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AAE annual session: Time to come together and learn

If you are like me, you enjoy dental meetings because they bring so many of us together under one roof to learn. The American Association of Endodontists annual session is definitely something to look forward to. It’s certainly one of the highlights of my year.

Perhaps you picked up this copy of roots at AAE15 in Seattle — or maybe at one of the many other spring meetings — and you are reading this on the plane home. That’s good, because this issue includes many helpful articles.

Dr. Steven G. Morrow offers a report on the use and abuse of antibiotics in endodontic treatment. Dr. Rich Mounce shares his knowledge of the new Mani Silk files for canal shaping. Dr. Brett E. Gilbert, in an interview, discusses his experience using the new Sonendo GentleWave system in clinical practice. There are also articles about some other new product offerings.

The article by Dr. Morrow, which originally appeared in AAE’s ENDODONTICS: Colleagues for Excellence newsletter, is being made available in this issue of roots with the permission of the AAE. By reading this article, and then taking a short online quiz at www.DTStudyClub.com, you will gain one ADA CERP-certified C.E. credit. Keep in mind that because 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. You need only register at the Dental Tribune Study Club website to access these C.E. materials free of charge. You may take the C.E. quiz after registering on the DT Study Club website.

You can also access the vast library of C.E. articles published in the AAE’s clinical newsletter by visiting www.aae.org/colleagues.

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. I hope you will enjoy this issue and that you will take advantage of the C.E. opportunity.

For those of you attending the AAE meeting this spring in Seattle, be sure to say hello in person. I’ll also be at several other meetings this spring.

As always, I welcome your comments and feedback.

Sincerely,

Fred Weinstein, DMD, MRCD(C), FICD, FACD
Editor in Chief
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Use and abuse of antibiotics

Author_Steven G. Morrow, DDS, MS

For the past 80 years, antibiotic therapy has played a major role in the treatment of bacterial infectious diseases. Since the discovery of penicillin in 1928 by Fleming and sulfanilamide in 1934 by Domagk, the entire world has benefited from one of the greatest medical advancements in history. The discovery of safe, systemic antibiotics has been a major factor in the control of infectious diseases and, as such, has increased life expectancy and the quality of life for millions of people.

According to the Centers for Disease Control and Prevention, life expectancy of individuals in the United States born in 1900 was 47 years, while those born in 2005 is projected to be 78 years. At the beginning of the 20th century, the infant (< 1 year) mortality rate in the United States was 100/1,000 live births compared to 6.7/1,000 in 2006. The major reason for these phenomenal achievements has been the ability to control infectious diseases.

Development of antibacterial drug resistance

Along with the dramatic benefits of systemic antibiotics, there has also been an explosion in the number of bacteria that have become resistant to a variety of these drugs. The problem is not the antibiotics themselves. They remain one of medicine's most potent weapons against diseases. Instead, the problem is in the way the drugs are used. The inappropriate overuse of antibiotics has resulted in a crisis situation due to bacterial mutations developing resistant strains.

Many worldwide strains of Staphylococcus aureus exhibit resistance to all medically important antibacterial drugs, including vancomycin; and methicillin-resistant S. aureus has become one of the most frequent nosocomial, or hospital-acquired, pathogens. The rate at which bacteria develop resistance to antibacterial drugs is alarming, demonstrating resistance soon after new drugs have been introduced. This rapid development of resistance has contributed significantly to the morbidity and mortality of infectious diseases, especially nosocomial infections.

A nosocomial infection is a hospital-acquired infection that develops in a patient after admission. It is usually defined as an infection that is identified at least 48 to 72 hours following admission, so infections incubating, but not clinically apparent at admission, are excluded. Nosocomial infections are costly, resulting in increased morbidity, requiring longer periods of hospitalization and limiting access of other patients to hospital resources. The direct costs of hospital-acquired infections in the United States are estimated to be $4.5 billion per year. Nosocomial infections also contribute to the emergence and dissemination of antimicrobial-resistant organisms. Antimicrobial use for treatment or prevention of infections facilitates the emergence of more resistant organisms. Patients with infections caused by antimicrobial-resistant organisms are then a source of infection for hospital staff and other hospitalized patients. These drug-resistant infections may subsequently spread to the community.

The British Society for Antimicrobial Chemotherapy published a review in the Journal of Antimicrobial Chemotherapy. This review examined the contributions antibiotic prescribing by general dentists in the United Kingdom has made to the selection of antibiotic resistance in bacteria of the oral flora. The review concluded that inappropriate antibacterial drug prescribing by dental practitioners...
is a significant contributing factor in the selection of drug-resistant bacterial strains.

The American Dental Association reported the results of a survey of antibiotic use in dentistry in the November 2000 Journal of the American Dental Association.7 The authors surveyed all licensed dentists practicing in Canada and found that confusion about prescribing antibiotics and inappropriate prescribing practices were evident, and that inappropriate antibiotic use, such as improper dosing, duration of therapy and prophylaxis are all factors that may affect development of antibiotic resistant microorganisms.

There is a glimmer of hope

A report from Aker University in Oslo, Norway, strongly suggests that bacterial resistance to antibacterial agents can be reversed.8 While dangerous and contagious staph infections kill thousands of patients in the most sophisticated hospitals in Europe, North America and Asia, there is virtually no sign of this “killer superbug” in Norway. The reason? Norway stopped using so many antibiotics.

“We don’t throw antibiotics at every person with a fever. We tell them to hang on, wait and see, and we give them a Tylenol to feel better,” said Dr. John Haug, infectious disease specialist at Aker University Hospital.8 In Norway’s simple solution, there is a glimmer of hope.

The proper clinical use of antibacterial drugs

In 1997, the ADA Council on Scientific Affairs issued a position statement on Antibiotic Use in Dentistry.9 The Council stated: “Microbial resistance to antibiotics is increasing at an alarming rate. The major cause of this public health problem is the use of antibiotics in an inappropriate manner, leading to the selection of dominance of resistant microorganisms and/or the increased transfer of resistance genes from antibiotic-resistant to antibiotic-susceptible microorganisms.”9

The council’s position statement further identified that “Antibiotics are properly employed only for the management of active infectious disease or the prevention of metastatic infection, such as infective endocarditis, in medically high-risk patients.”9

One method of education is to teach from errors rather than principles. Psychologists from the University of Exeter have identified an “early warning signal” in the brain that helps us avoid repeating previous mistakes. Published in the Journal of Cognitive Neuroscience,10 their research identifies for the first time, a mechanism in the brain that reacts, in just one-tenth of a second, to things that have resulted in us making errors in the past. Evaluating the following eight misconceptions or “myths” may help to establish general guidelines to aid us in making clinical decisions regarding the use of antibiotic therapy, thereby leading to optimum use and therapeutic success.11

Myth No. 1: Antibiotics cure patients. Except in patients with a compromised immune system, antibiotics are not curative, but instead function to assist in the re-establishment of the proper balance between the host’s defenses (immune and inflammatory) and the invasive agent(s). Antibiotics do not cure patients; patients cure themselves.

Myth No. 2: Antibiotics are substitutes for surgical intervention. Very seldom are antibiotics an appropriate substitute for removal of the source of the infection (extraction, endodontic treatment, incision and drainage, periodontal scaling and root planing). Occasionally, when the infection is too diffuse or disseminated to identify a nidus for incision, or the clinical situation does not allow for immediate curative treatment, the prudent dentist will choose to place the patient on appropriate antibacterial therapy until such time as curative treatment can be implemented. It is imperative to remove the cause of the infection prior to, or concomitant with, antibiotic therapy.

Primary Reasons for Revision of Infective Endocarditis Guidelines

1. IE is much more likely to result from frequent exposure to random bacteremias associated with daily activities than from bacteremias caused by a dental, GI tract or GU tract procedure.

2. Prophylaxis may prevent an exceedingly small number of cases of IE, if any, in individuals who undergo a dental, GI tract or GU tract procedure.

3. The risk of antibiotic-associated adverse events exceeds the benefit, if any, from prophylactic antibiotic therapy.

4. Maintenance of optimal oral health and hygiene may reduce the incidence of bacteremia from daily activities and is more important than prophylactic antibiotics for a dental procedure to reduce the risk of IE.

Table 1
when the cause is readily identifiable. Whenever antibiotic therapy is used, the risk of bacterial selection for antibiotic resistance is present.

Myth No. 3: The most important decision is which antibiotic to use. To avoid the deleterious effects of needless antibiotics on patients and the environment, the most important initial decision is not which antibiotic to prescribe but whether to use one at all. It has been estimated that up to 60 percent of human infections resolve by host defenses alone following removal of the cause of the infection without antibiotic intervention.

Endodontic disease is infectious. Microorganisms cause virtually all pathoses of the pulp and periapical tissues. There is ample evidence to support that opportunistic normal oral microbiota colonize in a symbiotic relationship with the host, resulting in endodontic infections. The majority of endodontic infections do not require systemic antibiotic therapy when the cause of the infection has been properly managed (complete debridement of the pulp space and proper obturation and sealing of the pulp space from the oral environment).

Apical periodontitis lesions of pulpal origin are generated by the immune system and are the result of intraradicular infections (Fig. 1). In most situations, this inflammatory process successfully eliminates the bacteria emerging from the apical foramen and prevents their spread to the periapical tissues. This process is primarily facilitated by the polymorphonuclear leukocytes that eventually phagocytize and kill the bacteria. Asymptomatic apical periodontitis of pulpal origin does not routinely require systemic antibiotic therapy for satisfactory resolution and healing. Endodontic therapy alone is usually sufficient.

When the intraradicular infection is able to overwhelm the host’s immune response, viable bacteria are able to gain access to the periapical tissues and colonize, forming an active infection. This results in the formation of an apical abscess. A chronic apical abscess usually presents with gradual onset, no to mild symptoms and the presence of a sinus tract or parulis (Fig. 2). The majority of chronic apical abscesses of endodontic origin do not require systemic antibiotic therapy for satisfactory resolution and healing.

An acute apical abscess usually presents with rapid onset, spontaneous pain and swelling, both localized and intraoral, sometimes with exudate present, or with diffuse facial cellulitis. When the abscess is intraoral and localized (Fig. 3), debridement of the pulp space and placement of calcium hydroxide cement will allow for the usual oral flora to be re-established. If an individual receiving long-term parenteral antibiotic therapy for IE requires dental treatment, the treatment should be timed to occur 30 to 60 minutes after the parenteral antibiotic therapy has been delivered. This will allow for the usual oral flora to be re-established. If an individual receiving long-term parenteral antibiotic therapy for IE requires dental treatment, the treatment should be timed to occur 30 to 60 minutes after the parenteral antibiotic therapy has been delivered, and proper obturation and sealing of the pulp space from the oral environment.

**Medical Conditions for Which Endocarditis Prophylaxis is Recommended:**

Premedication is recommended ONLY for patients with the following conditions associated with the highest risk of adverse outcomes from endocarditis:

1. Prosthetic cardiac/heart valve.
2. History of IE.
3. Cardiac transplant recipients who develop valve pathology.
4. One of the following congenital heart diseases:
   - Unrepaired cyanotic CHD, including palliative shunts and conduits.
   - Completely repaired congenital heart defects with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first six months after placement of the material or device (because endothelialization of prosthetic material occurs within six months after the procedure).
   - Repaired CHD with residual defects at, or adjacent to, the site of a prosthetic patch or prosthetic device (which inhibits endothelialization).
5. Special situations and circumstances:
   - Patients already receiving antibiotics—Occasionally, a patient may be taking an antibiotic when coming for a dental appointment. If the patient is taking an antibiotic normally used for endocarditis prophylaxis, it is prudent to select a drug from a different class rather than increase the dose of the current antibiotic. If possible, you should delay the dental procedure until at least 10 days after completion of the antibiotic. This will allow for the usual oral flora to be re-established. If an individual receiving long-term parenteral antibiotic therapy for IE requires dental treatment, the treatment should be timed to occur 30 to 60 minutes after the parenteral antibiotic therapy has been delivered.
   - Failure to administer pretreatment antibiotic dose—If the dosage of an antibiotic is inadvertently not administered before the procedure, the dosage may be administered up to two hours after the procedure. However, administration of the dosage after the procedure should be considered only when the patient did not receive the preprocedure dose.
   - Individuals with kidney dialysis shunts—Individuals with permanent kidney dialysis shunts should be placed on prophylactic antibiotics using the same protocol as for IE.
general medical status. However, when the patient presents with diffuse facial swelling (cellulitis) resulting from an acute apical abscess or an infection with systemic involvement (fever or malaise) (Fig. 4), debridement of the pulp space with placement of calcium hydroxide, surgical incision for drainage, when possible, and an appropriate regimen of systemic antibiotics (oral or IV) are the treatments of choice.

Understanding the enemy is an important factor in winning any battle. The rational choice and use of antimicrobial agents begins with the knowledge of the microorganisms most likely responsible for common dental infections of pulpal origin. The bacterial flora found in endodontic infections is indigenous, mixed (Gram-positive and Gram-negative) and predominately anaerobic. Several species have been implicated with acute apical abscesses. These species include dark-pigmented bacteria (Prevotella and Porphyromonas), eubacteria, fusobacteria and Actinomyces.12

Baumgartner and Xia published a report of the susceptibility of bacteria recovered from acute apical abscesses to five commonly used antibiotics in dentistry. Antibiotic susceptibility data from 98 species of bacteria recovered from 12 acute apical abscesses led to the following conclusions:

1. Pen-V-K is the antibiotic of choice for endodontic infections due to its effectiveness in polymicrobial infections, its relative narrow spectrum of activity against bacteria most commonly found in endodontic infections, its low toxicity and low cost.

2. Clindamycin is the antibiotic of choice for patients allergic to penicillins.

3. While amoxicillin and augmentin (amoxicillin plus clavulanate) demonstrated a higher antibacterial effectiveness than Pen-V-K, due to the broader antibacterial spectrum of amoxicillin and the increased cost of augmentin, the authors recommended that amoxicillin/augmentin be reserved for unresolved infections and patients who are immunocompromised.

4. Metronidazol demonstrated the greatest amount of bacterial resistance and is only effective against anaerobes. Therefore, it should not be used alone for the treatment of endodontic infections.13

Myth No. 4: Antibiotics increase the host's defense to infection. The increased prevalence in organ and tissue transplants, resulting in patients with compromised immune systems, has heightened the interest in the potential effects of antimicrobial drugs on the host’s resistance to infection.15 In vivo and in vitro studies are highly variable and sometimes contradictory. However, the following considerations appear valid: 1) Antibiotics that can penetrate into the mammalian cell (erythromycin, tetracycline, clindamycin and metronidazole) are more likely to affect the host defenses than those that cannot (beta-lactams); 2) Tetracyclines may suppress white cell chemotaxis; 3) Most antibiotics (except tetracycline) do not depress phagocytosis; and 4) T- and B-lymphocyte transformation may be depressed by tetracyclines. The greatest potential harm to the host defenses may result from antibiotics that easily penetrate into the mammalian cell and the least harm is observed with bactericidal, nonpenetrating agents (penicillins and cephalosporins).

Myth No. 5: Multiple antibiotics are superior to a single antibiotic. It is often assumed that a combination of antibiotics is superior to a single carefully chosen antibacterial agent. When the purported benefits of antibiotic combinations are weighed against the possible consequences to the host as well as to the bacterial environment, this assumption is not always reality. The usual sequela to combined antibiotic therapy results in a greater selective pressure on the microbial population to develop drug resistance. The greater the antibacterial spectrum of the antimicrobials used, the greater the number of drug-resistant microorganisms that develop, and the more difficult it is to treat a resulting superinfection. The primary clinical indication for combined antimicrobial therapy is a severe infection in which the offending organism(s) is unknown and major consequences may ensue if antibiotic therapy is not instituted immediately before culture and sensitivity tests are available.3

Myth No. 6: Bactericidal agents are always superior to bacteriostatic agents. Bactericidal agents are required for patients with impaired host defenses.3 However, bacteriostatic agents are usually satisfactory when the host’s defenses against infections are unimpaired. Postantibiotic effects (PAEs—persistent suppression of bacterial growth after previous exposure to antibiotics) are more persistent and reliable with bacteriostatic agents (erythromycin, clindamycin) than with bactericidal agents (beta-lactamase) because the clinical effects of bacteriostatic agents are less dose-dependent.

Myth No. 7: Antibiotic dosages, dosing intervals and duration of therapy are established for most infections. After more than 80 years of antibiotic usage, the proper

### Dental Procedures for Which Antibiotic Prophylaxis is Reasonable

- Dental extractions
- Periodontal procedures, including surgery, subgingival placement of antibiotic fibers/strips, scaling and root planing, probing, recall maintenance
- Dental implant placement
- Replantation of avulsed teeth
- Endodontic (root canal) instrumentation only if beyond the root apex and endodontic surgery
- Initial placement of orthodontic bands (not brackets)
- Intraligamentary and intraosseous local anesthetic injections
- Postoperative suture removal (in selected circumstances that may create significant bleeding)
- Prophylactic cleaning of teeth or implants where bleeding is anticipated

Table 3
dosages, dosing intervals and duration of therapy are essentially unknown for most specific infections. Infectious diseases are associated with a high number of variables that affect treatment outcome (microbial characteristics and drug sensitivity, diverse resistance mechanisms, tissue barriers to antibiotic diffusion, and the integrity and activity of the host's defense mechanisms). However, basic principles are available to guide the dental health care provider in establishing proper dosages, dosing intervals and duration of therapy once the microbial pathogen(s) is suspected or identified and a rational choice of antimicrobial agent is made.

The following principles of antibiotic dosing are adapted from Dr. Thomas J. Pallasch:

1. The current recommendation is to employ an antimicrobial on an intensive basis with vigorous dosage for as short a period of time as the clinical situation permits. The major factor in the clinical success of most antimicrobial agents is the height of the serum concentration of the drug and the resulting amount in the infected tissue(s). Also important is to expose the host to the antimicrobial agent for as short a duration of therapy as possible. The shorter the duration of therapy the lower the risk to the patient for the development of antibiotic-induced toxicity and/or allergy, and a reduced risk of developing resistant microorganisms.

2. The goal of antibiotic dosing is to achieve drug levels in the infected tissue equal to or exceeding the minimal inhibitory concentration of the target organism. Serum levels of antibiotics do not necessarily reflect those in tissues. Blood concentrations of the antibiotic should exceed the MIC by a factor of two to eight times in order to offset the tissue barriers that restrict access of the drug to the infected site.

3. It is advisable to initiate antibiotic therapy with a loading dose (an initial dose higher than the maintenance dose). An antibiotic loading dose should be used whenever the half-life of the drug is longer than three hours or whenever a delay of 12 hours or longer to achieve a therapeutic blood level is expected. Most antibiotics used in the treatment of orofacial infections have a half-life shorter than three hours but, due to their acute nature, most orofacial infections require therapeutic drug blood levels sooner than 12 hours. Steady-state blood levels of any drug are usually achieved in a time equal to three to five times the drug's half-life. Amoxicillin has a half-life of one to one-and-a-half hours. A steady-state blood level would then be achieved in three to seven-and-a-half hours, thereby leading to a substantial delay in achieving therapeutic antibiotic blood levels. A loading dose of two times the maintenance dose is recommended for acute orofacial infections, which better achieves the goal of rapid, high blood levels rather than initiating therapy with the maintenance dose.

4. An oral antibiotic should ideally be administered at dosing intervals of three to four times its serum half-life, particularly if steady-state blood levels are desired (as may be indicated with beta-lactam agents). For example, the serum half-life of Pen-V-K is 0.75 hours. Higher continuous blood levels of this antibiotic are more likely to be obtained with four-hour rather than six-hour dosing intervals. The shorter the serum half-life of the drug, the shorter the dosing interval will need to be in order to maintain continuous therapeutic blood levels of the drug. When determining the appropriate dosing interval, it is also important to consider the following: 1) The postantibiotic effects of the drug; and 2) the relative merits of continuous or pulse dosing. PAEs are more persistent (two to seven hours) with antibiotics that act intracellularly within the microbial cytoplasm (erythromycin, clindamycin and tetracycline) or by suppression of nucleic acid synthesis (metronidazole, quinolones). As a result, these antibiotics are more effective with pulse dosing (high antibiotic dosing at widely spaced intervals). The beta-lactam antibiotics, however, have a slow, time-dependent killing activity and demonstrate very little PAE. Beta-lactam microbial killing requires microbes in the process of cell division (interference with cell wall development); hence, they must be continuously present (steady-state blood levels) because bacteria divide at different rates or times.

Myth No. 8: Bacterial infections require a "complete course" of antibiotic therapy. There is no such thing as a "complete course" of antibiotic therapy. The only guide for determining the effectiveness of antibiotic therapy, and hence, the duration of treatment, is the clinical improvement of the patient.

A common misconception asserts that prolonged (after clinical remission of the disease) antibiotic therapy is necessary to prevent "rebound" infections from occurring. Orofacial infections do not "rebound" if the source of the infection is properly eradicated. Most orofacial infections persist for two to seven days, and often less. Patients placed on antibiotic therapy for an orofacial infection should be clinically evaluated on a daily basis. When there is sufficient clinical evidence that the patient's host defenses have regained control of the infection and that the infection is resolving or resolved, the antibiotic therapy should be terminated.

**Patients at Potential Risk of Experiencing Hematogenous Total Joint Infection**

<table>
<thead>
<tr>
<th>Patient Type</th>
<th>Condition Placing Patient at Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients during first two years following joint replacement</td>
<td>N/A</td>
</tr>
<tr>
<td>Immunocompromised/Immunosuppressed patients</td>
<td>Inflammatory arthropathies such as rheumatoid arthritis, systemic lupus erythematosus Drug or radiation-induced immunosuppression</td>
</tr>
<tr>
<td>Patients with comorbidities</td>
<td>Malnourishment</td>
</tr>
<tr>
<td>(Conditions listed for patients in this category are examples only; there may be additional conditions that place such patients at risk of experiencing hematogenous total joint infection)</td>
<td>Hemophilia HIV infection Insulin-dependent (type 1) diabetes Malignancy</td>
</tr>
</tbody>
</table>

Table 4
Antibiotic prophylaxis for medically at-risk patients

Antibiotic prophylaxis is the administration of antibiotics to patients without evidence of infection to prevent bacterial colonization and reduce subsequent postoperative or post-treatment complications. The only established use of antibiotic prophylaxis in dentistry is in the attempt to reduce the potential consequences of bacteremias induced by dental treatment in certain medically at-risk patients. The principle indication for antibiotic prophylaxis for dental patients is the prevention of infective endocarditis during specified dental treatment of patients who also have specific medical conditions. Controversial indications include dental patients with orthopedic prosthetic devices, indwelling catheters and impaired (immunosuppressed) host defenses.

Dental patients presenting for treatment with impaired host defenses (chemotherapy, organ transplant or tissue graft recipient, insulin-dependent diabetes, alcoholics) or patients with indwelling catheters (hemodialysis) may benefit from antibiotic prophylaxis if their white cell count is below 2,500 (normal = 4,000-11,000). It is not currently recommended that patients with AIDS receive routine antibiotic prophylaxis prior to dental treatment. The opportunistic pathogens common to this disorder are not susceptible to routine prophylactic antibiotics and such a practice may result in the development of antibiotic-resistant microorganisms, thereby resulting in a serious superinfection.

Antibiotic prophylaxis for prevention of infective endocarditis

The American Heart Association has published guidelines for the prevention of IE in medically at-risk patients for more than 50 years. The most recent guidelines, published in April 2007, represent a significant change from the previous guidelines. One of the stated reasons for the development of the current revised guidelines was that the risk of antibiotic-associated adverse events exceeds the benefit, if any, from prophylactic therapy (Table 1). It is well accepted that the risk for developing bacterial resistant strains to the antibiotic drug used is considered an antibiotic-associated adverse event.

The majority of published studies regarding IE being caused by oral bacteria have focused on dental procedures. Although the infective dose required to cause IE in humans is unknown, the number of microorganisms present in the bloodstream following a dental procedure is low. It has long been assumed that dental procedures may cause IE in patients with underlying cardiac risk factors and that antibiotic prophylaxis is effective. However, scientific proof is lacking to support this assumption. Cases of IE caused by oral bacteria probably result more from exposures to low inocula of bacteria in the bloodstream that result from routine daily activities (brushing and flossing) and not from a dental procedure.

The 2007 AHA report regarding prevention of IE concludes: "If prophylaxis is effective, such therapy should be restricted to those patients with the highest risk of adverse outcomes from IE and who would derive the greatest benefit from prevention. In patients with underlying cardiac conditions associated with the highest risk of adverse outcomes from IE, prophylaxis for some dental procedures is reasonable, even though we acknowledge that its effectiveness is unknown."

Therefore, the 2007 AHA guidelines suggest that antibiotic prophylaxis should be considered for patients presenting for treatment with the cardiac conditions identified in Table 2, and who are undergoing any dental procedure that involves the gingival tissues or periapical region of a tooth and for those procedures that perforate the oral mucosa. This would include procedures such as biopsies, suture removal, placement of orthodontic bands, and intraoral and intraosseous local anesthetic injections, but it does not include routine local anesthetic injections through noninfected tissue (Table 3).

Antibiotic prophylaxis for prevention of delayed prosthetic joint infection

In 1997, the ADA and the American Academy of Orthopedic Surgeons convened an expert panel of dentists, orthopedic surgeons and infectious disease

<table>
<thead>
<tr>
<th>Suggested Patient Type, Drug and Regimen for Antibiotic Prophylaxis for Total Prosthetic Joint Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient Type</strong></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>Patients not allergic to penicillin</td>
</tr>
<tr>
<td>Patients not allergic to penicillin and unable to take oral medication</td>
</tr>
<tr>
<td>Patients allergic to penicillin</td>
</tr>
<tr>
<td>Patients allergic to penicillin and unable to take oral medication</td>
</tr>
</tbody>
</table>

*Note: No second doses are recommended for any of these dosing regimens.*
specialists and published an Advisory Statement on Antibiotic Prophylaxis for dental patients with prosthetic joints. A 2003 advisory statement included some modifications of the classification of patients at potential risk and the stratification of bacteremic dental procedures (Table 4), but no changes in terms of suggested antibiotics or antibiotic regimens. Antibiotic prophylaxis is not indicated for most dental patients with total joint replacements or for patients with pins, plates or screws. However, it is advised to consider antibiotic premedication in a small number of patients who may be at potential increased risk of experiencing hematogenous total joint infection (Table 5).

While bacteremias can cause hematogenous seeding of total joint implants, it is likely that more oral bacteremias are spontaneously induced by routine daily events than are dental treatment-induced. Patients who have undergone total joint arthroplasty should be encouraged to perform effective daily oral hygiene procedures in order to maintain good oral health. The risk of bacteremia is much higher in a mouth with chronic inflammation than one that is healthy and well maintained.

Occasionally, a patient with a total joint prosthesis may present for dental treatment with a recommendation from his or her physician that is inconsistent with the current guidelines. In this case, the dentist is encouraged to consult with the patient’s physician to discuss the nature of the needed dental treatment, to review the current guidelines regarding antibiotic prophylaxis and to determine if there are any special considerations that might affect the physician’s decision regarding antibiotic prophylaxis for the patient. After this consultation, the dentist may decide to follow the physician’s recommendation or, if in his or her professional judgment antibiotic prophylaxis is not indicated, decide to proceed with the needed dental treatment without antibiotic prophylaxis. The dentist is ultimately responsible for making treatment decisions for his or her patient based on the dentist’s professional judgment.

In 2003, a panel of experts convened by the American Academy of Orthopedic Surgeons and the American Dental Association published a systematic review and clinical practice guideline, titled “Prevention of Orthopedic Implant Infection in Patients Undergoing Dental Procedures: Evidence-based Guideline and Evidence Report.” This report contained the following three recommendations:

The practitioner might consider discontinuing the practice of routinely prescribing prophylactic antibiotics for patients with hip and knee prosthetic joint implants undergoing dental procedures.

We are unable to recommend for or against the use of topical oral antimicrobials in patients with prosthetic joint implants or other orthopedic implants undergoing dental procedures.

In the absence of reliable evidence linking poor oral health to prosthetic joint infections, it is the opinion of the work group that patients with prosthetic joint implants or other orthopedic implants maintain appropriate oral hygiene.

The report also stated that the above recommendations “are not intended to stand alone. Treatment decisions should be made in light of all circumstances presented by the patient. Treatments and procedures applicable to the individual patient rely on mutual communication between patient, physician, dentist and other healthcare practitioners.”

In 2014, a panel of experts convened by the American Dental Association Council on Scientific Affairs developed an evidence-based clinical practice guideline on the use of prophylactic antibiotics in patients with prosthetic joints who are undergoing dental procedures. This clinical practice guideline was published in The Journal of the American Dental Association in January 2015 and contained the following recommendation:

In general, for patients with prosthetic joint implants, prophylactic antibiotics are not recommended prior to dental procedures to prevent prosthetic joint infection. The practitioner and patient should consider possible clinical circumstances that may suggest the presence of a significant medical risk to providing dental care without antibiotic prophylaxis, as well as the known risks of frequent or widespread antibiotic use. As part of the evidence-based approach to care, this clinical recommendation should be integrated with the practitioner’s professional judgment and the patient’s needs and preferences.

Summary

Since their discovery eight decades ago, safe systemic antibiotics have revolutionized the treatment of infections, transforming once deadly diseases into manageable health problems. However, the growing phenomenon of bacterial resistance, caused by the use
and abuse of antibiotics and the simultaneous decline in research and development of new antimicrobial drugs, is now threatening to take us back to the pre-antibiotic era. Without effective treatment and prevention of bacterial infections, we also risk rolling back important achievements of modern medicine such as major surgery, organ transplantation and cancer chemotherapy.22

A fundamentally changed view of antibiotics is needed. They must be looked on as a common good, where individuals must be aware that their choice to use an antibiotic will affect the possibility of effectively treating bacterial infections in other people. All antibiotic use, appropriate or not, “uses up” some of the effectiveness of that antibiotic, diminishing our ability to use it in the future. For current and future generations to have access to effective prevention and treatment of bacterial infections as part of their right to health, all of us need to act now. The window of opportunity is rapidly closing.22

References


About the author

Having taught future oral health-care professionals at Loma Linda University School of Dentistry since 1965, Steven Morrow, DDS, MS, is currently a professor in the department of endodontics that he chaired from 1987 to 1990. He maintains responsibilities he accepted in 2000 as director of patient care services and clinical quality assurance. He was director, District VI, of the American Association of Endodontists from 1990 to 1993. He has also served as president of the Southern California Academy of Endodontics and as president of the California State Association of Endodontists. In 1997, he earned diplomat status from the American Board of Endodontics. Since 1998, he has been a fellow of the American College of Dentists; and since 2003, he has served on the editorial review board of the Journal of Endodontics. A life member of the American Dental Association, the American Association of Endodontists and the California State Association of Endodontists, he is currently serving his second term as a member of the Dental Board of California.
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Mani Silk: A new and novel means of predictable canal shaping

Author: Rich Mounce, DDS

Introduction

Irrespective of how a root canal is shaped, the goals of canal shaping remain the same. These goals include:

1) Keeping the canal in its original position.
2) Keeping the minor constriction of the apical foramen in its original position and at its original size.
3) Creating a final shape that resembles a tornado (a prepared space with narrowing cross-sectional diameters moving from orifice to apex).
4) Creating a taper that is proportional to the external root form, avoiding perforation and minimizing the long-term risk of vertical fracture from excessive dentin removal.
5) Creating a taper that facilitates cone fit with tug back and provides ideal vertical compaction hydraulics during warm obturation.
6) Creating a taper, which allows copious volumes of activated (ultrasonic, sonic, mechanical, negative pressure, multisonic (Sonendo) irrigation to reach the apex safely and without undue risk of extrusion.

Before the advent of nickel titanium (NT) instruments, Gates Glidden drills and stainless-steel hand files were used to shape canals. While predictable results were possible using these instruments, iatrogenic risk (including canal transportation and blockage, lengthy treatment, hand fatigue and complex treatment algorithms) were frequent challenges.

Gates Glidden drills and stainless-steel canal preparation, especially in the developed world, gave way to NT canal preparation. When stressed, the more ordered and stiffer austenite crystalline phase configuration (CPC) of NT alloys, flexes to the less ordered and more flexible martensitic CPC to accommodate the stress. This is known as the martensitic transformation. This transformation allows the metal, when stressed, to absorb approximately an 8 percent recoverable strain (flex without deformation). After the stress is relieved, the metal returns to its original shape (shape memory) and the more ordered austenite CPC. The ability to stress NT alloys and change CPC in this manner is known as superelasticity. Martensitic transformation makes NT a relatively ideal material for endodontic shaping instruments, reducing hand fatigue, iatrogenic events and saving time relative to other methods. These benefits notwithstanding, NT instrumentation is subject to unexpected instrument fracture.

Initial generations of superelastic NT instruments were ground (and not heated treated either before or after grinding). Heat treatment of NT alloys (either before grinding or after grinding) influences the austenite finish temperature (the temperature at which the material is completely in the austenite CPC). As a result of heat treatment, among other attributes, NT alloys are more resistant to cyclic fatigue stresses, have greater fracture resistance and are more flexible.

In 2007, DENTSPLY introduced NT instruments by a proprietary process made from a heat-treated material called “M wire.” In 2008, SybronEndo introduced “R phase” technology, whereby NT files were manufactured by twisting NT while in the...
rhombohedral CPC (an intermediate crystalline phase between austenite and martensite). In 2010, Controlled Memory (CM) NT instruments were commercially introduced. Controlled Memory instruments are extremely flexible relative to their superelastic and non-heat-treated counterparts. They do not possess shape memory. CM instruments retain the curvature placed upon them; in essence they remain curved as they rotate in a curved canal. As a result of the above evolution in NT instrumentation, clinicians now have two generations of NT alloys available for shaping canals — the first generation of non-heat-treated superelastic alloys and the second generation of heat-treated superelastic and non-superelastic alloys (CM). References on CM technology and heat treatment of nickel titanium alloys are provided.1–15

At present there is no literature-based superiority as to the optimal means to prepare canals. The vast marketplace options available in NT instrumentation give testimony to this fact. The above notwithstanding, it is the opinion of the author that there are many valid means to shape canals, some of which are safer, more efficient and economical than others. With the above introduction to provide perspective, this article was written to introduce clinicians to the Mani Silk (SILK) shaping system now distinguishing itself from the other options above.

**_Mani Silk_**

A strong addition to the current marketplace options is the new and novel Mani Silk NT instrumentation system. Silk is novel because, after orifice shaping, it is a two-file system that can be either rotated or reciprocated (clockwise cutting) while possessing all the flexibility, cutting efficiency and fracture resistance provided by its design and heat treatment.

The pack configurations of Silk are anatomy-based in that the configurations are designed to specifically treat the anatomy commonly encountered by clinicians. The files are grouped into “Simple” (relatively straight canals), “Standard” (moderate curvature, no calcification) and “Complex” (moderate to severe curvature and/or calcification present) packs. Silk is designed to shape these specific anatomies safely, efficiently and economically without complex algorithms and yet with tactile precision, hence its name, “Mani Silk.” While Silk has a relatively simple treatment algorithm (detailed below) making the system easily adopted by general dentists, Silk is functional in both specialist (more curved and calcified canals) and general dentist case types (less severe curvatures and calcification).

**_Silk system specifications_**

Silk has a unique “tear drop” cross section. The tear drop cross sectional shape allows debris to be channeled out of the canal efficiently, keeps the file centered in the canal and significantly decreases the “screwing in” effect common with many other systems all the while cutting efficiently. Silk files have a constant taper (0.08, 0.06, 0.04).

Simple packs include a 0.08/25 orifice opener (OO), 0.06/25 and 0.06/30 instruments. Standard packs include a 0.08/25 (OO), 0.06/20 and 0.06/25 instruments. Complex anatomy packs include the 0.08/25 (OO), 0.04/20 and 0.04/25 instruments. Silk instruments are also available (three files per pack) in the following individual sizes: 0.04/20, 0.04/25, 0.04/30, 0.04/35, 0.04/40, 0.06/20, 0.06/25, 0.06/30, 0.06/35, 0.06/40 and 0.08/25. All pack configurations and individual sizes are available in 21 and 25 mm (Figs. 1a–2c).

The Silk 0.08/25 mm OO in all three packs (simple, standard, complex) is available in the same length as the other instruments; in essence a 21 mm Silk instrument pack has a 21 mm OO and a 25 mm Silk instrument pack has a 25 mm OO. The OO is also available in an 18 mm length. Regardless of the length of the OO, the 0.08/25 Silk OO is placed to the point of first canal curvature and not beyond. Once orifice shaping is done, Silk becomes a two-file system for any given canal anatomy with the remaining two files of the given pack acting as the canal shaping files.

Silk instruments are heat treated from their tip roots to 20 mm.
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with a patented and proprietary process that provides exceptional strength and flexibility to the file. No other file available commercially has its apical 10 mm heated, providing flexibility where needed.

While heat-treated, Silk possess shape memory, in contrast to CM instruments. Silk system can both be rotated and reciprocated in reciprocating motors that cut primarily in a clockwise reciprocating movement.

Silk instruments can be used with any torque-controlled endodontic motor. 500 rpm is recommended for all Silk instruments with a torque setting of 300 g-cm. This introduces simplicity into motor selection, as rpm and torque presets are not required to use Silk. This saves time, as the clinician does not need to change motor settings after using every file.

The tactile insertion of Silk is smooth, intentional and should take approximately three seconds. Silk does not “screw in” using the correct speed, pressure and finger fulcrum. Each insertion of Silk should remove approximately 4 to 6 mm of dentin. The flutes of the Silk file are wiped after every insertion and the canal recapitulated with a small hand file. Silk instruments should either be inserted or removed from the canal but never inserted apically and left in a stationary position rotating in the canal. Silk is not used with a pecking motion.

To minimize iatrogenic risk (canal transportation, canal blockage, file separation, etc.) each Silk instrument should be inserted to the true working length (TWL) only once for one to two seconds and then removed.

**Mani Silk clinical technique**

1) After obtaining profound anesthesia and making straight-line access, all canals are located.

2) Using the Silk 0.08/25 (OO) the cervical dentinal triangle (CDT) is removed and the orifice shaped. In the presence of a viscous EDTA gel, the Silk OO is inserted 3 to 4 mm below the pulpal floor and removed by brushing up and away from the furcation against the root wall of greatest thickness. After removal of the CDT, the pulp chamber is irrigated copiously. If the canal will allow it, subsequent insertions of the OO are made to the point of first curvature and/or resistance with irrigation and hand file recapitulation occurring after each insertion.

3) After orifice shaping, stainless-steel hand files are used to establish apical patency and shape the glide path before Silk shaping below the point of first canal curvature or previous shaping by the OO. Mani D Finders are an excellent “stiff file” option for calcified canal negotiation. Mani K files, SEC O K files (safe ended K files) and D Finders are all well suited for glide path creation. All hand files should be precured before insertion. Single use of hand files is recommended to maintain sharpness and improve both tactile control and ease of canal negotiation (Figs. 3a–c).

Once the first hand file reaches the apex of the root, an electronic apex locator should be used to determine the TWL. Once the TWL is established, the clinician should sequentially enlarge the canal until a #20 hand file spins freely at the TWL, in essence to prepare a glide path. Irrigation and recapitulation should be copious and frequent during glide path creation.

4) a. Using the Simple pack, after orifice shaping the 0.06/25 (the middle file in the pack) is inserted to resistance followed by the 0.06/30 Silk (the instrument at the far right of the pack). The sequence is repeated until the 0.06/30 reaches the TWL.

b. Using the Standard pack, after orifice shaping the 0.06/20 (the middle file in the pack) is inserted to resistance followed by the 0.06/25 Silk (the instrument at the far right of the pack). The sequence is repeated until the 0.06/25 reaches the TWL.

c. Using the Complex pack, after orifice shaping the 0.04/20 (the middle file in the pack) is inserted to resistance followed by the 0.04/25 Silk (the instrument at the far right of the pack). The sequence is repeated until the 0.04/25 reaches the TWL.

In any of the case types above, if the clinician wants to prepare a larger taper or master apical diameter he or she can do so with the individual files available in the Silk armamentarium.

All of the above sequences can be reversed in a “crown down” approach, if desired, using the larger tip size instrument first followed by the smaller until the apex is reached. For example, if desired, for simple anatomy, the 0.06/30 instrument can be inserted first and followed by the 0.06/25 (Figs. 4a–c).

**Mani Silk FAQs**

1) How many times can I use a Silk instrument?

Mani recommends single use of Silk instruments.

2) How do I sterilize new packs of files?

With a steam autoclave, sterilize the instruments at 136 degrees C for 20 minutes.
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3) Can I use Silk instruments to remove gutta-percha?
Yes. While Silk is not specifically designed for this purpose, appropriately sized Silk instruments can be used to remove gutta-percha in retreatment. Mani GPR instruments are specifically designed for gutta-percha removal. Please see www.mani.co.jp/en/product/dental/nrt_gpr.pdf for more information.

4) What kind of motor do I need to power Silk?
Any torque-controlled endodontic motor that can provide 500 rpm and 300 g-cm of torque control is suitable to power Silk.

5) Can I reciprocate Silk instruments?
Yes, any reciprocating motor that reciprocates instruments clockwise can be used.

6) How do I obturate canals prepared by Silk?
Any clinically appropriate obturation technique can be used for obturation of canals shaped by Silk.

7) What if I want to prepare a larger apical diameter than that prepared in the given Silk pack?
Silk is available in 0.04/30, 0.04/35, 0.04/40, 0.06/35 and 0.06/40 individual sizes for preparation of a larger apical diameter. Above these sizes the clinician can prepare the canal in any clinically appropriate manner.

Conclusion

This article has introduced the new, novel and unique Mani Silk heat-treated nickel titanium instrument system. Mani Silk provides a safe, efficient and economical means to shape canals that is simple to learn and simple to use. Emphasis has been placed on using Mani Silk with sound clinical principles, including straight-line access, removal of the cervical dentinal triangle, attainment of patency and achieving the goals of canal preparation. I welcome your feedback.

Dr. Mounce is a clinical consultant for Mani and receives honorarium for this work.

References


About the author

Rich Mounce, DDS, is in full-time endodontic practice in Rapid City, S.D. He has lectured and written globally in the specialty. He owns MounceEndo, an endodontic supply company. He can be contacted at RichardMounce@MounceEndo.com. via his website at MounceEndo.com and on Twitter at @MounceEndo.
I A newly developed system for endodontic cleaning and disinfection — GentleWave™ — utilizes broad-spectrum acoustic energy to remove all pulp tissue, debris, decay and bacteria from the entire root canal system. This pioneering technology — developed by Sonendo® — employs advanced fluid dynamics and hydroacoustics to create effective cleaning.

According to Sonendo, GentleWave delivers multiple, various and specific wavelengths of sound, delivering energy over a broad range of frequencies to remove unhealthy pulp tissue and bacteria safely, regardless of the complexity of the canal system.

In an interview, Brett E. Gilbert, DDS, of King Endodontics, in Niles, Ill., discusses his experience using this new system in clinical practice.

Incorporating new technology into your practice seems to be important to you. Why is that?

The primary reason I pursue new technologies for my practice is to provide the best possible treatment for my patients. I believe that the Sonendo GentleWave system accomplishes this goal. As a full time clinician and an endodontic educator for over 11 years, being at the leading edge of this technology allows me to lead by example among my peers. I believe that we have found the next level of clinical excellence with this modality.

Bringing any new procedure-based technology into your practice can be a significant undertaking when you consider the amount of training involved. What did you do to ensure this learning was as short as possible?

Any alteration to the treatment protocol of a smoothly running endodontic practice will be challenging. To my delight, the training my staff and I received from the Sonendo team allowed us to incor-

‘I love the GentleWave system because it advances the science of endodontics beyond anything previously achievable.’
‘The creation of Multisonic Ultracleaning by Sonendo delivers true cleaning from crown to apex, a new reality for my patients and the highest possible standard for my practice.’

Sonendo provided an in-depth and practical two-day training program that allowed me to learn the clinical skills needed for the procedure. A Sonendo clinical support specialist was then present on site in my office for two weeks. The transition to using the GentleWave was smooth, quick and very effective. Within a few days we were efficiently performing GentleWave cases on a regular basis.

What do you like best about this new technology?
I love the GentleWave system because it advances the science of endodontics beyond anything previously achievable. The creation of Multisonic Ultracleaning by Sonendo delivers true cleaning from crown to apex, a new reality for my patients and the highest possible standard for my practice.

One of the keys to a successful endodontic practice is an effective referral base communication strategy. How is Sonendo helping you with this?
Sonendo has a marketing team and approach that guided my practice in announcing, presenting and promoting the GentleWave technology to my referral base. They have a marketing program to provide the materials and guidance needed to successfully help build referrals. They provide printed materials, website materials and support for planning and running a successful event to showcase the GentleWave system in the practice.

The marketing team also has a public awareness campaign to educate patients directly about how root canal therapy with the GentleWave can increase the ability of endodontists to save their natural teeth.

Anything you would like to add?
I am beyond excited about how this new innovation allows us to completely clean root canal systems safely and efficiently while maintaining the structural stability that natural tooth structure provides. The GentleWave provides completely clean root canal systems from crown to apex, regardless of complexity — something that throughout our history has been impossible to accomplish.

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Attendees at AAE15, the American Association of Endodontists annual meeting, being held May 6-9 in Seattle, will be able to view the GentleWave system and take part in demonstrations at the Sonendo booth, No. 133.

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Global Surgical is unveiling its new A-Series™ microscope. "Global’s latest technological advancement sets the standard in dental microscopy," the company said.

The new microscope is making its debut in Seattle, May 6–9, at AAE15, the annual meeting of the American Association of Endodontists.

Designed by dentists for dentists, the new A-Series microscope features the intuitive AXIS™ Control System. Offering a greater range of motion from a single point of reference, the A-Series is easier to maneuver than any other brand, according to the company.

Features include the brightest LED light source available and a new Multi-Focal Lens. The MFL provides an enhanced range of fine focus adjustment. Once gross focus is achieved, the fine focus can be adjusted up to 150 mm without moving the microscope head. There is no need to adjust the binoculars or move the scope, keeping you “in the zone” while maintaining a healthy ergonomic position.

Global Surgical is committed to providing the best microscope experience in the dental market. The company’s products are used in universities and learning facilities worldwide, and employees pride themselves in offering knowledgeable customer service and prompt technical support.

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Offerings from Vista Dental Products include Micro-Evac tips, color-coded syringes

**Author** Vista Dental Products Staff

Vista Dental Products recently introduced its new Micro-Evac™ tip. This flexible, narrow tip was designed to easily navigate curved canals during endodontic aspiration.

Micro-Evac tips include HVE luer adaptors, for the fast and efficient removal of moisture from canals. Micro-Evac tips virtually eliminate the need for paper points. Micro-Evac features Vista’s Secure-Lock™ threads to lock the tip in place for increased safety and ease of use.

Color-coded syringes

Vista Dental Products also recently expanded its line of luer-lock syringes, now offering 12 cc and 3 cc color-coded syringes. These luer-lock syringes provide a fast and easy way to organize and identify irrigants and solutions, helping to reduce incidences of syringe swap, according to Vista.

The tips offer increased safety at no added cost. A box of Vista Color-Coded Syringes costs no more than a box of standard luer-lock style syringes.

Vista Color-Coded Syringes are latex-free and available in four easy-to-identify colors: blue, red, yellow and white.
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The latest innovation from FKG Dentaire lets practitioners treat complex root canal systems and clean once impossible-to-reach areas with minimal impact on the dentin. Made with a highly flexible NiTi-based alloy, the XP-endo Finisher follows the contours of the canal with an improved reach of 6 mm in diameter—or 100-fold that of a standard instrument of the same size.

"With the XP-endo Finisher, we can finally solve a common problem for dentists," said Thierry Rouiller, CEO of FKG Dentaire, one of the world’s leading manufacturers of endodontic instruments. "They’ll now be able to reduce the risk of future infection by offering patients a deeper cleaning for a better root canal treatment."

Studies using micro CT technologies show that standard NiTi files manage to clean just 45 to 55 percent of the canal walls, leaving debris and bacteria to accumulate in areas left untouched. However complex the morphology of the canal, dentists can use the XP-endo Finisher following a root canal preparation starting at diameter ISO 25.

A unique FKG alloy, the MaxWire (Martensite-Austenite electropolish-fleX), gives the instrument unparalleled flexibility so it can remove debris from those hard-to-reach areas, while limiting the impact on the dentine.

"Now [the canal] is cleaner, perhaps two to three times compared to the conventional techniques we have today," said Dr. Gilberto Debelian, Norway.

The instrument also features a strong resistance to instrument fatigue, thanks to its zero-taper design, and is simple enough for dentists to quickly learn to use.
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