canal treatment or when the treatment has proven to be successful? The treatment is significant, the root canal system is significantly infected, then it should be communi- cated to the patient and a well compacted direct restoration may be the ideal course of action. Otherwise an onlay or if tooth tissue is significantly reduced, a crown should be provided soon after completion.

**Conclusion**

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

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**Editorial note:** The article was pub- lished in Endo Tribune International al 2017.

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**By Dr Alfredo landolo, Italy**

As usual in the human anatomy, root canals come in all forms and sometimes develop in very random structures. Luckily, NiTi allows us to prepare and clean the canals in next to no time. In this article, we will compare three different endodontic systems. We will quickly add a thorough and efficient root canal preparation is easy with the right set of NiTi files. A file with variable geometry is the best option. As we know, not all bacteria are removed or killed during dressing. Dressing the canal with calcium hydroxide may contain the process of eradication of the residual microorganisms over a 2-week period. During this period, 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 chemically 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 utilized.

**Case 1: Straight down to business**

A 48-year-old female patient intro- duced to our surgery complaining of pain caused by chewing in the maxil- lar left side. We quickly found that tooth 24 had a large lesion. Radiograph reflected (Fig. 6).

**Case 2: Cut and try technique**

In our second case, a 65-year-old female patient was referred to our practice with chief complaint of pain in the right side mandible. The radiograph showed defects in two teeth. The treatment was significant for the root canal treatment had led to a per- iapical lesion. In the neighbouring molar, a deep root reflection 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 OneStart to get to the apex. A few finishing touches were provided with the help of a 45/04 EDM file.

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 Gut- taperal Biocore. The 3:1 obtura- tion material combines fluid gut- taperal with a suitable seal at room temperature and biomechanics in an autotomax (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-dimensionality, which is, in fact, an efficient and reliable way to fill even complex root canal structures.
First, we warm the gutta-percha us-
ing system B heat source. For our pur-
purpose, we decrease the tempera-
ture to 130 degrees from the aver-
age 200 degrees, as this totally suf-
fices. 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 plugger, if necessary.
However, with a new technique the
gutta-percha itself does not have
to get inside the accessory canals, as
the bioceramic sealer will already
flow into any hidden canals

In previous test settings, you can see that the modified obturation tech-
nique allowed the sealer to advance
deeper inside lateral canals in com-
parison to a traditional single cone
technique (Fig. 9). Inserting the obtu-
ration material with more speed also
generates higher pressure: you do not
have to reach the desired work-
ing length in one go, but can use
another stroke until you reach the
desired length. The sealer sets only
around 2 minutes earlier than nor-
mal with the reduced heat settings
and fast penetration. Thanks to 3-D
obturation, you let the sealer do its
job in areas which are hard to reach,
while it gets pushed further down
into the canal by the slightly melted
gutta-percha on top. The fine white
line in the postoperative radiograph
of tooth number 45 showed the ob-
turated small lateral canal leading
away from the main canal (Fig. 10).
Moreover, in the follow-up session,
we noted that healing of the affected
tooth 45 and 46 had already taken
place. The bioactive components
of the obturation material further
add to the regeneration process,
while it gets pushed further down
the canal with a plugger, if necessary.

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Case 3: Severe double curvature
to finish off

Last but not least, we come to the
extraordinary S-shaped canal as
mentioned in the introduction. With
strong curves it is always good to
know that NiTi files with a so-called
“controlled memory” (CM) effect can
be prebent like classic stainless steel
files, but do not bounce back. Using
their unique material properties,
you can work comparatively stress-
free even under difficult conditions.

This time, the patient with the rath-
er challenging canal anatomy was a
40-year-old female patient with
complaints in her right side mandi-
ble. In our analysis, the clinical diag-
nosis revealed an irreversible pulpitis
in tooth 47. The radiograph indicated
that we needed to get around a very
sharp angle in the mesial root (Fig.
12); endo specialists know how dis-
tal molars are notorious for their
winding root canal system! We used
the following sequence to get to the
length very quickly without straight-
ening the canal at all:

Hyflex EDM 25/12, 10/05 and the
afore-mentioned Hyflex EDM One-
File 25/.12, 10/.05 and the
Hyflex EDM help you to follow
the natural path of the root canal and
quickly remove debris for chemical
cleansing and long-term obturation
of the various root canal structures.

The extremely fracture resistant files
are literally “cutting edge” technol-
ogy which make an excellent travel
compassion on virtually every road
Now, everyone in your dental team can **SHOOT!**

Ultra-Light  
**SIMPLE** Compact  
**Accurate** Intuitive

**SHOFU** Smart Digital *EyeSpecial* C-II

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- Uncomplicated photo management system

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