_C.E. article
Endodontic retreatment and adhesive restoration of structurally compromised second premolar

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PATENT PENDING
There is always more to learn

I always enjoy myself at dental meetings. It sure is great to connect with compatriots, and there is undoubtedly something different to experience, a novel approach or technique to explore, or new technology to learn about. There is also plenty of printed material available to take home. Perhaps you picked up this very magazine at a dental meeting and are reading it on the plane or train trip home.

Welcome.

For this issue of roots, you can read a report on an endodontic retreatment and adhesive restoration of a structurally compromised second premolar by Dr. Stela Nicheva, Dr. Lyubomir St. Vangelov and Dr. Ivan Filipov of Bulgaria. And speaking of meetings, Managing Editor Fred Michmershuizen has written a report on the many offerings for endodontists that were available at the recent Greater New York Dental Meeting.

You can also read a preview of the American Association of Endodontists Annual Session, which is planned for April 17-20 in Honolulu.

But there's even more.

Every issue of roots magazine also contains a C.E. component. By reading the article on endodontic retreatment and adhesive restoration, then taking a short online quiz about this article at www.DTStudyClub.com, you will gain one ADA CERP-certified C.E. credit. Keep in mind that since roots is a quarterly magazine, you can actually chisel four C.E. credits per year out of your already busy life without the lost revenue and time away from your practice.

To learn more about how you can take advantage of this C.E. opportunity, visit www.DTStudyClub.com. Annual subscribers to the magazine ($50) need only register at the Dental Tribune Study Club website to access these C.E. materials free of charge. Non-subscribers may take the C.E. quiz after registering on the DT Study Club website and paying a nominal fee.

I know that taking time away from your practice to pursue C.E. credits is costly in terms of lost revenue and time, and that is another reason roots is such a valuable publication.

For those of you who will be attending the upcoming AAE meeting in Hawaii, I will see you there. Meanwhile, I hope you will enjoy this issue of roots and that you will take advantage of the C.E. opportunity.

Sincerely,

Fred Weinstein, DMD, MRCD(C), FICD, FACD
Editor in Chief
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Image courtesy of Barry Lee Musikant, DMD, FICD
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In light of the scientific literature concerning the outcome of the endodontic treatment, it doesn’t sound inappropriate that the restoration of the endo-coronal complex has to be completed by the endodontist. In this context the following report presents a complete rehabilitation of a second premolar, including retreatment and definitive restoration.

Teeth that need retreatment are most often grossly decayed due to caries, fracture and/or previous restoration. The endodontic retreatment in such cases is a challenge concerning the isolation, overcoming different obstructions, perforation management (if they exist) and final restoration. The success rate for teeth that exhibit one or more technical problems, such as transportation, strip-
Perforation, perforation or internal resorption, is reported to be 47 percent. Perforations have the most negative influence.

One of the factors that influence the outcome following non-surgical retreatment is the final restoration. Though some authors question the importance of the coronal restoration for the longevity of endodontically treated teeth, it is well accepted that the final restoration is as important for the outcome of the endodontic treatment as the quality of the treatment itself. Still, restoration of endodontically treated teeth remains a controversial issue. In the context of the increasing relevance of biomimetics, adhesively inserted indirect partial tooth-colored restorations are gaining more and more attention. The restoration or mimicking of the biomechanical, structural and esthetic integrity of the teeth in a conservative manner is an advantage that must be used and preferred whenever possible. Still, these types of restorations are an underutilized restorative modality, particularly on endodontically treated teeth compared to crowns. This may be because clinicians and dental technicians are more familiar with crown restorations, the results of which are predictable, and insecure about the adhesive protocol for bonded partial restorations.

Once the decision for tooth-colored partial restoration is made, the operator must choose between two materials — composite or ceramics. The benefits of the former (less abrasiveness and brittleness, lower costs, easy to polish and repair, user friendly) encounter the strength, inertness and biocompatibility of the latter. While some studies indicate that ceramic and composite inlays provide similar fracture resistance on endodontically treated premolars, other suggest that when cuspal coverage is required composite resin may be more beneficial in endodontically treated posterior teeth compared to ceramics pertaining to its greater survival rate, fatigue resistance and more favorable failures. This can be explained with the more friendly stress distribution of composite resin onlays, confined above the cemento-enamel junction.

The present report describes the microscopic retreatment and the definitive restoration of a


A 34-year-old male patient reported to the department of Operative Dentistry and Endodontics, complaining of symptoms from another tooth. The radiographic examination (Fig. 1) revealed inadequate endodontic treatment and perforation with radiolucent area at the apex of tooth 15. The tooth was endodontically treated four years ago.

Medical history was non-contributory. Probing was within normal limits. Local anesthesia with Ubistesine DS was administered. After the removal of the old restoration (Fig. 2) and cleaning up the decay, a pre-endodontic buildup was accomplished. Undercuts were not removed but were blocked out with the composite resin. The operative field was isolated with retraction cord immersed in AlCl₃ and Matrix band (Fig. 3). While keeping the orifice and perforation open with gutta-percha points and Cavit, a total etch technique was performed. Enamel and dentin were covered with adhesive (Prime & Bond NT, Dentsply) and polymerized for 10 seconds. Bulk-fill flowable composite was applied (SDR, Dentsply) and polymerized for 40 seconds in order to create a reservoir for the irrigants during endodontic retreatment (Fig. 4). After the removal of gutta-percha points and Cavit, the real canal (blue arrows) and the perforation (red arrow) were easily accessible (Fig. 5).

Since the artificial canal was previously obturated with a paste, cleaning with a combination of hand files, ultrasonics (Pro Ultra 5 and 6) and irrigation with citric acid was used. To confirm the effectiveness of the cleaning procedure, an intra-operative X-ray was done (Fig. 6). Because of the different angulation of the beam, it seems as if the perforation is on the level of the crestal bone, which is not the real case.

For cleaning and shaping of the real root canal, the following protocol was used:

1) Glide path was established using SS K-files 08, 10, and Path Files 013, 016, 019, (Dentsply Maillefer).

2) The upper two-thirds was prepared using S1 and S2 files from Pro Taper system (Dentsply Maillefer).

3) The apical third used a 20 (04) GTX file (Dentsply Maillefer).

Throughout the whole procedure, irrigation with Citric acid (40 percent, Cerkamed, Poland) and NaOCl (2 percent, Cerkamed, Poland) was used.

We preferred S1 and S2 files because of their ability to brush against the canal wall, which is very useful in cases with oval cross sections, where it is of paramount importance to clean all aspects of the root canal spaces. For the apical one third we choose a landed GTX file, because the canal was very narrow and we wanted to eliminate the possibility to transport the apical foramen. Both artificial and true canal were obturated using warm vertical compaction of gutta-percha and MTA-based sealer (FillApex, Angelus, Brazil). On the post-op radiograph, the preparation and obturation seem short, but this was the reading we repeatedly got with our apex locator (RayPex5, WDV, Germany) (Fig. 7).

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Fig. 6

Fig. 7

grossly decayed perforated maxillary premolar. The reasons for the applied treatment are discussed.

_case report_

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After the completion of the endodontic retreatment, the pre-endodontic buildup was left at place and the endodontic access was restored again with SDR, creating a core, on which an onlay preparation with diamond burs (Mani Inc.) was performed (Figs. 8,9). The enamel margins were exposed and unsupported enamel prisms were removed using fine-grit diamond points. The remaining tooth structure was prepared to create a butt-joint with the restoration margins. Internal line angles were rounded and the walls provided 5- to 15-degree path of divergence. The proximal boxes preparations extended to the existing composite, since they were located in the dentin. The dimensions of the preparation provided at least 2 mm interocclusal clearance, which could be verified on the impression. A condensable silicone impression was taken (Fig. 10). A custom-made provisional restoration was created using direct technique and temporarily cemented with a non-eugenol luting agent (TempBond NE) (Fig. 11). The fitting aspect of the restoration was sandblasted by the dental technician.

At the second appointment after assessment of the prepared restoration, removal of the provisional and cleaning of the preparation the fit and aesthetics of the onlay were evaluated. Rubber dam was placed and the preparation was cleaned with acetone, etched with 37 percent phosphoric acid for 15 seconds, rinsed and dried. The fitting aspect of the restoration was also cleaned with acetone prior to cementation. A dual-cure self-adhesive luting resin (SmartCem2, Dentsply) was applied to the walls of the preparation and the restoration was placed with firm pressure until fully seated. The excess cement was removed with an explorer, a #12 scalpel blade and dental floss in the interproximal area after five-second polymerization that brought the cement to a “rubbery” stage (Figs. 12,13). The restoration was covered with glycerin and finally cured for 60 seconds from each side (Figs. 14,15). The minimal occlusal adjustments were done with fine diamond burs under water coolant. Finishing and polishing were accomplished with the Enhanse system (Dentsply) (Fig. 16).

Once finishing and polishing was done, a 37 percent phosphoric acid gel was applied for 15 seconds to clean the surface of the restoration and to acid etch the marginal enamel. After
washing and drying, the nanofilled adhesive (Prime&BondNT, Dentsply) was applied and permitted to rest for 10 seconds to permeate the surface and margin fissures created by the finishing process. The adhesive was then thinned with air and polymerized for 40 seconds (Fig. 17). At the six-month recall, the tooth was asymptomatic and the patient was completely satisfied (Figs. 18,19).

**Discussion**

This case report demonstrates endodontic retreatment and composite onlay as definitive restoration for a compromised tooth with minimal coronal tooth structure.

The two most important factors in terms of prognosis of treatment of perforations are the age of the lesion and degree of bacterial contamination. In our case, the previous endodontic treatment was done four years ago. The long period of time is not favorable for the prognosis, but since the perforation is in the apical third the likelihood of bacterial contamination is low.

After the patient has been informed, he chooses orthograde endodontic retreatment as a treatment modality.

The material of choice for perforation repair is MTA (mineral trioxide aggregate). Because of the small size and apical position of the lesion, we decided to treat it like a second canal and to obturate with gutta-percha and MTA based sealer. The absence of worsening of the periapical conditions in the six months post-op X-ray (Fig. 19) supports this approach, and the patient is still under observation.

Although still debatable, recent comprehensive meta-analysis by Gillen et al. demonstrates that a well-fitting, bacteria-proof final restoration has the same importance for the long-term prognosis of the endodontically treated tooth as does the well-performed endodontic therapy. Besides the prevention of coronal microleakage, a key factor for the long-term survival of an endodontically retreated tooth appears to be the amount of remaining tooth substance, which is determined by the dimensions of the final restoration. So an ideal treatment option...
for an endodontically retreated tooth seems to be adhesively bonded restoration that preserves as much of the tooth structure as possible.

An endodontically treated posterior tooth presenting with extensive decay is most frequently restored with a post and a crown. That is intelligible, because crowns are a well-established and known, clinically proven restorative modality, and still a considerable amount of research is being performed in this direction.\textsuperscript{15} On the other hand, partial tooth-colored restorations are recognized as valuable alternatives to full coverage crowns, and questions are raised if intracanal posts are necessary at all for an endodontically treated tooth.

Since their introduction in 1980,\textsuperscript{16} indirect laboratory processed composites are being continuously improved in their physical and mechanical properties. Now this restorative option offers adhesive, biomimetic approach far less aggressive than crowns and far less technique sensitive than ceramics.

Achieving a perfect marginal quality with composite onlays, when gingival margins are located in the dentin, continues to be critical even when new adhesive techniques and systems are used.\textsuperscript{17} The application of a composite base underneath indirect composite restorations represents a feasible non-invasive alternative to surgical crown lengthening to relocate cavity margins from an intra-crevicular to a supra-gingival position. This also permits the placement of a rubber dam for absolute isolation. Surgical crown lengthening may also compromise the periodontal tissue support of neighboring teeth.\textsuperscript{18} We did this relocation simultaneously with the pre-endodontic buildup with SDR. This material has the intimate wetting ability of low viscosity composite and in the same time polymerization shrinkage stress similar to regular viscosity composite.

To simplify the procedures for bonding indirect restorations, resin cements have been introduced recently that are promoted as self-adhesive — i.e., do not require a separate adhesive application step. Manufacturers claim that these cements are hydrophilic when mixed (acidic phase) but become hydrophobic (neutral pH) upon reaction with the tooth structure. The bond strengths to the tooth structure are questioned. In our case we decided to additionally etch the enamel margins of the preparation,
although not recommended by the manufacturer, because the procedure is simple and, as Duarte et al., and de Andrade et al. demonstrated, improves the bond strength of the restoration.

We preferred condensation-type silicone impression material for its better ability to reproduce the surface characteristics of low viscosity resin reported by Takano et al.

The surface and margins of the restoration were sealed with filled adhesive. This treatment improves the marginal adaptation, and it could be demonstrated that adhesives are superior to specially designed resin coating materials._

References


About the authors

Stela Nicheva, DMD, graduated in dentistry from Medical University, Plovdiv, Bulgaria, in 2010. Currently she is taking a PhD position at the Department of Operative Dentistry and Endodontology, Faculty of Dental Medicine, Plovdiv-Bulgaria. She may be contacted at stelanicheva@gmail.com.

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Ivan Filipov, DMD, PhD, is associate professor at Faculty of Dental Medicine, Department of Operative Dentistry and Endodontics, Plovdiv-Bulgaria, and maintains his private practice in Dental Center “Avangard.”
Greater N.Y. Dental Meeting offers lots of resources for endodontists

When it comes to learning about the newest procedures and the most innovative products in dentistry, there was no better place to be in late November 2012 than at the Greater New York Dental Meeting (GNYDM). The meeting, held for the 88th time, attracted dental professionals from across the country and around the world. A wide range of offerings were of particular note to endodontists.

The event featured products and services from hundreds of exhibiting companies, plus a plethora of educational opportunities.

The Live Dentistry Arena, which had 425 seats and two big screens so that every seat in the house was a good one, was standing-room-only through much of the meeting. Right next door to the Live Dentistry Arena was the Dental Tribune Study Club C.E. Symposium. The lineup featured lectures on a range of topics, including endodontics.

Dr. Selma Camargo presented “Optimizing Endodontic Treatment with High Intensity Laser Therapy.” She discussed how to identify endodontic disease, treatment possibilities and understand their limitations. Furthermore, attendees could hear how scientific and clinical points of view establish laser therapy indications for endodontics. Attendees learned how to perform such procedures and to implement this type of treatment into their practices.

On the exhibit hall floor, NSK offered the Ti-Max Z, a durable premium handpiece that is claimed to have the smallest head and neck in the industry, as well as an exceptionally low noise level and virtually no vibration.

Coltene Endo showcased its HyFlex CM NiTi files with Controlled Memory, which the company says are up to 300 percent more resistant to cyclical fatigue compared to other NiTi files, which substantially helps reduce the
incidence of file separation. According to Coltene Endo, HyFlex CM NiTi files have been manufactured utilizing a unique process that controls the material’s memory, making the files extremely flexible but without the shape memory of other NiTi files. This gives the file the ability to follow the anatomy of the canal very closely, reducing the risk of ledging, transportation or perforation.

Essential Dental Systems (EDS) offered its Endo-Express reciprocating handpiece and its SafeSiders, designed to eliminate the fear of fracture associated with crown-down systems and the typical shortcomings of the step-back process.

Roydent Dental Products offered 12.5, 15 and assorted packs 06-10 of C-Files, all in 21 and 25 mm lengths. Roydent brand C files are indicated for calcified canals, and they are also ideal for locating canals and instrumenting narrow canals.
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The American Association of Endodontists 2013 Annual Session will offer more than 100 high-quality educational sessions in Honolulu at the Hawaii Convention Center April 17-20. Attendees can earn up to 22.5 hours of continuing education credit by attending the various courses during the meeting, “Endodontics: Exceeding Expectations.” Curriculum varies from nine different tracks. New tracks this year include Endo 2025, Imaging, Pain and Pharmacology and Systemic Health, covering pertinent topics such as tissue engineering, pain management, outcome assessments, medical myths in dentistry and more. “Mega-Session Wednesday,” also new, will allow attendees to delve deeper into a topic of their choice with longer, more in-depth presentations on the first day of the meeting.

“We have educational sessions given by cutting-edge presenters on cutting-edge topics,” said AAE President Dr. James C. Kulild. “Attendees can apply those principles in their own practices in order to increase their quality of care and their value to their referrers and their patients.”

The always popular “Master Clinician Series” and hands-on workshops will feature leading experts in topics such as “Differential Diagnosis of Pain,” “Clinical Application of High Resolution CBCT in Endodontics,” “Maximizing the Value of Your Endodontic Service” and “Functional Crown-Lengthening Surgery.” Attendees can attend one of these workshops for a more hands-on experience in technique and then head to a practice management course or to the exhibit hall to explore specialized endodontic distributors.

In addition to the C.E. opportunities, numerous special events fill the schedule, allowing attendees to network and catch up with old and new friends. The schedule for the meeting sessions start and end earlier this year, allowing guests to explore the beautiful Honolulu surroundings. The AAE Foundation live auction will feature a dunk tank, where well-known members have volunteered to help raise money by testing the fate of the payers’ accuracy. Additionally, during the Grossman breakfast, the American Board of Endodontics will recognize the 86 endodontists who achieved board certification in the past year, the largest class of diplomates ever.

To make the meeting experience seamless and convenient, attendees can download the AAE’s Annual Session app to a smartphone or tablet. Visit your mobile device app store and search for “2013 AAE Annual Session,” or access crwd.cc/AAEAnnual13 from your mobile device. Attendees can also connect with the AAE through the AAE Facebook page at www.facebook.com/endodontists, the AAE YouTube channel at www.youtube.com/rootcanalspecialists and Twitter at www.twitter.com/AAENews.

For more information, to register or to see the full schedule, visit www.aae.org/annualsession. Dental professionals who join the AAE receive a member discount on meeting registration of more than 40 percent._

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PATENT PENDING
Wykle Research has announced the release of two new Calasept Endo products, which it distributes for Nordiska Dental of Sweden, the manufacturer of Calasept and Calasept Plus.

Calasept Irrigation Needles are high-quality, double-side-vented, luer-lock irrigation needles that optimize the cleansing of canals, creating a “swirl effect.”

The needles are available in 27 g or 31 g, in packs of 40 needles. Features include the following:
- Bendability
- Luer-lock hub
- Sterile and disposable
- Designed for ease in cleaning roots
- High-quality stainless steel

Calasept Irrigation Syringes are 3 ml luer-lock, single-use syringes. They are color coded to eliminate risk when using multiple irrigation liquids. They are available in packs of 20 syringes, 10 white and 10 green.

Features include the following:
- High-quality, three-part syringe
- Color coded
- Luer lock

These new products complement Wykle’s popular Calasept line, which includes Calasept and Calasept Plus calcium hydroxide paste for temporary filling of root canals, sold in packages of four syringes with 20 needles. Calasept EDTA is 17 percent EDTA solution. Calasept CHX is 2 percent chlorhexidine solution for irrigation. Both solutions are packaged with a luer adaptor for easy filling of syringes.

Wykle Research distributes Calasept Endo products by Nordiska Dental, a Swedish manufacturer of Dental supplies. Wykle Research and Nordiska Dental will continue to provide new endo products.

For more information, contact Wykle Research at (800) 859-6641 or visit the company online at www.wykleresearch.com.
submissions formatting requirements

Please note that all the textual elements of your submission:

- complete article
- figure captions
- literature list
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must be combined into one Microsoft Word document. Please do not submit multiple files for each of these items. In addition, images (tables, charts, photographs, etc.) must not be embedded in the text document. All images must be submitted separately, and details about how to do this appear below.

If you are interested in submitting a C.E. article, please contact us for additional instructions before you make your submission.

Text length

Article lengths can vary greatly — from a mere 1,500 to 5,500 words — depending on the subject matter. Our approach is that if you need more or less words to do the topic justice, then please make the article as long or as short as necessary.

We can run an extra long article in multiple parts, but this is usually discussing a subject matter where each part can stand alone because it contains so much information. In addition, we do run multi-part series on various topics. In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

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Please use single spacing and do not put extra space between paragraphs. We also ask that you forego any special formatting beyond the use of italics and boldface, and make sure that all text is left justified.

If you would like to emphasize certain words within the text, please only use italics (do not use underlining or a larger font size).

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Please do not "center" text on the page, add special tab stops or use underlines in your text as all of this must be removed manually before layout. If you require a special layout, please let the word processing program you are using help you to do this formatting automatically rather than doing it manually.

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Please number images consecutively by using a new number for each image. If it is imperative that certain images are grouped together, then use lowercase letters to designate the images in a group (i.e., Fig. 2a, Fig. 2b, Fig. 2c).

Insert figure references in your article wherever they are appropriate, whether that is in the middle or end of a sentence, but before the period rather than after. Our preference is to have figure references noted in the appropriate place within the text, as it helps the readers to orient themselves when moving through the article. In addition, please note:

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- Images should be 1 MB in size each

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Also, please remember that you should not embed the images into the body of the text document you submit. Images must be submitted separately from the textual submission.

You may submit images through a zipped file via e-mail, unzipped individual files via email or post a CD containing your images directly to us (please contact us for the mailing address as this will depend upon where in the world you will be mailing them from).

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the international C.E. magazine of endodontics

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