By Fred Michmershuizen, USA

Fred was an inspiration for me for all these years, ever since we met over 30 years ago,” said Gerald N. Glickman, DDS, MS, professor and chair at Texas A&M College of Dentistry. “He brought a world of enthusiasm and knowledge to the global endodontic community. I will miss him dearly.”

“Fred always had a smile and was known as the ‘Canadian Mountie’ for his outfit that he wore at every dental meeting to promote the IFEA meeting in Vancouver in 2007,” remembered Samuel O. Dom, DDS. “He was truly dedicated to the Canadian Academy of Endodontics and its place in global endodontics. His passing will never be forgotten.”

“Cheerish my photo of us with him dressed as a Mountie when he was president of IFEA,” said Dr. William Ben Johnson. “Fred and I started out as endodontic colleagues, then became friends. So much so he would go snow skiing with me even when he didn’t care for skiing, and I would drink wine with him when I preferred scotch. I’ve lost a friend.”

After his retirement from practice, Weinstein continued to travel to dental meetings to keep his knowledge of the specialty current and to visit with his many friends.

For many years, Weinstein was editor in chief of roots magazine, the international C.E. magazine of endodontics, published by Dental Tribune America.

“He had a gentle heart of gold, compassion and sincerity and a smile that would illuminate a room.”

Weinstein’s accomplishments within the profession were notable. He served as an assistant clinical professor at the University of British Columbia and was a past president of the Canadian Academy of Endodontics, the British Columbia Society of Endodontics, the Inter specialty Society of British Columbia and the International Federation of Endodontic Associations (IFEA). He was a member of the Royal College of Dentists, and he was a fellow of the American College of Dentists and the International College of Dentists.

He served on advisory boards for several leading dental manufacturers, and he lectured extensively throughout the world. He also served as a volunteer endodontist at the 2010 Vancouver Winter Olympics, and performed root canal treatment on world boxing champion Sugar Ray Leonard in the 1970s.

Weinstein was born in 1939 in Winnipeg, Manitoba. He graduated from the University of Manitoba at the age of 22 with a degree in dentistry, and then he went on to study endodontics at the University of Pennsylvania School of Dental Medicine in Philadelphia, under the tutelage of Dr. Louis Grossman, known as the “Father of Endodontics.” After receiving his Certificate in Endodontics from the University of Pennsylvania in 1969, he moved his family to Vancouver and established an office in the Fairmont Medical Building, where he would go on to practice for more than 40 years.

“We loved his patients, and he equally enjoyed teaching and lecturing throughout the world to advance the learning within dentistry,” his family wrote in an obituary published in the Vancouver Sun.

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MTA placement with the Produits Dentaires (PD) MAP System

By Dr. Mauro Amato, Switzerland

More than 20 years ago, Torabinejad et al. (1993) first described a new root-end filling material called mineral trioxide aggregate (MTA). MTA showed in vitro better sealing ability than amalgam or Super EBA when used as a root-end filling material. Later, several in vivo and in vitro studies demonstrated more applications for MTA. Pulp capping, apexitification, repair of root perforations, and root-end filling are commonly described clinical procedures to seal the pathway of communication between the root canal system and the external surface of the tooth. The application of MTA was first described as being achieved with aid of plastic or metal spatulas (Torabinejad and Chivian 1999). Unfortunately, proper placement was not possible in this manner.

Therefore, Produits Dentaires introduced a universal carrier system for clinical and surgical MTA placement. Its Micro-Apical Placement (MAP) System offers different application points for every clinical situation. The Intro Kit and the Universal Kit are for orthograde obturation and the Surgical Kit for retrograde obturation. The NiTi Memory Shape tips can be manually shaped to any required curvature. After autoclave sterilization, the needle returns to its initial shape. With the use of the MAP System, proper placement of MTA has become an easy task for every dentist.

In combination with the MAP System, Produits Dentaires offers a white MTA specially developed for placement with the MAP System. The optimized practical size means economical application for each treatment. There are many indications for the PD MTA White, and with the MAP System, proper placement is easy in every situation.

Pulp capping
Vital pulp therapy has become more popular in recent years. Calcium hydroxide has been the most common material for pulp capping, but MTA showed even better results in biocompatibility and outcome (Aguilar and Linusawoo 2016). Cases with large carious pulp exposure can be treated successfully with partial pulpotomy and MTA as a capping agent, keeping teeth vital (Figs. 1a–e).

Apexitification
In order to prevent extrusion of root canal filling material in immature teeth with open apices, MTA is used as an apical plug. The results of many studies have shown that MTA induced apical hard tissue formation more often and its use was associated with less inflammation than with other test materials (Simon et al. 2007) (Figs. 2a–g).

Repair of root perforations
Accidental perforation of the pulp chamber or of the root canal significantly changes the prognosis of the tooth. Perforation repair with a biocompatible sealing material such as MTA may save compromised teeth (Ments et al. 2014) (Figs. 3a–e).

Apical surgery
MTA is the material with the most favorable outcome as a root-end filling material for apical surgery. MTA has been associated with significantly less inflammation, cementum formation over MTA and regeneration of the periapical tissue (Torabinejad and Chivian 1999) (Figs. 4a–f).

Dr. Mauro Amato is a lecturer and researcher at the Department of Periodontics, Endodontics and Cariology of the University of Basel in Switzerland. Dr. Amato is a committee member of the Swiss Society for Endodontology. He can be contacted at mauro.amato@unibas.ch
Preservation of root cementum: A comparative evaluation of power-driven versus hand instruments

By Bozbas E, Dominić F, Cakobrat AS, Dautovic S, Guida L, Aydin MS, Mariotti A, Pilloni A, Italy

Background
Ginisik et al suggested that cementum plays an important regulatory role in periodontal regeneration. One of the major goals of periodontal treatment is the removal of pathogenic micro-organisms by scaling and root planning. In the past the misconception was to obtain a root surface with smooth and hard surface characteristics that was free of endotoxins which resulted in the removal of the subgingival plaque and calculus deposits, and the removal of all or most of the cementum. Recent studies have reported that endotoxins were not located within cementum and removal of ‘diseased’ cementum was not necessary for a successful periodontal treatment. Saygin et al concluded that preservation of cementum on the root surface was necessary for new attachment and as a source of growth factor. Hence non-aggressive removal of cementum is essential for optimal periodontal health and regeneration.

Ultrasonics with new shaped tips and subgingival air polishing devices has been developed for removal of root accretions with minimal root damage. Air polishing has been suggested as a treatment modality for root debridement resulting in probing depth reductions and removal of subgingival biofilm. No scientific evidence exists today showing the loss of root substance or surface roughness produced by either ultrasonics or Air polishing.

Aim
To assess the amount of cementum remaining following in vivo root instrumentation as well as the surface characteristics of the retained cementum.

Material and Methods
- 48 caries free single rooted teeth in 27 patients diagnosed with severe chronic periodontitis with periodontal probing depth (PFD) ≥5 mm in at least two sites per tooth with radiographical bone loss of more than two thirds of root length and scheduled for extraction were included in this study.

- Teeth were randomly divided into four treatment groups: Instrumentation and as a source of growth factor. Hence non-aggressive removal of cementum is essential for optimal periodontal health and regeneration.

Results
Remained cementum:
- Percentage of coronal cementum remaining following subgingival instrumentation was 84% for U, 80% for U + AP, 94% for AP and 65% for HC.
- The amount of retained cementum with AP was significantly greater than with HC.

- Smoother root surfaces were produced by the HC followed by the AP.
- Conventional and apical sections showed that AP produced the least amount of cementum loss and therefore the greatest retention of residual cementum.

- Root surfaces instrumented by U or U + AP presented grooves and scratches.

- Time taken to complete root instrumentation:
- Shortest time taken was using AP and the longest time was with U + AP.
- AP required 3% less time for root preparation in comparison to HC, whereas U + AP needed 30% more time.

Conclusions
- Air polishing was significantly more effective and superior in preserving cementum.
- Hand instrumentation using curettes was most effective in removing cementum in comparison to ultrasonic or hand instruments.

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- Paul Abbott, Australia
- Is there still a role for medicaments in endodontics?
- Antonis Chaniotis, Greece
- Management of severe curvatures and complex anatomy with controlled memory res. A new approach
- Samuel O. Dorn, USA
- Extirpation-Replantation: An alternative surgical technique
- Mo K. Kang, USA
- Pub tissue regeneration: Challenges and new outlook
- Sergio Kuttler, USA
- “Yes, present and future of endodontic files”: Where science meets technology
- Tara Mc Mahon, Belgium
- Does heat treated NiTi facilitate endodontic therapy?
- Cliff Ruddle, USA
- Endodontic Disinfection: 3D Irrigation
- Michael Solomonov, Israel
- Contemporary approaches to instrumentation of non-round root canals
- Yoshi Terauchi, Japan
- Predictable and minimally invasive method to retrieve a separated file
- Andreas K. Braun, The Netherlands
- Root resorption after dental trauma - Findings and treatment possibilities
- Gustavo De-Deus, Brazil
- The relationship among reincorporation, gliadipath and canal scouting
- Gianluca Gambarini, Italy
- 3D endodontics: Shaping root canals in 3 dimensions
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- Seung Jong Lee, Korea
- Are the viable cells the only predictor for clinical success?
- Zvi Metzger, Israel
- Early diagnosis and biomechanics of vertical root fractures
- Frank Setzer, USA
- Management of iatrogenic errors by creating a mechanical reproducible glide path
- Dafna Ova, Israel
- Endodontic microsurgery
- Hiroyuki Tomoshima, Japan
- Soft tissue management in endodontic microsurgery
- Yosef Nahmias, Canada
- How to prevent instrument breakage by creating a mechanical reproducible glide path (don’t rotate, reciprocate)
- Hayag Shemesh, The Netherlands
- Ibrahim Abu Tahane, Jordan
- Re-establishing biological order in microperforating the pulp-dentin complex
- Ghassan Yared, Canada
- Management of second mesio-buccal, narrow and curved canals with only one reciprocating instrument
- Lecture titles are tentative and subject to change.
Top performance Flexible NiTi file
HyFlex EDM performs well internationally

By Coltene

In the course of two major international events in the dental industry, Swiss dental specialist Coltene interviewed over 130 dentists and endo experts about their experiences with its latest NiTi file system. The results of the product tests are more than impressive: 98% of the participants would continue to use the HyFlex EDM for the treatment of their endodontic cases, even after the tough test.

The necessary cutting edge
Every two years, both the International Dental Show in Cologne (IDS for short) and the Congress of the European Society for Endodontology (ESE Congress) serve as an international platform for professionals with an interest in endodontics to exchange experiences between colleagues. Thus, both events in 2017 provided the ideal occasion for a large-scale test campaign for the latest NiTi file generation from Coltene. Selected dentists and joint practices throughout Europe were given the opportunity to put the flexible HyFlex EDM’s file system through its paces under heavy-duty use. In fact, HyFlex EDM files are up to 70% more resistant to cyclic fatigue compared to traditional NiTi files. A special combination of material surface and tapering allows a significant reduction in the number of files used without compromising the preservation of the natural root canal anatomy. These smart features were also evaluated positively in the test and the dentists use the robust high performance instruments primarily for cases where they want to produce reliable results quickly with a reduced number of files.

Additional files sizes allowing more flexible application
Due to limited access endo experts often want more flexibility from their instruments. Pre-bendable tools can extend the horizon into new dimensions. Particularly in a limited working space, modular nickel-titanium systems display their full strength. With a total of seven highly flexible file variants, Coltene offers a wide-ranging HyFlex NiTi program. In addition to the usual lengths of 25 mm, all preparation files of the popular EDM series are also available in 21 mm working length. The application of the more agile, shorter models is particularly recommended in cases of posterior molars and in patients with cranio mandibular problems.

The new HyFlex EDM 20/0.5 prepation file augments the existing Hyflex EDM line. The additional file enables fans of the flexible NiTi range to treat curved channels only with the efficient EDM files. After creating a glide path with the glide path file 20/0.5, the new file with the same taper allows minimally invasive, fast preparation of the canal. Subsequently the actual shaping can be done in the usual manner with the universal file Hyflex EDM OneFile, size 25. Depending on the channel anatomy, apical preparation can be finished with EDM files up to ISO size 60. Even in those large sizes the files work safely and without transportation of the canal center.

Further product information:
https://hyflex.coltene.com/

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Success evaluation of N2 treated teeth with open apical foramen. A retrospective study

By Dr Annette Joschko, Dr Robert Teuswenn & Prof. Jerome Rotgans, Germany

Abstract

59 teeth with open foramen were identified in a general dentist practice during the years 1985–2006. 75 of which could be followed-up by X-ray after an average time of 70 months (follow-up X-ray). 40 teeth were subject to vital extraradicular (VIT), 28 teeth to vital amputation (VITA) and seven teeth with necrotic pulp underwent conservative root canal treatment (RT). Apexitisic success rate amounted to 85.5% (VITA 90.5%, VITA 85.7%, non-vital RT 97.6%). Another 12% could be judged as partial success in molars, as a certain number of the molar roots showed apicification, however, others not yet. The percentage difference of a successful apicification between vitally extraradicular and root canal treatment of non-vital teeth was significant (p = 0.0195). Apicification result was irrespective of the filling level of root canal treated teeth as well as of endodontic success.

Endodontic failures resulted in two cases (3.3%). Statistic significance was found regarding failure rate of VITA (15%) and root canal treatment of non-vital teeth (28.6%, p = 0.0195).

Within the observation period 19 out of the 59 teeth with open foramen (32%) were extracted. There was a significant difference regarding extraction frequency between the VIT group (4.6%) and the non-vital group (52%, p = 0.0195).

Introduction

Endodontic treatment of teeth with incomplete root growth poses a special challenge. In young patients, the necessity for endodontic treatment results from an accident or profound caries. Aside from damage control, this treatment aims at promoting tooth maturation including narrowing respectively closure of the apical foramen (apicification) and possibly root extension (apexogenesis).

According to Zehdow (1997) the following treatment options are commonly used:

- For vital teeth: Pulpotomy (VitA) with subsequent conservative root canal treatment (RT)
- For non-vital teeth: – other RT or
  – RT in connection with apicocrysin/tetradenrode root canal filling or
  – inducing of bleeding with root canal filling in the coronal root part only.

Kraakow et al. (1997) disagree of a VITA inevitably following root canal filling (Joschko)2002 points out that the often diverging roots of immature teeth exclude a dense root canal filling, and that open apical foramen promotes overfilling. Some authors, like Konuusland et al. (1996) and Huft et al. (2005), state that the dental pulp may simulate an apical periodontitis in the area of the open apical foramen.

Various methods favouring maturation of the immature teeth are described. Surgical interventions turned out to be less promising (Kreter 1999, Khoury 1999, Herforth 1998) obtained a very high healing rate of apical periodontitis with ibufride deposits, however the success rate regarding stimulation of hard tissue induction only amounted to 3% versus 85% with calcium hydroxide (Ca(OH)2). Hermann (1920, 1930) introduced calcium hydroxide as material with osteogenic potential. Frank (1966) was the first to use it as medical dressing in teeth with incompletely root growth. These dressings should be replaced every three months for a period of six through 18 months (Cvek 1972) and Frolig (1985), however, do favour a replacement of the dressings only in case of pathology. The long treatment duration—and thus loss of patient compliance—as well as a decrease of fracture resistance (Cvek 1972, Andreasen, Munksgaard 2002, Andreasen, Munksgaard 2003, Andremes, Munksgaard and Bakland 2006, Trope 2006) are regarded as adverse features of the calcium hydroxide method.

As formaldehyde also features an osteogenic potential (Urban 1979), tests with formocresol versus calcium hydroxide were made as well. Within a pulpotomy study, Spedding et al. (1965) judged formocresol as being more appropriate for apicification. Latest literature prefers mineral trioxide aggregate (MTA) over calcium hydroxide (Andresen et al. 2006, Schwartz et al. 2008, Schäfer 2003, Shabahang et al. 1999) as well as IlMegley et al. (2006) made a comparison between mineral trioxide aggregate and calcium hydroxide ending up in favour of MTA.

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A prospective study, Simon et al. (2007) report on 43 one-stage MTA treatments, which were followed up after a control period of at least 12 months (up to 36). 65% of apical lesions were completely healed and an apical barrier could be observed in 11 cases (26%). 78.7% were free from apical periodontitis, whereas apicification took place in only 64 out of 75 cases (85.5%). The time period for control of apical development was clearly longer, though, amounting to 70 months.

From the advice with various medicaments, the ‘revascularisation therapy’ was established also (Ito et al. 2003, Hüllmann et al. 2008, Bese et al. 2009, Cohn et al. 2012, Garcia-Goly and Murray 2010) provoking a light bleeding into the pulp by puncturing the apex. Dressing is placed coronary. MTA, calcium hydroxide, formocresol or a triple antibiotic paste. The latter one provided thicker canal walls than calcium hydroxide respectively formocresol. Also the growth length was stronger versus MTA application (Heblemsder 2004).

Based on the knowledge that formaldehyde preparations have a similar (necrotizing, osteogenic) effect to the pulp like calcium hydroxide, the secondary author of this study as long-time owner of a general dental practice suggested an analysis of endodontic treatment cases with open apical foramen regarding apicification/openogenesis, which had been carried out by Joschko (2013) as then doctoral candidate from which this article reports.

Material and method

99 endodontic treatments of teeth with open apical foramen were taken...
from the files of the practice examined in this study in the years 1985 through 2006. Treatment method was the so-called N2 method according to Sargenti and Richter (1954), which meant no canal rinsing and application of the paraformaldehyde-containing N2. Rubberdam was not used. The N2 powder contained 5% formaldehyde before admission by the EU, afterwards the content was decreased to 5%.

Four cases were excluded.

- A non-vital case where the initial X-ray did not clearly reveal whether the apical radiolucency of both roots was a matter of apical periodontitis or apical papilla.
- A VitA case was extracted allo loco a few days up to 18 months after VitA. X-ray was insufficient in the third case. Vit of an upper molar
- In the fourth case, the patient did not show up again after devitalization of an upper premolar.

Thus, 95 cases to be judged remained, of which only two non-vital teeth were treated in a two-stage therapy. 93 cases were treated in one appointment, inclusive definite filling. For root canal filling, the N2 powder was mixed with N2 liquid to a creamy texture, a harder consistency was needed for VitA. N2 application for root canal filling was done by lentulo, for VitA a carrier instrument was used to bring the material into the excavated pulp cavity up to 1–2 mm into the canal access.

The 95 anonymous made cases were clinically followed-up without recall at an average of 73 months after treatment. 75 cases underwent X-ray control (follow-up X-ray) after an average of 70 months. 44 cases as single tooth X-ray in parallel technique and 11 cases as orthopantomogram.

Judged as endodontic failure were:
- Pain or fistula at treated tooth,
- Development of apical periodontitis,
- Linging or newly developed apical periodontitis.

Treatment success of the 75 cases was analysed in two modes considering the questions:
- Did apexification/apexogenesis occur?
- Did the apex remain unaffected of apical periodontitis?

In multi-rooted teeth with different apical diagnosis, the worst diagnosis was assumed as being valid for the tooth. A double magnifier served as diagnostic aid. Three persons evaluated the X-rays independently from each other. The doctoral candidate (author AJ), a dentist with ten years of professional experience and the practice owner (author RT). The final diagnosis resulted from the consensus of the three ratings.

Statistic significance was assumed for an error assumption of $p < 0.05$ for comparison of two parameters and calculated by means of the logrank test.
Avocado's endodontic success rate with/without root growth had an average of 2.2 years. Those with root growth amounted to 9.5 years, those without root growth had an average age of 2.1 years. Overall, an apical determination success was found in 65 cases (83 %, confidence interval 77.2–93.1 %) in nine months. However, no significant statistic clarification was attempted. Maturation processes of the immature teeth was observed on the basis of the 49 cases of non-vital teeth, with open apical foramina in different intervals. A first follow-up X-ray was available after an average of 34 months (87.6 % of all cases were treated) and featured advancement, whereas the status of the other cases remained unchanged.

Not considering the nine partial suc- cesses as mentioned above, an apica- lisation success rate with/without root growth of 86% (confidence interval 80.3–91.6 %) was determined in the present study. According to the data of the VitA group, the success rate of the VitE group was significantly higher (confidence interval 77.2–93.1 %). The non-vital group versus the non-vital group with p = 0.0217. The percentage difference of apica- lisation success rate with/without root growth had a probability of error of p = 0.0393 and VitA versus non-vital group with p = 0.0024. A significant difference could be determined in the present study between the VitE group and the non-vital group with p = 0.0024.

Apexification success in root-filled teeth proved not to be dependent on the filling level (p = 0.2441).

Ten endodontic failures (13%), nine of which radiographically and one clinically due to fistula formation (see case 2) were observed: six following VitA (9%), two following VitE (7%) and two following conservative root canal treatment of the seven non-vital teeth (28.6%). Regarding endo-dontic success/failure of VitA versus non-vital group, a statistic significance was recognized (p = 0.0582). A statistic sig- nificance could be determined in the present study between the VitA group and the non-vital group (p = 0.0575). Apexification occurred in nine of the ten failures. Patient clas- sification in age groups of younger than 125 months and older than 125 months was not relevant regarding avoidance of endodontic failure (p = 0.494). 19 teeth (40 % of the 95 treated teeth) were treated with calcium hydroxide by 58 practitioners. 21 months af- ter MT A treatment of 30-root, non-vital teeth with open apical fora- men Annamalai and Mangora (2009) determined a success rate of 95.1% for their 20 teeth treated by MTA in several appointments. The healing and apexification process was not subject to recall interval. How- ever, advanced growth of the apex could be verified. Two cases featured a root with closed apical periodontitis questionable, 26 % of these cases (N = 11) to the present study (average without extraction, 71 months, with extraction 17 months), possibly due to the different characteristics of MTA versus N2.
The authors Simon et al. (2007) ob- served 45 single rooted teeth with 28 months without root growth had an average age of 20 years. The present study is: 78.8 % positively complete healing in 65%, an incom- plete healing in 30 % and an ‘apical closure in 26 % of these cases (N = 21). The radiographic diagnosis of the present study is: 79.8 % positively without apical periodontitis, 93 % apical periodontitis questionable, 2 % apical periodontitis with 85 % featuring ‘apical closure’ and 94 % root closure. However, a direct comparison between the Simon and the present study is not admissible due to the low number of cases, the different observation periods and the non-coordinated interpretations of the evaluation modalities.

El Mehly et al. (2006) examined 30 pulp vectors (15 CaOE), 15 MTA, 14 of which were first molars, which suggests a comparison with our study. The following assumptions were evaluated: no clinical problems, radiographically apical periodontitis, operated with calcium hydroxide (87 %), but all MTA cases were operated with calcium hydroxide containing N2: 90 % following VitE, 87 % following VitA, 57 % following conservative root canal treatment of non-vital teeth. The success rate of 57.1 % for non-vital teeth should not be taken too seriously because of the 20.5–93.8 % wide confidence interval due to the small number of cases and cases. The presented success referred to the respective teeth as a whole. Another 12 % referred to some molar roots with partly open, partly closed apexes. Shefris and Kobbert (1997) comparatively report on the forma- tion of a hard substance barrier after calcium hydroxide application after 1–3 months in 7–10 % of the cases.

In contrast, the authors Robert and Brant (1973) considered the inter- pretation of an X-ray as being unre- alistic for determination of a possible apical closure matching the Liang et al. (2006) insufficient diagnostic of the pertaical X-ray versus digital volume tomography. X-ray teeth of 2% apical periodontitis with 85 % featuring ‘apical closure’ and 94 % root closure. However, a direct comparison between the Simon and the present study is not admissible due to the low number of cases, the different observation periods and the non-coordinated interpretations of the evaluation modalities.

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