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. Siquiera 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 petrol station 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 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 obtura-
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As usual in the human anatomy, root canals come in all forms and sometimes develop in very random structures. Lately, 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 systems, and see how each system handles a tooth quickly and adequately with a thorough and efficient root canal preparation is easy with the right set of instruments. The importance of the shape of the canal itself.

Reading endodontic case reports, sometimes you get the impression that root canals always spot an extremely double curved morphology. With the latest technology and treatment auxiliaries, the endodontic world has to offer, you should, of course, feel confident to take on even the most unusual shapes of canals. Would not it be nice though to have a universal, flexible NiTi file system that allows you to prepare all sorts of canals, whether they are S- or J-shaped, or just straight down. To the apex? In Italy, we say “tutte le strade are the right way”.

Bacteria and the biofilms

Unlike what we once thought, bacteria do not tend to just sit alone and remain from one another. If only they were this antiscial 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 and development. The majority of bacteria will be encapsulated in this layer, purely irregulating without disturbing this layer is inefficient. The word disrupting is a bit hard really—it needs to be, in order to reveal all its contents and expose it to the beaches for chemical action. It is the methods of disruption of the canal biofilm that has seen a lot of development over the last 10 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.

Keeping the canal clean

Once irrigant has been used, the clinician has a choice—to obturate or to dress. Some may argue that the canal is cleanest at the end of instrumentation and that for convenience, obturating in a one visit arrange- ment is the best option. As we know, not all bacteria are removed or killed during dressing. Dressing the canal with calcium hydroxide may con- tinue the process of eradication of the residual microorganisms over a 2-week period, whereas irrigation of the two schemes sometimes boils 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 rein- fection and entomb any bacteria not eradicated by chemomechani- cal debridement. If the obturation is through the apex, this can have significant implications. If the apex can carry bacteria outwith of the canal and exacerbate symp- toms the instrument body 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 sub-standard treatment. It can be difficult to assess the “quality” of treatment when a radiograph of a patient’s mouth is not available. Instead, 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 suc- cessful than the therapy oneshot scenario. Attributing too much significance to the radiographic appearance of the obturation is short-sighted. Indeed, Katchbeu and colleagues in the late 90s witnessed a gap in the absence of obturation where teeth instrumented and irrigated optimally under isolation. Sealants are also antichloral and aside filling the voids between the GP and the canal system. One further option would be to provide a sub-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 BIM with a placed.

Covering the cusps

The provision of a coronal restora- tion (of provided optimally) can improve the coronal seal while also structurally protecting the underly- ing tooth tissue. Due to endodontic treatment, resulting in reduction in the tooth and risk of fracture increases. Where mesial and distal margins have not been reached with the application of the cavity is confined to the occlusal surface, a crown restoration may not be re- quired. Once a margin is breached the tooth is more likely to fail and result in cracks or fractures. A Commonly asked question, “What should the crown be provided? Soon after the root canal treatment or when the treatment has proven to be successful? In the late 90s witnessed an increase in the number of patients who sought treatment or who returned to the patient and a well compacted direct restoration may be the best option. This can then be com- municated to the patient and a well compacted direct restoration may be provided. Further options, otherwise an endo- lay 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 conjunction with mechanical in- strumentation is key to success in root canal therapy. Preventing fur- ther 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. 1: Pre-operative radiographs of case 2

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 maxi- mal left side. We quickly found that the necrotic pulp of tooth 24 caused the complaint. The pre-operative radiographs revealed a deep canal as well as a medium sized periapical le- sion (Fig. 1).

The root canals were positioned in a comparatively straight, almost parallel way with hardly any curvature. Quick preparations with a reduced sequence of NiTi files should consequently be possible in that particular case, as there were no contraindica- tions to a root therapy in general.

To provide a clean and dry operat- ing field, dental dam was applied to isolate tooth 24 for the following treatment. First of all, we handled the main canals up to ISO size 10. We were thus able to create a suitable glide path, before the actual prepara- tion took place.

In our endodontic practice, we nor- mally use the latest generation of nickel titanium wire by Swiss den- tal specialist COLTENE for cleaning and shaping the canal. As the name already indicates, the Hyflex EDM is a "highly flexible" NiTi file, which proves to be incredibly fracture re- istant in close cooperation with polyethylene and international endo-specialists, the renowned research department of the innova- tive provider of endo equipment de- veloped a literally sharp solution for their customers. A new, powerful tool they employed a clever idea that is widely used in other areas and revolutionized the industry. The abbreviation "EDM" stands for Electric Discharge Machin- ing (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 coronal seal, cleaning we then irrigated the canal several times for a total of at least 30 minutes. Following the classic irrigation protocol, we used the highly flexible nickel titani- um hypodermic (lakodo technique, 7% EDTA solu- tion and 2 % chlorine dioxide digi- nate solution to remove all debris and possible remnants from the canal. After eradicating the infection, we dried the canal with the corresponding paper points size 25. The last step was to create a proper seal to prevent microorganisms from reentering the root canal system and thus pro- tect the root from future recoloniza- tion. Potentially, the obturation material was applied in a special technique as described in the follow- ing case to ensure that all internal and side canals were filled. The postop- erative radiograph after the treatment most notably showed a lateral canal in the apical third as well as an itch- ium between the main canals, which got filled safely (Fig. 5). The re- sult was a tight, durable seal of the whole root canal system, as the final radiograph reflected (Fig. 6).

Case 2: A carefully prepared 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 radiog- raphs showed defects in two teeth; one a resorbed root canal treatment had led to a peri- apical lesion. In the neighboring mesial, a deep remaining cavity was clearly visible. Tooth 46 was therefore diag- nosed with a necrotic pulp (Fig. 7). To obtain an ideal coronal seal, cleansing we then irrigated the canal several times for a total of at least 30 minutes. Following the classic irrigation protocol, we used the highly flexible nickel titani- um hypodermic (lakodo technique, 7% EDTA solu- tion and 2 % chlorine dioxide digi- nate solution to remove all debris and possible remnants from the canal. After eradicating the infection, we dried the canal with the corresponding paper points size 25. The last step was to create a proper seal to prevent microorganisms from reentering the root canal system and thus pro- tect the root from future recoloniza- tion. Potentially, the obturation material was applied in a special technique as described in the follow- ing case to ensure that all internal and side canals were filled. The postop- erative radiograph after the treatment most notably showed a lateral canal in the apical third as well as an itch- ium between the main canals, which got filled safely (Fig. 5). The re- sult was a tight, durable seal of the whole root canal system, as the final radiograph reflected (Fig. 6).

Obliterating 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- taperf bioseal. The 3:1 obtura- tion material combines fluid gut- tapercha with a suitable sealer at room temperature and bioactive in an autotypic synergy (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 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 usu-
ality 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.
Moreover, in the follow-up session,
we noted that healing of the affected
place. The bioactive components
treated NiTi files, they can be quickly
ready for their next application until
regenerated by autoclaving and are
often used. They move perfectly in
the centre of the canal, therefore I
have never come across any perfora-
tions or ledges during my numerous
endodontic treatments so far. After using “CM”-
treated NiTi files, they can be quickly
regenerated by autoclaving and are
ready for their next application until
they reach the end of their life cycle
by displaying an uneven, bent shape.
As long as they are not unwound
they can be re-used safely, otherwise
they have to be discarded.

After drying and successfully obtu-
rating the canal, we were able to dis-
miss the patient with a very prom-
ising prognosis. The immediate
postoperative radiograph showed
the naturally formed, filled mesial
canal with its striking double curva-
ture at the end. We are very
glad that even in more challenging
cases like the present one we can rely
on the versatility of the latest genera-
tion of rotary instruments.

Conclusion
The latest generation of nickel tita-
rums files adapt easily to all shapes of
root canals thanks to their flexible

design and unusual cutting power.
Whatever way you choose to reach
the open, protruding NiTi files like
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
companion on virtually every road.
Now, everyone in your dental team can **SHOOT**!

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

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

- The only one true dental camera  
- 8 automated pre-set dental modes  
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- Fast auto-focusing capability and excellent depth of field  
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- Registration and imprinting of patient ID  
- Uncomplicated photo management system

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