Dentistry Clinical

Clinical study with Endox endodontic system

AJ Chaparro Heredia reviews a new system which promises to change the way you do endodontics.

Professor Antonio Chaparro Heredia is a medicine and surgery graduate with first class honours from the University of Seville,1971. He is also a graduate in stomatology from the University of Madrid, and holds a doctorate in medicine and surgery from the University of Seville, 1978, with first class honours 'cum laude'. Professor Chaparro has been titular professor of the dental pathology and therapeutics department at the University of Seville since 1984 and is a scholarship holder at the universities of Bergen (Norway) and Aarhus (Denmark), as well as an honorary member of the Associaçao Portuguesa de Odontologia. He is a member of the Pierre Fauchard Academy and has had numerous professional studies published in scientific magazines.

The Endox endodontic system offers us a completely new concept in the field of endodontics as it is the electronic sterilisation and devitalisation of the root canals by means of the application of high frequency current that produces a temperature increase inside the root canal. This results in the vaporisation of pulp tissue and the bacteria content present therein. We have performed 400 endodontic treatments using this system, verifying that results are satisfactory which means an important advance in endodontic therapy has arrived.

Endodontics is a discipline that can provide highly reliable and predictable results depending on the quality of treatment, based on two fundamental criteria: correct diagnosis and correct operative technique. These are both addressed to get an obturation as hermetic as possible that will aid the periapical tissue healing and repair (Gulabivala K, 1996; Eriksen HM, 1991; Ray H et al, 1993; Blanco M et al, 1998). Patients' increasing demand to preserve their teeth has resulted in endodontics being focussed on continuous research for a process that helps us improve the quality of treatment. In connection with this, an electromagnetic system has been invented permitting root canal treatment quality to be improved and simplifying the working method by means of applying a high frequency current (600 kHz) for 0.01 seconds. The pulp tissue is vaporised along with the bacterial content present in the radicular canal, thus reducing part of the biomechanical instrumentation of the radicular canals.

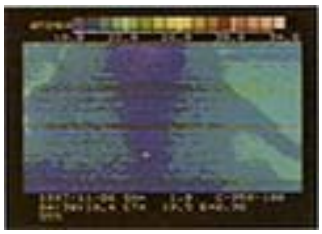

Figure 1

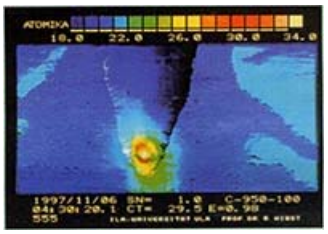

Figure 2

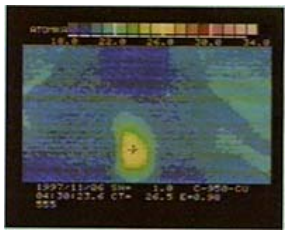

Figure 3

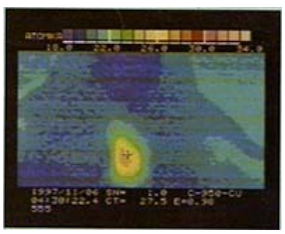

Figure 4

Clinical and histopathologic studies

Histopathologic studies have been performed in vitro and in vivo at the Ludwig Maximillian University of Munich starting five years ago (Haffner C et al, 1998) and by other authors in Milan (Haffner C et al, 1999).

The first concern was to determine if the temperature increase produced inside the canal might, although brief damage the periodontal tissue. Therefore a high-speed infrared camera was installed which provides a colour scale of temperature. The highest increase outside the canal takes place at the apical area verifying histologically that there is no damage in the periodontal tissue, in spite of repeated use of high frequency current, due to the insulation provided by the dental cement (Figures I to 5). The temperature variation depends on the amount and condition of the existing pulp tissue. In cases of necrotic pulp the temperature increase is clearly lower.

The next step was to check the elimination of biological material present in the canal (neuro-vascular tissue, cellular components and connective tissue) with an electronic microscope. Evaluation of the radicular surface following the discharge of current showed similar results in both in vitro and in vivo studies. This was the disappearance of the pulp tissue, with the dentinal tubules perfectly clean and free of smear layer and debris (Figure 6). The area not reached by the discharge of current appears desiccated, but not vaporised (Figure 7),

therefore results were improved by repeated application of the electro- magnetic current (Figures 8 to 9) at different levels in the root canal (apical, middle and coronal thirds) (Figures 10 to 12).

Regarding the bacterial content, research was performed in 30 uniradicular teeth divided in two groups, the first inoculated with e. coli and the second with s. aureus, both stocks radio-actively marked with 99mTc/TI/2 99m in concentrations of 3.fix 106bacteria/ml. The amount of bacterial suspension and the use of a buffer make a reasonable certainty of complete contamination of the accessory canals.
The use of germs with radioactive markers allows an extremely accurate residual germ count after treatment. It has been demonstrated that the Endox Endodontic System eliminates the germs in both primary and accessory canals.

The clinical studies have been performed at the Department of Odontoiatrics of Seville over three and a half years (Morella E et al; Chaparro Heredia A et al, 2000; Murillo del Castillo C et al, 2000) and by other authors (O'Neill LJ, 1974).

Materials and methods
We have performed 400 endodontic treatments using the Endox Endodontic System as per instructions in both monoradicular and multi-radicular teeth. In addition we have used this system in 12 cases requiring re-treatment. The patients' ages were between seven and 68 years. Clinically, 303 presented irreversible pulpitis symptoms, of which 45 presented evident inflammatory signs (abscess). The remaining 97 did not demonstrate clinical symptoms, though after examination we found 43 vestibular fistulas.

In 225 cases radiologically we observed slight widening in the periodontal area, 91 showed radiolucent periapical images, the rest had normal X-rays.

The endodontic treatment was performed in a single session in 381 cases and in two sessions for the remaining 19. As these cases came in as emergencies, we did not have enough time to complete the therapy, leaving a cotton ball without any medication in the pulp chamber after performing the electronic devitalisation. Patients showing inflammatory symptoms received medication for one week, except in three cases where the patients had to travel and the endodontic treatments were done without previous prescription and in the same session.

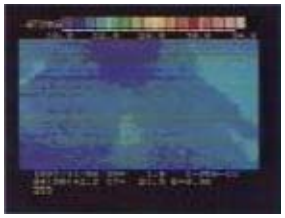
Figure 5

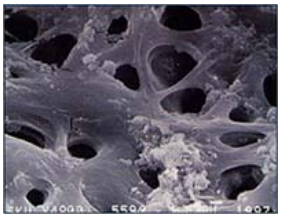
Figure 6

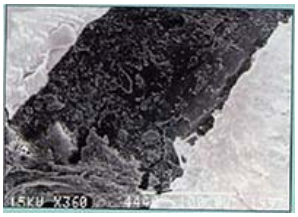
Figure7

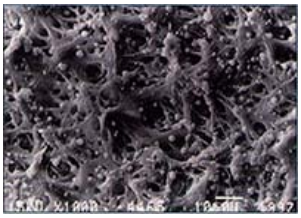
Figure 8

The Endox endodontic system has a control panel (Figure 13) with several controls (buttons, indicators) and two sockets, one for the positive needle electrode, the other for the neutral electrode. The positive needle electrode is made up of a probe with a socket for insertion of the appropriate needle, depending on the canal size (Figure 14) to be treated, and the neutral electrode made up of a metallic cylinder to be held by the patient in his/her hand to close the circuit. The Endox endodontic system should not be used on patients with pacemakers, contact lenses (in which case they should be removed) and cellular phones should be turned off to avoid interference. There are three different needles (Figure 15), a black one, longer and larger diameter, for molars (30 mm long/0.20mm diameter), a shorter red one with a slightly smaller diameter (24mm/0.15) and a Teflon covered green needle to be used exclusively for apical measurements in cases of teeth with necrotic pulp.

The working area should be dry and isolated with a rubber dam to avoid any metallic contact and the patient must always be anaesthetised to avoid the prickly sensation produced by the passage of an electromagnetic current. We proceed to open the pulp chamber until the canal openings are clear. In the case of haemorrhage we used H202 for haemostasis and dry the root canals openings with paper cones or cotton. In chronic pulpitis cases, wash the canals with physiological solution to permit the current to flow.

Sodium hypochlorite or other saline solution should be avoided as they interfere with the passage of the current. Next we gave the metallic neutral electrode to the patient and slowly inserted the selected needle inside the canal (Figure 14). The Endox endodontic system will emit beeping sounds that become slower when the apical constriction has been reached. If we pass beyond the apex the sound becomes continuous, at which point Endox

will not function. We then proceed with the high frequency discharge, as per instructions with several discharges at different canal heights (apical, middle and coronal thirds). Later, we manually check with a conventional reamer

for existing pulp debris, then not finding any, the root canal lumens were widened to ISO 25 and ISO 30 sizes, depending on the case and blocked with A26 and Gutta Percha.

In re-treatment cases it is necessary to reach to the apex even though the filling material is not fully eliminated, checking with an X-ray the length to apex and placing a rubber stopper at said length proceeding as per instructions.

Results

When radiologically verified, the apical measurement results show 96.5% accuracy, presenting difficulties in cases with necrotic pulp where we could not establish it properly. During the electromagnetic devitalisation phase, 230 patients experienced a prickly sensation at the discharge of high frequency current in spite of being anaesthetised. During the post-operatory stage, out of the 400 patients, only 37 noted a slight discomfort of any kind when chewing during three and a half years in the treatments performed with the Endox endodontic system.

In the 12 cases in which it became necessary to perform re-treatment, we could eliminate the Gutta Percha in the apical third but without reaching the apex with the needle as recommended in the instructions.

Figure 9

Figure 10

Figure 11

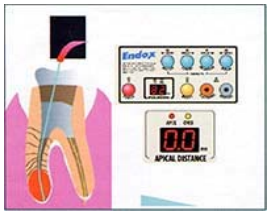

Figure 12

Discussion

The results of the apical measurement are comparable to other endometric studies (Inoue N, 1977; Blank LW et al, 1975; Bal CS et al, 1989; Stein JT et al, 1990), as much as we use this system or another of the third and fourth generation. Normally, studies regarding the accuracy of different apex locators, including the Endox endodontic system, show slightly variable results for the same apex locator in different studies. These differences may be due to different factors including use conditions and the instrument calibration, but undoubtedly all of these instruments require a learning period to become familiar with handling them. We think these differences are mainly because of the lack of familiarity and skill that all dentists experience when trying a new technique or product.

Apex locators are very reliable but not to the point of replacing X-rays. Nevertheless, they help us to reduce the number of X-ray shots and errors of the under-instrumentation and the over-instrumentation type.

Many patients, although anaesthetised, feel the passage of the high frequency current as a prickly sensation. This disturbance is minimal and it does not upset the patient. Nevertheless, it is notable that this disturbance is stronger if the electrical grounding is inadequate or non-existent in the dental office.

We all know that endodontic treatment is based on a system that we can consider consists of three basic stages: the diagnostic phase in which we determine the pathological status to establish a correct treatment plan, a cleaning phase in which we meticulously remove the content within the canal and we prepare an adequate shape for a correct blocking, and last the obturation phase in which we use the most adequate materials to obtain the most hermetic possible sealing which allows the periradicular tissue to heal (Keller ME et al, 1990; Fouad AF, 1990).

A key factor in obtaining long-term success is precisely the meticulous cleaning of the canals, because germs and their waste products are free in the root canal and colonise in varying degrees in the dentinal tubules. In conventional endodontics this is achieved by chemical and mechanical means, as it is compulsory to widen the radicular lumen to ensure that the bactericide material penetrates to the apex. Nevertheless we cannot have access to the lateral canals system and dentinal tubules, and this has been demonstrated by means of an electron microscope, which has shown the presence of infected residuum with bacteria and toxins (smear layer). On one hand, smear layers tend to seal dentine and on the other it may interfere with the obturation and re-infect the root canals (Ducoin F, 1991). Luckily for us, in most cases it will be sufficient just to reduce the bacteria content or an

altered residual flora and fewer pathogens to obtain success in the treatment. In such an important matter as this, we think the use of the Endox Endodontic System contributes very efficiently with respect to conventional

endodontics as it is perfectly demonstrated in the histopathological studies that the liberated energy, in form of heat, eliminates the pulpal tissue and the root canal system germs as well as the smear layers, avoids re-infection and assures one of the bases for long term success, as is Schilder's opinion (Lucci A et al, 1993). It has been noted that the best results are obtained with a repeated application of the high frequency current inside the canal (apical third, medium third and coronal third), mainly in wide canals and in teeth with necrotic pulp. This is with the certainty that no damage exists for the peri-radicular tissues as demonstrated previously, it being impossible to pass the electric shock through the apex because of the safety system provided in the Endox endodontic system.

Additional advantages

Another advantage derived from this system is the reduction of biomechanical instrumentation as it not necessary to enlarge the root canal, just enough to allow a correct obturation. This contributes on one side to an important reduction in working time, nearly 40%, which is very important in our dental offices and on the other it prevents the risk of vertical fractures when we eliminate a substantial amount of dentine, thus weakening the root.

Another important aspect is obtaining a more compact obturation of the root canal as the fulguration leaves a smooth intra-radicular surface as demonstrated by the histopathological studies.

A frequent symptom after endodontic treatment is post-operative pain. This takes place often as a result of manipulation, use of irrigant, filling extrusion material, vertical fractures and so on.

It is reasonable to suppose that being able to be more conservative with the biomechanical instrumentation and the reduced use of irrigation substances provides a better post-operative condition. This is demonstrated in this study in conformity with other previous studies and with Dr Oliveres (Chaparro Heredia A et al, 2001) who has performed over 1,500 treatments with Endox. Just 37 patients out of 400 noted a slight discomfort when chewing and we think that this is due to the concomitant periodontal process. We have not noted any post-operative difference between the cases performed in a single session and those in two sessions. We have not found any kind of complications during three and a half years with the 400 treatments performed and we think, like other authors, that the prognosis is the same for vital or necrotic teeth independently of the existence of radiolucent lesions of pulpal origin.

Figure 13

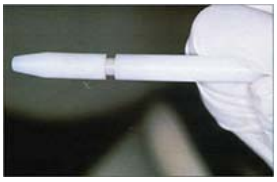

Figure 1

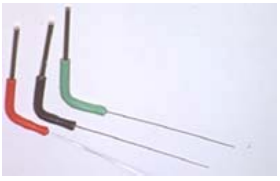

Figure 15

Figure 16

The results achieved in the cases of endodontic re-treatments make us very optimistic because, for a week after the procedures, all the vestibular fistulas disappeared in patients who presented them, including the case where we could not eliminate all the filling of the apical third, although we reached the apex with Endox. Nevertheless, and in honour of the truth, we believe that any medical technique must be analysed as a function of the results of a minimum period of five years study, and in fact, the five years have already elapsed since the first Endox applications at the Universities of Munich and Milan and our own experience at the University of Seville. This provides statistics enough to confirm that we have an important advance in endodontic therapy before us. Endodontics by means of high frequency discharge simplifies our work, considerably improves the results, helping the patient with a shorter procedure, less post operative pain and safer, providing a higher prognosis of success. This provides a better quality service to our patients, which we owe to them as good professionals.

A complete list of references accompanying this article can be obtained from the editor by emailing: newsdesk@dentistry.co.uk.

This article is taken from Dentistry Magazine, 20th November 2003

For further information, contact Dental Practice Systems:
Tel: 01438 820550, Fax: 01438 821425, Email: dps@btinternet.com, Web: www.d-p-s.uk.com