"He brought a world of enthusiasm and knowledge to the global endodontic community"
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 N3I 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 Linuswaanoot 2016). Cases with large cuspial 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 bio-compatible sealing material such as MTA may save compromised teeth (Mints 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 periodontal 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

| Figs. 1a–e: (a) Deep carious lesion. (b) Partial pulpotomy. (c) MTA application with the MAP System and PD MTA White. (d) Filling. (e) Post-op radiograph showing the pulp capping with MTA. |
| Figs. 2a–g: (a) Endodontically treated tooth with fistula. (b) After retreatment, the tooth showed an open apex. (c) MTA application with the MAP System and PD MTA White. Condensation of the MTA with pluggers (d) or paper points (e). (f) MTA plug. (g) Post-op radiograph showing the MTA plug and the reconstruction with a fiber post. |
| Figs. 3a–e: (a) Radiolucency in the cervical part of the canal. (b) Bleeding from the perforation. (c) MTA application with the MAP System and PD MTA White. (d) Original canal and repair of root perforation. (e) Post-op radiograph showing the root canal filling. |
| Figs. 4a–f: (a) Pre-op radiograph with a large periradicular lesion. (b) Periapical surgery. (c) MTA application with the MAP System and PD MTA White. (d) Condensation of the MTA with pluggers. (e) Mirror view of the root-end cavity filled with MTA. (f) Post-op radiograph showing the root-end filling. |
Preservation of root cementum: A comparative evaluation of power-driven versus hand instruments

By Bozbay E, Dominio F, Gokbuget AA, Gourrie S, Guida L, Aydin MS, Mariotti A, Pilloni A, Italy

Background
Grenis 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 planing. 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 calculus. 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
- All cases, single-rooted teeth in 27 patients diagnosed with severe chronic periodontitis with periodontal probing depth (PPD) ≤ 5 mm in at least two sites per tooth with radiographical bone loss of more than three thirds of root length and scheduled for extraction were included in this study.
- Teeth were randomly divided into four treatment groups. Instrumentations were performed with medium power settings.

3. Air polishing with the glycine powder - (Air-Flow Powder Pero, PerioFlow Nozzles, EMS SA) - AP.
4. Hand instruments (Gracey curettes 5/6, 11/12, 13/14 American Eagle, Microsurge, MT, USA) - HC.

Treatment
- One approximal root surface of each tooth was randomly subjected to debridement, and the other approximal surface was used as control.
- Following instrumentation, the teeth were immediately extracted traumatically and analyzed with a dissecting microscope.
- Remaining calculus, root surface roughness and loss of root substance were evaluated along with scratches, gouges, cracks, and any other changes in the cementum that was present.

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.
- Conical and apical sections showed that AP produced the least amount of cementum loss and therefore the greatest retention of residual cementum.

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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World Endodontic Congress
October 4-7, 2018, Coex, Seoul, Korea

Endodontics: The Ultmost Values in Dentistry

Overview

Confirmed Invited Speakers

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
Exodontia-Replantation: An alternative surgical technique

Mo K. Kang
USA
Pub tissue regeneration Challenges and new outlook

Sergio Kuttler
USA
"Not 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
Precise 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 reimplantation, glinepath and canal scouting

Gianluca Gamborini
Italy
3D endodontics: Shaping root canals in 3 dimensions

Seung Jong Lee
Korea
Are the viols the only provider for diseasereimplantation?

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 (don't rotate, reciprocate)

Hayag Shemesh
The Netherlands

Yosef Nahmias
Canada
How to prevent instrument breakage by creating a mechanical reproducible glide path (don't rotate, reciprocate)

Ghassan Yared
Canada
Management of second mesial buccal, narrow and curved canals with only one reciprocating instrument

Lecture titles are tentative and subject to change.
In the course of two major international events in the endodontic industry, Swiss dental specialist COLTENE interviewed over 150 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 Endodontics (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. The necessary cutting edge.

76% of the participants particularly praised the high flexibility that leads to good adaptation in the canal. The pre-bendable files work reliably in all the lengths and sizes currently available on the market without displacing the centre of the canal like the proven HyFlex™ CM files, the HyFlex™ EDM files also possess the so-called “Controlled Memory” effect and are distinguished by their high level of flexibility. In contrast to classic NiTi files, they have almost no recovery effect and can be pre-bent. As a result, the files move perfectly through the centre of the canal, which significantly reduces the risk of ledging, transportation and perforation. During autoclaving, they recover their original shape so that they can be reused safely until they recover their original shape so that they can be reused safely until they recover their original shape so that they can be reused safely until they recover their original shape so that they can be reused safely until they recover their original shape so that they can be reused safely until they recover their original shape so that they can be reused safely until they recover their original shape. As a result, the files move perfectly through the centre of the canal. Like the universal file HyFlex EDM One-Size 60. Even in these large sizes the files work safely and without transportation of the canal center.

The multitude of sophisticated treatment aids, ranging from specially hardened instruments to bio-active obturation materials, reflects the self-image of the Swiss innovation leader. True to the company’s motto “Upgrade Dentistry”, the COLTENE service team regularly asks practice owners and endodontic specialists about their wishes for even more confident work in virtually all situations. This also formed the basis for the development of the production process called “Electrical Discharge Machining” (EDM for short) by the dental manufacturer’s renowned R&D department, which ultimately gave the exceptionally break-resistant files their name. The practice-oriented Endo offer is complemented by a large number of application-related workshops, training materials and personal services.

Full control in the dental practice
As an established Endo provider, COLTENE has been working closely with leading dentists, universities and endo experts for many years. The multitude of sophisticated treatment aids, ranging from specially hardened instruments to bio-active obturation materials, reflects the self-image of the Swiss innovation leader. True to the company’s motto “Upgrade Dentistry”, the COLTENE service team regularly asks practice owners and endodontic specialists about their wishes for even more confident work in virtually all situations. This also formed the basis for the development of the production process called “Electrical Discharge Machining” (EDM for short) by the dental manufacturer’s renowned R&D department, which ultimately gave the exceptionally break-resistant files their name. The practice-oriented Endo offer is complemented by a large number of application-related workshops, training materials and personal services.

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More than just a long-lasting post – VDW’s Double Taper Shape preserves more dentin

**By VDW**

**MUNICH, Germany:** Improved dentin preservation and better aesthetics are two of the convincing advantages of VDW’s DT Posts. These are resulting from VDW’s Double Taper Shape design and quartz fiber technology: the key to a long-lasting endo-dontic treatment success.

For endodontically treated teeth with more than one missing dentin wall the placement of a post to maintain the coronal structure is strongly suggested. To place it properly, it is key to retain as much dentin as possible while preparing the root canal beforehand. VDW’s DT Posts with Double Taper Shape preserve more dentin as the two-stage design corresponds optimally to the morphology of the prepared root canal. Thus, the dentist avoids unnecessary dentin removal to fit in the post.

**Tooth protection and better aesthetics.** The DT Posts break-resistant quartz fiber material has advantageous mechanical characteristics. Its low modulus of elasticity distributes chewing forces correctly and minimizes the risk for root fractures. Thanks to the quartz fiber material’s translucency properties the patient benefits from better aesthetics.

**Safe retention and easy post location.** VDW’s DT Posts offer more convincing features. The Safety Lock® coating ensures maximum bond properties and thus a safe long-standing retention of the post. The thermal reactive color pigments of VDW’s DT ILLUSION® XRO® SL posts enable their location after the placement. Being barely visible at body temperature, they become clearly detectable after cooling below 29° Celsius.


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

**By Dr Anette Joschko, Dr Robert Teuwen & Prof. Jerome Rotgans, Germany**

**Abstract**

95 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 extirpation (VitE), 28 teeth to vital amputation (VHA) and seven teeth with necrotic pulp underwent conservative root canal treatment (RT). Apexification success rate amounted to 85.7% (VHA 90.5%, VIT A 85.7%, non-vital RT 37.6%). 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 extirpated teeth and root canal treatment of non-vital teeth was insignificant (p = 0.0537).

Within the observation period 29 out of the 95 teeth with open foramen (20%) were extracted. There was a significant difference regarding extraradicular extension frequency from the VHA group (64.6%) and the non-vital group (56.3%, p = 0.0069).

**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 (angiogenesis).

According to Zelkow (1996) the following treatment options are commonly used:

- **For vital teeth:** Pulpotomy (VIT A) with subsequent conservative root canal treatment (RT)
- **For non-vital teeth:** – either RT or
  - RT in connection with apicocentric endo-crown root filling or
  - inducing of bleeding with root canal filling in the coronal root part only.

Krakow et al. (1997) disapproved of a VIT A inevitably following root canal filling (Jochko) (2006) points out that the often diverging roots of immature teeth exclude a dense root canal filling, and that open apical foramen permits overfilling. Some authors, like Korsnäsdal et al. (2001) and Haft et al. (2005), state that the dental papilla 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 1992). Herforth (1981) points out that the dental pulp may simulate an apical periodontitis in the area of the open apical foramen.

Endodontic failures resulted in two cases (3.3%). Statistic significance was found regarding failure rate of VIT A (71%) and root canal treatment of non-vital teeth (28.6%, p = 0.0037). Apexification/apexogenesis, which had failed for the open apical foramen regarding apexification, which had been carried out by Jochko (2013) as the long-time owner of a general dental practice.

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 apexification/apexogenesis, which had been carried out by Jochko (2013) as the long-time owner of a general dental practice.

**Material and method**

95 endodontic treatments of teeth with open apical foramen were taken

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**Fig. 1: Probability of survival of the 3 therapy groups with the target criterion “No Extraction”**

**Fig. 2: Time history of the extractions (N = 115)**
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 7% 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 radio lucency of both roots was a matter of apical periodontitis or apical papilla.
- A VITA case was extracted also loco a few days up to 18 months after VITA.
- X-ray was insufficient in the third case, VITA 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, exclusive 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, 40 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,
- lingering 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.

**Result**

The average age of the patients was 10.7 years (6–25). Most cases (N=54) were attributed to mandibular molars (72%), among these mostly the first lower molars with 48 cases (90.5% of the cases to be analyzed), followed by maxillary incisors. 75 cases were subject to one or—in intervals—multiple follow-up X-rays, 40 teeth (53%) were extirpated vital, 28 teeth (37%) were amputated vital and seven non-vital teeth (9.5%) underwent conservative endodontic treatment. Post endodontic clinical control averaged at 73 months (62–271), the follow-up X-rays to be evaluated at 70 months (10–228). In 41 cases, X-ray evaluation was done more than 48 months after endodontic therapy.
The longer therapy dated back, the easier it was to treat, aim apséparation or apgenosis could be verified. Two cases featured open apical foramen, seven patients with open apical foramen, of whom four were finally opened. Matura- tion progress of the immature teeth was observed on the basis of the 49 cases, which were followed at the VITAB group. Results concerning the success rate of the VITAB group showed a success rate of 57.1% (non-vital teeth), whereas the success rate of the VitE group was 85.7% (confidence interval 80.7–99.3%).

Overall, an apséparation success was found in 64 cases (83.3%), confidence interval 77–94.3%. In nine cases, no success was registered when comparing the VITAB group with the VitA group. A statistic significance of 0.005 was found when comparing the VITAB group with the non-vital cases (p = 0.0056). Figure 1 shows the three groups with the probability of success with the aim of no extraction.

Nine teeth (4%) were extracted with- in the first 50 months after treatment. The time history of all extractions is featured in Figure 2. Main reason for extraction was extraction/failure of the natural tooth crown (42%) or an extraction without root growth had an average age of 2.1 years. All 95 cases, which were mentioned in this study, were treated by MTA in several appointments. The generated during this therapy should be solved by MTA in several appointments. The generated during this therapy should be taken too seriously because of the fact that these teeth erupt late and are often luxated/subluxated maxillary front teeth treated with calcium hydroxide by 58 practitioners. 21 months af- ter MTA treatment of 30 single-root, non-vital teeth with open apical foram- en Ammanu and Mangora (2009) determined an apical healing 80%, apséparation 86.6%, root extension 30%. After an observation period of 24–36 months, Holdini et al. (2008) determined a success rate of 85% (N = 47) for their 56 teeth treated by MTA in several appointments. The healing and apséparation process was not subject to recall interval. How- ever, advanced growth of the apices after N2 application over a period of several years could have been well served in the present study (average without extension 71 months, with extension 17 months), possibly due to the different characteristics of MTA versus N2.

The authors Simon et al. (2007) ob- served 49 single rooted teeth with a follow-up time of 20 years. They stated that the natural tooth crown had been had no apical healing in 65%, incom- plete healing in 30% and an ‘apical closure’ in 26% of the cases. 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.

The presented success referred to the respective teeth as a whole. Another 12% referred to some molars with partly open, partly closed apices. Sheehy and Roberts (1997) comparatively report on the forma- tion of a hard substance barrier after calcium hydroxide application after 3–30 months in 7–100% of the cases.

In contrast, the authors Bontempi and coworkers (2008) considered the inter- pretation of an X-ray as being unre- alistic for determination of a possible apical closure matching the liang et al. proof of insufficient diagnostics of the periapical X-ray versus digital volume tomography (DVT) 23 teeth were reexamined according to both techniques two years after endodon- tic treatment. 74% of periapical radio- lucencies could not have been visual- ized with conservative X-ray and 6% with DVT. Despite of the diagnostic de- ficits to be assumed, X-ray in com- bination with a clinical examination remains the only practical method. An inter pretation bias in this study can be largely eliminated due to the consensus finding of the three X-ray evaluators.

While in short-term studies with low case numbers extractions are not mentioned, this study counted 19 extractions, 14 of which were allotted to the first mandibular molars. Thus the mentioned molar cases represents 77.3% of all extractions with a 50.5% share in treatments. This relatively high extraction frequency may be due to the fact that these teeth erupt late as the first permanent molars thus having been exposed to tooth- damaging influences for the longest time.

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. This difference referred to the respective teeth as a whole. Another 12% referred to some molars with partly open, partly closed apices. Sheehy and Roberts (1997) comparatively report on the forma- tion of a hard substance barrier after calcium hydroxide application after 3–30 months in 7–100% of the cases. In contrast, the authors Bontempi and coworkers (2008) considered the inter- pretation of an X-ray as being unre- alistic for determination of a possible apical closure matching the liang et al. proof of insufficient diagnostics of the periapical X-ray versus digital volume tomography (DVT) 23 teeth were reexamined according to both techniques two years after endodon- tic treatment. 74% of periapical radio- lucencies could not have been visual- ized with conservative X-ray and 6% with DVT. Despite of the diagnostic de- ficits to be assumed, X-ray in com- bination with a clinical examination remains the only practical method. An inter pretation bias in this study can be largely eliminated due to the consensus finding of the three X-ray evaluators.

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