Endodontic irrigants
Gary Glassman discusses the uses of irrigants

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With the introduction of modern techniques, success rates of up to 98 per cent are being achieved. 1 The ultimate goal of endodontic treatment per se is the prevention or treatment of apical periodontitis such that there is complete healing and an absence of infection, 2 while the overall long-term goal is the placement of a definitive, clinically successful restoration and preservation of the tooth. For these to be achieved, appropriate instrumentation, irrigation, decontamination and root canal obturation must occur, as well as attainment of a coronal seal.

There is evidence that apical periodontitis is a biofilm-induced disease. A biofilm is an aggregate of microorganisms in which cells adhere to each other and/or to a surface. These adherent cells are frequently embedded within a self-produced matrix of extracellular polymeric substance. The presence of microorganisms embedded in a biofilm and growing on the root canal system is a key factor for the development of periapical lesions. 1,7

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The challenge for successful endodontic treatment has always been the removal of vital and necrotic remnants of pulp tissue, debris generated during instrumentation, the dentine smear layer, micro-organisms, and micro-toxins from the root canal system. 8

Success depends on a number of factors, including appropriate instrumentation, successful irrigation and decontamination of the root canal space to the apices and in areas such as isthmuses. These steps must be followed by complete obturation of the root canals, and placement of a coronal seal, prior to restorative treatment.

Several irrigants and irrigant delivery systems are available, all of which behave differently and have relative advantages and disadvantages. Common root canal irrigants include sodium hypochlorite (NaOCl), chlorhexidine gluconate, alcohol, hydrogen peroxide and ethylenediaminetetraacetic acid (EDTA). In selecting an irrigant and technique, consideration must be given to their efficacy and safety.

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There is no other root canal irrigant that can meet all these requirements, even with the use of methods such as lowering the pH, increasing the temperature, or adding surfactants to increase the wetting efficacy of the irrigant. 15

However, although NaOCl appears to be the most desirable single endodontic irrigant, it cannot dissolve inorganic dentine particles and thus cannot prevent the formation of a smear layer during instrumentation. 20

Calcifications hindering mechanical preparation are frequently encountered in the root canal system, further complicating treatment. Demineralising agents such as EDTA have therefore been recommended as adjuncts in root canal therapy. 20

Thus, in contemporary endodontic practice, dual irrigants such as NaOCl with EDTA are often used as initial and final rinses to circumvent the shortcomings of a single irrigant. 20 These irrigants must be brought into direct contact with the entire canal-wall surfaces for effective action, particularly in the apical portions of small root canals. 20

The combination of NaOCl and EDTA has been used worldwide for antisepsis of root canal systems. The concentration of NaOCl used for root canal irrigation ranges from 2.5 to six per cent, depending on the country and local regulations; it has been shown, however, that tissue hydrolysis is greater at the
NaOCl has a broad antimicrobial spectrum, including but not limited to E. faecalis. NaOCl is superior among irrigants that dissolve organic matter. EDTA is a chelating agent that aids in smear layer removal and increases dentine permeability, which will allow further irrigation with NaOCl to penetrate deep into the dentinal tubules.

**General safety precautions**

Regardless of which irrigant and irrigation system is employed, and particularly if an irrigant with tissue toxicity is used, there are several general precautions that must be followed. A rubber dam must be used and a good seal obtained to ensure that no irrigant can spill from the pulp chamber into the oral cavity. If deep caries or a fracture is present adjacent to the rubber dam on the tooth being isolated, a temporary sealing material must be used prior to performing the procedure to ensure a good rubber dam seal. It is also important to protect the patient’s eyes with safety glasses and protect clothing from irrigation splatter or spill.

It is very important to note that while NaOCl has unique properties that satisfy most requirements for a root canal irrigant, it also exhibits tissue toxicity that can result in damage to the adjacent tissue, including nerve damage. Should NaOCl incidents occur during canal irrigation. Furthermore, Salzgeber reported in the 1970s that apical extrusion of an endodontic irrigant routinely occurred in vivo.

This highlights the importance of using devices and techniques that minimize or prevent this. NaOCl incidents are discussed later in this article.

**Irrigant delivery systems**

Root canal irrigation systems can be divided into two categories: manual agitation techniques and machine-assisted agitation techniques. Manual irrigation includes positive-pressure irrigation, while NaOCl has unique properties.

Regardless of which irrigant and irrigation system is employed, the phenomenon of apical vapour lock should be considered.

**Apical vapour lock**

Since roots are surrounded by the periodontium, and unless the root canal foramen is open, the root canal behaves like a close-ended channel. This produces an apical vapour lock that resists displacement during instrumentation and final irrigation, thus preventing the flow of irrigant into the apical region and adequate debridement of the root canal system.

Apical vapour lock also results in gas entrapment at the apical third. During irrigation, NaOCl reacts with organic tissue in the root canal system, and the resulting hydrolysis liberates abundant quantities of ammonia and carbon dioxide.

This gaseous mixture is trapped in the apical region and quickly forms a column of gas into which further fluid penetration is impossible. Extension of instruments into this vapour lock does not reduce or remove the gas bubble, just as it does not enable adequate flow of irrigant.

The phenomenon of apical vapour lock has been confirmed in studies in which roots were embedded in a polyvinylsloxane impression material to restrict fluid flow through the apical foramen, simulating a close-ended channel. The result in these studies was incomplete debridement of the apical part of the canal walls with the use of a positive-pressure syringe delivery technique. Micro-CT scanning and histological tests conducted by Tay et al. have also confirmed the presence of apical vapour lock.

In fact, studies conducted without ensuring a close-ended channel cannot be regarded as conclusive on the efficacy of irrigants and the...
The apical va-
pour lock may also explain why no effect apical to the orifice of the irrigation needle in a closed root canal system. Fluid ex-
change and debris displacement were minimal. Equally important to his primary findings, Chow set forth an im-
mutable paradigm for endodontic irrigation: “For the solution to be mechanically effective in removing all the particles, it has to: (a) reach the apex; (b) create a current (force); and (c) carry the particles away.” The apical vapour lock and consideration for the patient’s safety have always prevented the thorough cleaning of the apical 3mm. It is critically important to determine which irrigation system will effectively irrigate the apical third, as well as isthmuses and lateral canals, and in a safe manner that prevents the extrusion of irrigant.

Manual agitation techniques
By far the most common and conventional set of irrigation techniques, manual irrigation involves dispensing of an irrigant into a canal through needles/cannulae of variable gauges, either passively or with agitation by moving the needle up and down the canal space without binding it on the canal walls. This allows good control of needle depth and the volume of irrigant that is flushed through the canal. However, the closer the needle tip is positioned to the apical tissue, the greater the chance of apical extrusion of the irrigant. This must be avoided, were NaOCl to extrude past the apex, a catastrophic accident could occur.

Manual-dynamic irrigation
Manual-dynamic irrigation involves gently moving a well-fitting gutta-percha master cone up and down in short 2-3mm strokes within an instrumented canal, thereby producing a hydrodynamic effect and significant irrigant exchange. Recent studies have shown that this irrigation technique is significantly more effective than automated-dynamic irrigation and static irrigation.

Machine-assisted agitation systems
Sonic irrigation: Sonic activation has been shown to be an effective method for disinfecting root canals, operating at frequencies of 1-6kHz. There are several sonic irrigation devices on the market. The Vibringe allows delivery and sonic activation of the irrigating solution in one step. It employs a two-piece syringe with a rechargeable battery. The irrigant is sonically activated, as is the needle that attaches to the syringe. The EndoActivator is a more recently introduced sonically driven canal irrigation system. It consists of a portable handpiece and three types of disposable polymer tips of different sizes. The EndoActivator has been reported to effectively clean debris from lateral canals, remove the smear layer, and dislodge clumps of biofilm within the curved canals of molar teeth.

Ultrasonics: Ultrasonic energy produces higher frequencies than sonic energy but low amplitudes, oscillating at frequencies of 25-50kHz. Two types of ultrasonic irrigation are available. The first type is simultaneous ultrasonic instrumentation and irrigation, and the second type is referred to as passive ultrasonic irrigation operating without simultaneous irrigation (PUI). The literature indicates that it is more advantageous to apply ultrasonics after completion of canal preparation rather than as an alternative to conventional instrumentation.

PUI irrigation allows energy to be transmitted from an oscillating file or smooth wire to the irrigant in the root canal by means of ultrasonic waves. There is consensus that PUI is more effective than syringe needle irrigation at removing pulpal tissue remnants and dentine debris. This may be due to the much higher velocity and volume of irrigant flow that are created in the canal during ultrasonic irrigation. PUI has been shown to remove the smear layer; there is a large body of evidence with different concentrations of NaOCl. In addition, numerous investigations have demonstrated that the use of PUI after hand or rotary instrumentation results in a significant reduction in the number of bacteria or achieves significantly better results than syringe needle irrigation.
to the apical third can be enhanced by using ultrasonic and sonic devices that demonstrate acoustic micro-streaming and cavitation.4,5,6 Acoustic micro-streaming is defined as the movement of fluids along cell membranes, which occurs as a result of the alternating endo- and exo-dentinal mechanical pressure changes within the tissue. Cavitation is defined as the formation and collapse of microbubbles or cavities in a fluid.

The Apical Vapour Lock theory was first clinically demonstrated64 to also include the middle third by Vera: “The mixture of gases is originally trapped in the apical third, but then it might grow quickly by the nucleation of the smaller bubbles, forming a gas column that might only impede penetration of the irrigant into the apical third but also push it coronally after it has been delivered into the canals.”61,62 Munoz demonstrated that passive ultrasonic irrigation (PUI) and EndoVac are more effective than sonic irrigation in removing irrigant by a microcannula in delivering irrigant to WL of root canals.66 This begs the efficacy question. Two recently published studies examined this issue with both systems by testing their ability to eliminate microorganisms during clinical treatment from infected root canal systems.67,68 Paiva found that after a supplementary irrigation procedure using PUI with NaOCl that 25 per cent of the samples produced positive cultures. Cohenca’s study examining the efficacy of the EndoVac found no microbial growth either after post instrumentation irrigation or at the one-week occlusion appointment. When questioning these different results one must remember that microbial hydrolysis via NaOCl is an equilibrium reaction. Hand demonstrated that a 50 per cent reduction of NaOCl concentration resulted in a 500 per cent reduction in dissolution activity. Accordingly, one must consider both the delivery of the irrigant to full working length, via PUI or apical negative pressure and the total volume of NaOCl exchanged. The volume of an instrumented file that is attached to a positive pressure delivery system is also advantageous in its ability to deliver irrigant from the chamber to the working length without causing undue extrusion into the periapical tissues.69,70,71

The volume delivered by conventional syringe needle irrigation within the same period,72 and resulted in significantly more debris removal at 1mm from working length than did needle irrigation. During conventional root canal irrigation, clinicians must be careful when determining how far an irrigation needle is placed into the canal. Recommendations for avoiding NaOCl incidents include not binding the needle in the canal, not placing the needle close to working length, and using a gentle flow rate when using positive-pressure irrigation.73

The EndoVac apical negative-pressure irrigation system has three components: the Master Delivery Tip, MacroCanna and MicroCanna. The Master Delivery Tip simultaneously delivers and evacuates the irrigant (Fig. 2). The MacroCanna is used to suction irrigant from the chamber to the coronal and middle segments of the canal. The MicroCanna or MicroCanna is connected via tubing to the high-speed suction of a dental unit.

The Master Delivery Tip is connected to a syringe of irrigant and the evacuation hood is connected to a syringe of irrigant via the Master Delivery Tip and evacuation hood is connected to a syringe of irrigant via the Master Delivery Tip and evacuation hood is connected to a syringe of irrigant via the Master Delivery Tip and evacuation hood is connected to a syringe of irrigant via the Master Delivery Tip and evacuation hood is connected to a syringe of irrigant via the Master Delivery Tip.

The ISO size 0.52mm diameter stainless steel MicroCanna has four sets of laser-cut, laterally positioned offset holes adjacent to its closed end, 100µg in diameter and spaced 100µg apart. This is attached to a finger piece for irrigation of the apical part of the canal when it is positioned at working length. The MicroCanna can be used in canals that are enlarged with endodontic files to ISO size 55 or larger.

Pressure-alternation devices Rinsing irrigates the canal by using pressure- suction technology. Its components are a handpiece, a cannula with a 7mm exit aperture, and a syringe carrying irrigant. The handpiece is powered by a dental air compressor and has an irrigation speed of 6.2ml/min. Research has shown that it has promising results in cleaning the root canal system, but more research is required to provide scientific evidence of its efficacy. Periapical extrusion of irrigant has been reported with this device.74,75

During irrigation, the Master Delivery Tip delivers irrigant to the pulp chamber and apically by negative-pressure irrigation is delivered by negative pressure to working length. A recent study showed that the volume of irrigant delivered was significantly higher than the volume delivered by conventional syringe needle irrigation within the same period,76 and resulted in significantly more debris removal at 1mm from working length than did needle irrigation.

Although the exact aetiology of the NaOCl incident is still uncertain, based on the evidence from actual incidents and simulation of the associated tissue trauma, it would appear that an intravenous injection may be the cause. The volume delivered by conventional syringe needle irrigation was performed with apical negative-pressure irrigation.77,78

Efficacy

Although a devastating endodontic NaOCl incident is rare,14 the cytotoxic effects of NaOCl on vital tissue are well established.14,79,80 The associated sequelae of NaOCl exposure have been reported to include acute threatening airway obstructions,28,81 facial disfigurement requiring multiple corrective surgical procedures,35 permanent palatal or labial perforation,7,82,83 trigeminal neuralgia,84-86 and the least significant consequence - tooth loss.14,88

Safety first

In order to compare the safety of different intra-canal irrigation delivery devices, an in vitro test was conducted using the worst-case scenario of apical extrusion, with neutral atmospheric pressure and an open apex.10 The study concluded that the EndoVac did not extrude irrigant after deep intra-canal delivery and suctioning of the irrigant from the chamber to full working length, whereas other devices did. The EndoActivator extruded only a very small volume of irrigant, the clinical significance of which is not known.

Mitchell and Baumgartner tested irrigant (NaOCl) extrusion under clinical conditions from the apical third with permeable agarose gel.89 Significant loss of NaOCl was observed. Although the EndoVac system was compared with positive-pressure needle irrigation. A well-controlled study conducted by Gondim et al. found that patients experienced less post-operative pain and swelling,89,90 and subjectively, when apical negative-pressure irrigation was performed (EndoVac) than with apical positive-pressure irrigation.91,92

The results indicate that despite an apparent correlation between the volume delivered and the volume required to saturate the NaOCl incident is rare,107 the volume delivered is often more than that required to fill the entire canal.108 This has led some to suggest that the volume delivered by conventional syringe needle irrigation is inadequate to clean the root canal system.109 The volume delivered is often more than that required to fill the entire canal.108 This has led some to suggest that the volume delivered by conventional syringe needle irrigation is inadequate to clean the root canal system.109

Fig. 2 EndoVac set-up. Fig. 3 Irrigation accident with apical leakage.

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In vitro and in vivo studies have demonstrated greater removal of debris from the apical walls and a statistically cleaner result using apical negative-pressure irrigation in closed endodontal systems with sealed apices. In an in vivo study of 22 teeth by Siu and Baumgartner, less debris remained at 1.5mm from working length using apical negative-pressure compared to use of traditional needle irrigation, while Shim et al. found in an in vitro study of 69 teeth comparing traditional needle irrigation with apical negative-pressure that these methods both resulted in clean root canals, but that apical negative pressure resulted in less debris remaining at 1.5 and 3.5mm from working length.114,116

When comparing root canal debridement using manual-dynamic agitation or the EndoVac for final irrigation in a closed system and an open system, it was found that the presence of a sealed apical foramen adversely affected debridement efficacy when manual-dynamic agitation was used, but did not adversely affect results when the EndoVac was used. Apical negative-pressure irrigation is an effective method to overcome the fluid-dynamic challenges inherent in closed root canal systems.117

Microbial control
Hockett et al. tested the ability of apical negative pressure to remove a thick biofilm of E. Faecalis, finding that these specimens rendered negative cultures obtained within 48 hours, while those irrigated using traditional positive-pressure irrigation were positive at 48 hours.99

One study found that apical negative-pressure irrigation resulted in similar bacterial reduction to use of apical positive-pressure irrigation and a triple antibiotic in immature teeth.120

In a study comparing the use of apical positive-pressure irrigation and a triple antibiotic that has been utilized for pulpal regeneration/vascularization in teeth with incompletely formed apices (Trimix = Cipro, Minocin, Flagyl) versus use of apical negative-pressure irrigation with NaOCl, it was found that the results were statistically equivalent for mineralised tissue formation and the repair process.109 Using apical negative pressure and NaOCl also avoids the risk of drug resistance, tooth discolouration, and allergic reactions.110

Conclusion
Since the dawn of contemporary endodontics, dentists have been syringing NaOCl into the root canal space and then proceeding to place endodontic instruments down the canal in the belief that they were carrying the irrigant to the apical termination. Biologically, scanning electron microscopy, light microscopy, and other studies have proven this belief to be in error. NaOCl reacts with organic material in the root canal and quickly forms microbubbles at the apical termination that coalesce into a single large apical vapour bubble with subsequent instrumentation. Since the apical vapour lock cannot be displaced via mechanical means, it prevents further NaOCl flow into the apical area. The safest method yet discovered to provide fresh NaOCl safely to the apical terminus to eliminate the apical vapour lock is to evacuate it via apical negative pressure. This method has also been proven to be safe because it always draws irrigants to the source via suction - down the canal and simultaneously away from the apical tissue in abundant quantities.115 When the proper irrigating agents are delivered safely to the full extent of the root canal terminus, thereby removing 100 per cent of organic tissue and 100 per cent of the microbial contaminants, success in endodontic treatment may be taken to levels never seen before.

Editorial note: A complete list of references is available from the publisher. This article has been reprinted in part from G. Glassman, Safety and Efficacy Considerations in Endodontic Irrigation (PenHill, January 2011).

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Endodontic dentistry in daily practice use (16,000 cases)

Dr. Robert Teeuwen - A Practitioner of Endo Techniques according to Sargenti

How did you learn about N2? During my years of study at the University of Bonn, Germany (May 1959 – February 1965) N2 was the preferred root canal filling material of the dental clinic. When assisting in my father’s dental practice I used to work with N2 as well – occasionally replaced by Endomethasone, Riehler and Diaket.

Since when have you been familiar with the method developed by Dr. Sargenti?

I first learned about the Sargenti method in the years 1968 – 1970. This method convinced me as it is efficient and time-saving, which was very convenient for me as I had opened my own dental practice in July 1969 and never knew how to cope with the heavy patient traffic. So I was forced to think about measures to work efficiently – not only in endodontics. From April 1972 I worked with an assistant according to my instructions. Since the day...
of opening my practice, all of mine and the assistant’s dental treatments have been recorded. All of these practice diaries do still exist, however, the patient’s file cards are no longer complete. So I was able to count the number of endodontic treatments.

How many root canal treatments have you done so far? I did 16,608 endodontic treatments with N2 in permanent teeth from 7/1969 to 12/2005. My assistants made it to 10,456.

N2 endodontic treatments in the time from 04/1972 to 12/2001. For comparison: In his book “Endodontic Therapy” (5th ed. 1998), the renowned endodontist Weine reports about 18,500 endodontic treatments he had personally done.

Only 22 (five done by myself, 17 by an assistant) out of more than 8,800 computerised vital endodontic treatments between the years 1985 – 1999 required more than one appointment. I haven’t counted thousands of vital amputations and endodontic treatments of deciduous teeth.

How are your experiences with these cases?

Several times I tried to treat deciduous teeth with Ca(OH)2. I judged the subsequent pain rate as being too high. It applies to all (dental) medical disciplines that the practitioner virtually loses face the more a patient has to see the doctor because of unsolved problems (pain after endodontic treatment, surgery, pressure marks).

How were you convinced to use N2 permanently?

If not overfilled, a vital endodontic treatment with N2 never ends up in pain, including endodontic treatment of deciduous teeth.

How did you get into contact with Dr. Sargenti?

I wanted to meet Dr. Sargenti whilst on vacation in Switzerland in 1989. He gave me quite a short shrift at his doorstep. In the year 1990, it was Dr. Sargenti who asked me for contact. He had suffered from a stroke and was in need of help. He knew that I had done a lot of endo

Fig 1 1994: X-ray control after 13 years, NAD

Fig 4 1983: Tooth 16 reimplanted with existing parulis

Fig 6 2007: X-ray control after 24 years

Fig 5 1996: X-ray control after 13 years, NAD
treatments and due to this experience he asked me to represent the N2 method in German speaking countries. After I had studied the endodontic scientific literature, prepared a lecture in English and presented unse- teen treatment cases to the AES (American Endodontic Society – professional association of N2 users in the US), Sargenti paid for my trip to an AES session in the United States, where I received the “fellowship”. After presentation of yet another lecture – out of the 40 completed cases I was bestowed the title of “mas- tership”.

My mentioning of more than 16,000 treatments does not nec- essarily mean that they all met high quality standards. Root canal treatment of molars was quite in disorder. Until mid of 1985, however, X-ray control di- rectly after root canal treatment was only done in exceptional cases, so we did not know what we were doing. Consequently, frequent failures due to poor root filling quality could be ob- served after years. At least this proved that the Sargenti method does not necessarily protect against failures due to poor root filling quality. In case of heavy overfilling, I prophylactically made a “Schroeder Airation” (= artificial fistulation). In most of the cases, gangrenous teeth could also be treated in one ap- pointment. In case of short root filling, I finished treatment by apectomy; the other teeth were treated by trephination.

Whether apectomy or treph- ination 2 – treatment has to be done efficiently without much fumbling to avoid subsequent problems. Acute exacerbations do very rarely occur after apec- tomy/trephination. I occasionally treated a “via falsa” with perforation and N2 leakage into the bone successfully by fistulation as well. I use the ex- pression “occasionally” as this happened only very rarely, thus there had been little chance to do the therapy. Basically I re- gard the perforation area as an artifi- cial foramen, a foramen not normally belonging here.

In few cases, I tried Diaket out as root filling material with following fistulation. Treatment is also successful with Diaket, however, I mind that it doesn’t pour off the lentulo the perfect way N2 does. It hardens as fast as N2, though. Root filling was followed by a noticeable apexo- my/fistulation after 20 minutes. I also know surgeons who use either N2 or Diaket.

What does the N2 method comprise?

- No canal rinsing
- Use of the root cement as sole root canal instrument

Rubberdam for safety’s sake for manual manipulations only
- Use of the strongly antimicro- bial N2 as root canal filling material (the powder contains five per cent formaldehyde, EU approval as medical device 6/1996)
- Root canal treatment in one appointment is the goal (no problem in vital teeth, in non- vital teeth with reservation – in the latter case definitely complete reaming during the same appointment). Alternatively in one appointment finished by “Schroeder Airation”. According to Sargenti, the “Schroeder Air- ation” comprises a wide treat- ment spectrum: pain prophylax- is during root canal treatment of non-vital teeth in one ap- pointment plus after overfilling of vital teeth roots, apart from that for pain therapy
- According to Sargenti, point condensation of the root filling is not necessary, however, it looks better on X-ray.

What do you think about the frequently discussed ingredient formaldehyde: Systemic distribution in the body ac- cording to literature?

There is only an ambivalent an- swer to this question. The Block study with dogs as test animals circulates in literature. First of all, it has to be made clear that results from animal experi- ments cannot simply be adopt- ed for humans due to different metabolisms. So formaldehyde features different half-lives in different animal species. In hu- mans, half-life of formaldehyde amounts to 1 – 1.5 minutes. In an N2 court hearing in the US, the former leading US toxolo- gist Brent stated that the results of the Block study had been misinterpreted. Due to the short half-life, formaldehyde had no longer bonded to marker C14. Correctly, the systemic distri- bution of C14 in the organs had been detected, however not for for- maldehyde. At this point, I also wish to criticise laboratory tests (in vitro). An adoption of in vitro results has to be judged skepti- cally as the enzymes of the liv- ing organism are missing.

Have you ever experienced intolerances or allergic reac- tions to N2 in your practice?

I have never seen an immediate or time-delayed allergic reaction against N2, my patients, who have been provided with N2 root fill- ings, actually do suffer from for- maldehyde allergy. Surely the (not verified) estimated num- ber of unreported cases might have been much higher. As can be learned from literature, al- lergies against dental material do occur extremely rarely. In addition, self-reported cases do not necessarily stand up to sci- entific examinations.

There is a lot of criticism against N2. What do you think about this and what would you answer the critics?

Counter question should be whether the respective critic re- fers to literature or whether the argumentation is based on own practical experience. A hand-

ful of cases are not sufficient, though. Regarding literature, it has to be clarified whether a so- called “publication bias” does exist, meaning that disagree- able results are not even being published.

What do you think is the rea- son for the fact that the N2 method is accepted in other countries?

Despite of professorship con- cerns, N2 has been approved in the EU. Even Sweden has reaccepted the method in 2011 as in some publications, the es- tablished root filling quality has not been presented convincingly – and especially it could not have been proven that newer methods deliver better results. In Oral Surg Oral Med Oral Pa- thology 2002, 94 (6): 651 – 652, Figdor G. had recorded that en- dodontologists have only achieved a modest progress over the last 100 years. This compiles with the statement of Ng et al. in Int. Endod J. 2008, 41:511-Outcome of root canal treatment: system- atic reviews of literature – Part 2 Influence of clinical factors”. As dental technology had pro- gressed strongly within the last 40 – 50 years, a higher probabili- ty of success could have been expected. Endodontologists, how- ever, deny this non-increase stat- ing that they are treating more risky endodontic cases now.

I’d like to add that the AES has in vain struggled to obtain N2 approval by the FDA (Food and Drug Association, respon- sible for approval of medical devices) for many years now. It is not a comfort for the local N2 users that so far also no other root canal filling material ob- tained an approval. It is shameful that hundreds of X-ray pho- tos requested by the FDA could not be relocated by the FDA.

Is there any evidence of can- cerogenicity or mutagenicity from your point of view?

Cancerogenicity or mutagenicity could not have been proven by now. However, formaldehyde has been classified as human carcinogenic some years ago, i.e. for pharyngeal tumor after i.e. for pharyngeal tumor after consumption of a high dosage. Like in many cases, the same rule must be obeyed: Toxicity depends on the dosage. Still the statement on formaldehyde of the German Federal Medical Association (Dr. Arztetblatt 1987; 84, issue 15; 8:207 – 8:2112) comprising that exceeding of a threshold value is the precondi- tion for cancerogenicity keeps valid.

What do you think about mul- tiply described parahrexis or dysesthesia after N2 treat- ment?

I wrote on these topics in “Endo- dentie 4/1996: 523 – 536; Dam- age to the N. alveolaris inferior by overfilling with root canal material”. I could refer to a sim- ilar discussion about his statement that the frequently reported nerve damages caused by N2 cannot be ascribed to the physical characteristics of the material but to its worldwide use. Naturally, such incidents are only published with some years’ delay. Unfortunately, the use of N2 has strongly been de- creasing for years, which cannot be only attributed to the statements of the dental author- ities but is also caused by the variety of new products. Each and every new technique and promoted root canal filling ma- terial on the healthcare market claims to offer a sophisticated product respectively material for the patients’ and practitioners’ interest. Could you ever blame your colleagues for taking hold of the new products?

Have you ever observed bone or gingival necrosis after the use of N2?

I had to diagnose a gingival ne- crosis only once after following Sargenti’s proposal to put an N2-soaked stripe of tamponade into the gingival pocket.

Publications:


- Studied Univer- sities Germany
- Editor of journal 1991

- Opening of dental practice 1968

- Joint practice with son 1994 – 9/2005
- Retired from active dentistry 9/2006

Fig 7 Tooth 43 with incomplete root canal filling and apical lesion

Fig 8 X-ray control after 19 months, NAD

Fig 9 Product Shot


About the author

What do you think about the importance of histology – what per cent of the histologically examined endo teeth are free from inflammation and why? We have never had any case of false negative resp. false positive X-ray find- ings. Apart from that, evaluation of one and another X-ray picture, done at intervals of some months, often results in a different diagnosis.

What have you done complaints or discontent with N2 treatment from the patients’ side?

No.

What do you think about multi- tidedly described pareshrexis or dysesthesia after N2 treat- ment?

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