

Enhanced Periodontal Debridement with the Use of Micro Ultrasonic Periodontal Endoscopy

Foreword by Kristy Menage Bernie, RDH, BS

When I graduated in 1984, I vividly recall a negative association applied to those clinicians who used powered instrumentation—they were not getting the job done effectively or safely, they were cheating. Here we are, over 20 years later, and the accepted norm is the use of powered ultrasonic instrumentation for the removal of gross deposits, periodontal debridement, and deplaquing procedures. Technological advances have included tips as small as periodontal probes, tips that are illuminated, and a multitude of ergonomic enhancements. We have come a long way.

Dr Kwan's article provides an excellent overview of the evolution of this technology. As one of the innovators in micro ultrasonics, he is a true leader and an accomplished clinician who exclusively uses ultrasonic instrumentation in his periodontal practice. As a client of his by choice vs disease, I can attest to the comfort, efficiency, and thoroughness of this method. I have not missed hand instrumentation for my own health or dental hygiene experience.

While many of us are not ready to toss out our trusted hand instruments, consider the distinct advantages powered ultrasonic instrumentation offers both you and your clients. Powered instrumentation is proving safer and more efficient, and is certainly a time saver. Regardless of your personal preference, there is no doubt that powered instrumentation is here to stay. In fact, most dental hygiene clinical boards now permit the technology to be used during the examination. Though research has demonstrated equal, or even better, results with this method over hand instrumentation, it is paramount for optimal results and client comfort that clinicians develop excellent technique and understand the basics behind the science.¹⁻⁴ Dr Kwan's article represents a comprehensive overview while providing readers case studies demonstrating the success behind the use of powered instruments.

Most research testing adjunctive therapeutic agents

or devices begin with full mouth scaling and root planing using a combination of powered and hand instrumentation. This phase of the study is usually completed within 1 week and then the test agents and/or devices are issued. Without a doubt, there are infinite studies using this protocol as a standard means to level the playing field. Clinicians should consider the actions and decisions of researchers to use powered instrumentation in their studies. As such, they can proceed with assurance that the decision to include powered instrumentation is well founded and based on research ongoing everyday.

Dr Kwan quotes Dr Irene Woodall at the end of his article. She was ahead of her time. She saw the possibilities and encouraged us all to consider opportunities beyond the obvious, beyond what is tried-and-true, beyond simply because it has always been done a certain way. The battle cry is now focused on biofilm disruption; glassy smooth roots are no longer needed, and indeed an assessment of our armamentarium is warranted. Enjoy Dr Kwan's article, consider your own instrumentation protocols, and make the necessary adjustments to use this highly effective debridement technology on each and every client. If you ever have the chance, attend one of Dr Kwan's courses, or better yet, experience micro ultrasonics in his practice. No longer cheating, but essential care—powered instrumentation is here to stay.

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ABSTRACT

Current literature supports the use of powered instrumentation over traditional hand instrumentation. The objective of scaling and root planing is the complete removal of plaque and calculus from root surfaces. While this is unrealistic, the accepted end point is a smooth, glassy root surface during periodontal instrumentation. This often has resulted in overinstrumentation and excessive removal of cementum. Cementum removal has been deemed generally unnecessary. What is essential is the removal of plaque, calculus, and the endotoxin adherent to the root surface. This cleaning of root surfaces is best done with judicious use of powered instrumentation. The excessive removal of cementum during hand instrumentation is because of the lack of visualization. Using endoscopic technology, the ability to visually debride roots can improve chances of success in a more conservative and minimally invasive way. This article provides a brief review of micro ultrasonic technologies and periodontal endoscopy, its implementation in the author's practice, and a limited case series.

The treatment of periodontal disease has always revolved around the effective debridement of the subgingival environment and the control of the microbial flora associated with the disease. There are multiple modalities available. Traditional nonsurgical treatment can be successful, but is limited by the lack of visualization. Alternatively, surgical treatment permits access to the root surface for visual debridement.¹

There are a multitude of hand and powered instruments available. Hand instruments require sharpening and are limited in their access to root surfaces because of their size and shape. This is especially true with deeper periodontal pockets.² Additionally, the forces required to use hand instruments increase the risk for repetitive stress injuries. Alternatively, powered instrumentation can allow providers to treat with less risk of repetitive stress injury, and more predictably access the entire root surface because of the availability of smaller size instrumentation.³

The periodontal endoscope (Dental View, Lake Forrest, Calif, www.dentalview.com) (Figure 1) allows for visual

access to root surfaces with great magnification, lessening the need for surgical intervention. Combined with a simple array of micro ultrasonic instruments, endoscopic debridement can be accomplished in a conservative, minimally invasive way by the dentist, periodontist, or dental hygienist.

The author's office has incorporated both powered micro ultrasonic and endoscopic techniques such that it provides a more effective periodontal debridement. The incorporation of these techniques requires developing some changes in office protocol, but the case series presented suggest these efforts may be worthwhile.

Micro Ultrasonics

Micro ultrasonics is a term coined in the early 1990s by the author and Peggy Hawkins, RDH. It is a generic term that identifies the refined use of powered instrumentation used for high-powered, supragingival, gross debridement. Micro ultrasonic instrumentation is small, approximating the size of a periodontal probe and can be used for supra- and subgingival treatment at low to high power, with little to no water spray, and little or no adjunctive use of hand instrumentation.⁴

The American Academy of Periodontology position paper on sonic and ultrasonic scalers in periodontics indicates that both power-driven and hand instrumentation provide similar clinical outcomes when one examines the various parameters associated with scaling and root planing: plaque removal, endotoxin removal, and wound healing. However, when appropriately used, power-driven scalers may cause less root damage and/or excessive cementum removal. Complete removal of cementum in an attempt to eliminate endotoxin adherent to the root surface is unnecessary and may result in treatment complications like hypersensitivity. Additionally, the power-driven instruments may provide better access to the base of the pocket and furcations.⁵⁻⁷

This position paper indicates a paradigm shift in that no longer is the clinical objective the production of a smooth, glassy root surface but the adequate removal of plaque, calculus, and its associated endotoxin such that the microenvironment permits periodontal healing. The implied message is that cementum removal is not recommended for periodontal debridement. Clinically, when root planing is performed with sharpened or abrasive instruments, the only indicator for a treatment end point is the production of a smooth, glassy root surface.

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Figure 1—Periodontal endoscope.

This invariably results in the intentional removal of cementum. Are we overinstrumenting roots unnecessarily?⁸ Micro ultrasonic instruments are less likely to overinstrument roots because they are generally not sharp or abrasive.

Comparing micro ultrasonic instruments to hand instruments, hand instruments are large (0.75 mm to 1.5 mm blades) and require manual force with limited active/working sides (1 or 2). Micro ultrasonic instruments are probe-like (measuring 0.2 mm to 0.6 mm in diameter), powered to move up to ultrasonic speeds (25,000 to more than 40,000 cycles per second), with active working sides on all surfaces of the vibrating instrument, and provide ultrasonically activated lavage in the working field.

Today's ultrasonic equipment is either magnetostrictive or piezo technology. Magnetostrictive technology creates instrument vibrations by electrically activating strips of metal in the ultrasonic insert. The frequency of vibrations is typically 25,000 or 30,000 cycles per second. The tip vibrates in a linear movement with

Table 1—Advantages and Disadvantages of Piezo Technology

Advantages	Disadvantages
Larger handpieces	Screw-in tips (not recyclable)
Lighter	Multiple handpieces needed to avoid screwing in tips
No water needed for cooling (water is for lavage)	Linear movement with straight tips
	Auto tuned only
	Expensive
	More discomfort than magnetostrictive

Table 2—Advantages and Disadvantages of Magnetostrictive Technology

Advantages	Disadvantages
Pop in/out inserts	Many auto-tuned machines are overpowered
Swivel/rotate	Auto tuning creates more water spray
Manual tuning available	Inadequate water flow can produce excessive heat
Any hand instrument can be made magnetostrictive	Manual tuning not as easily understood as auto tuning
Elliptical tip movement; better power distribution	
Inserts are recyclable	
Heat production warms water	
More affordable than piezo	
Widely used in the United States	

lateral wobble, which is usually described as being “elliptical.” Piezo technology creates instrument vibrations (generally more than 40,000 cycles per second) by electrically activating a quartz crystal and transferring the vibrations to the instrument tip. The tip vibrates in a very efficient linear movement. However, this produces a greater discrepancy of power between the front and the back of the instrument compared to the sides.

Ultrasonic equipment can be purchased with either automatic tuning or manual tuning. Automatic tuning “automatically” tunes the tip of the instrument to optimal vibration by a feedback loop, and power changes are made by amplitude adjustment, which

creates incrementally larger or smaller vibrations. Manual tuning allows for modulation of the amplitude and the frequency. The use of manual tuning allows the clinician more flexibility in the production of vibrations for cleaning teeth. In addition, manual tuning can produce various levels of power from very low to very high, with better control over reducing the water spray, especially at the low to medium power levels. This is possible because at any amplitude level (power setting) the provider can “manually” tune or “detune” the vibrations (frequency setting) and gain more control over the instrumentation. Magnetostrictive ultrasonic units can be found with either manual or automatic tuning, or

Table 3—Range of Power (the capacity to exert force)

Low power	High power
Automatic tuning (AM)	
Some water spray	More water spray
Manual tuning (FM)	
No water spray	More water spray

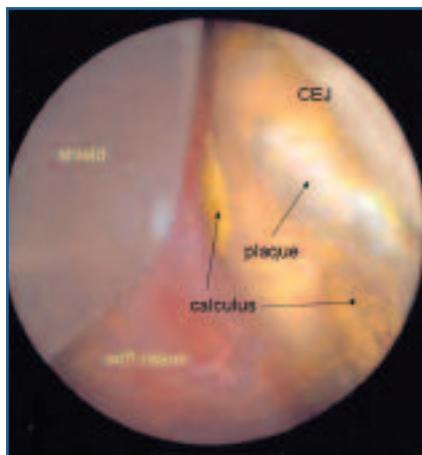


Figure 2—Graphic depiction of a magnified subgingival root surface.
CEJ = cemento-enamel junction

both, while piezo units are available only with automatic tuning (Tables 1 through 3).

Clinical Research Associates, in its clinical evaluation of ultrasonic equipment, concluded that ultrasonic scalers can remove tenacious hard deposits with less patient and operator discomfort, and with less overall chair-time. It was concluded that the purchase cost was not an indicator of its performance or features. Lastly, it was concluded that manually tuned units gave superior performance, although they required tuning and retuning when changing inserts.⁹

Periodontal Endoscopy

The periodontal endoscope allows for subgingival visualization of the root surface at magnifications of 24x to 48x (Figure 2). This is accomplished through a 0.99 mm fiber optic bundle that is a combination of a 10,000-

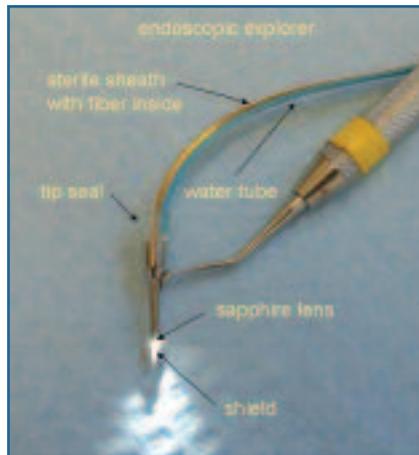


Figure 3—Endoscopic explorer.

pixel capture bundle surrounded by multiple illumination fibers. This fiber is delivered to the gingival margin coupled into an instrument called an “explorer.” A single-use sterile sheath isolates the fiber so it can be used repeatedly (average use for the author has been 70 to 80 uses per fiber). The captured image is relayed to a screen so that the user can see “real time” video of the highly magnified environment (approximately 3 mm on screen at a time).

The explorers come in shielded or nonshielded configurations. The shielded explorers are used for periodontal debridement. They provide a mechanism for viewing subgingivally while “pushing” the soft tissue away from the camera lens, which is recessed from the tip of the shield. This space from the tip of the shield to the camera lens (~4 mm) allows for instruments to be placed within the

viewing field for simultaneous viewing and instrumenting or “endoscopic debridement.” These explorers are available in angulations or can be bent to allow for access into various surfaces around the tooth.

The sheath, which isolates the fiber from the oral environment, is made up of 2 tubes: one isolates the fiber and the other delivers water to the end of the fiber or camera lens. They both merge in a part of the sheath called the “tip seal,” which fits into the explorer. Extending from the tip seal is a rigid metal tube with a very small sapphire lens. This metal tube and the tip seal secure the camera lens at the appropriate distance from the end of the shield and allows for clear visualization while isolating the fiber and allowing for water flow into the area of interest (Figure 3).

Protocols for Incorporating Micro Ultrasonic and Endoscopic Technology

The incorporation of these techniques requires financial, time, training, and operational changes in the office protocol. In this section, adaptation of these techniques in the author’s office are discussed.

Candidates for Endoscopy

Candidates for endoscopy include patients being treated for the following: initial periodontal therapy; sites that did not respond to traditional nonsurgical treatment; residual pockets in patients who are resistant to surgical therapy and where surgery is contraindicated (medical reasons, or esthetics); during maintenance for chronically inflamed or increasing pockets; suspected subgingival pathology such as caries, root fractures, perforations or resorption; and cases requiring documentation, such as for litigation.

Use the 2-Handed Technique

Endoscopic instrumentation is a difficult task to master. It requires a desire to learn, focused attention, lots of practice, and much patience. The best way to provide endoscopic care is by using the 2-handed technique. For a right-handed person, the endoscope is placed in the left hand and the instrument (preferably micro ultrasonic) in the right hand, viewing and instrumenting (or cleaning) at the same time (Figure 4). It is not recommended to place it with the right hand, then switch and hold with the left hand, then instrument with the right hand. Nor is it recommended to use only 1 hand to view, then instrument, and then view. On occasion, using the 2-handed technique, you may need to view, instrument, and then view again, while still keeping the endoscope and instrument in their respective hands.

Combined with a simple array of micro ultrasonic instruments, endoscopic debridement can be accomplished in a conservative, minimally invasive way by the dentist, periodontist, or dental hygienist.

Automate Your Debridement

In the author's office, micro ultrasonic instrumentation is the preferred method for periodontal debridement. To improve efficiency, automate your endoscopic debridement using powered micro ultrasonic instrumentation only and limiting your instruments. The author typically uses 1

straight and 2 curved/angled micro ultrasonic instruments (Tony Riso Company, Miami Beach, Fla, 305-466-5681) (Figure 5). "Focus" on using the 2-handed technique and view while instrumenting, as the objective is to see what you are doing, not just to see what you have done. The use of the dental mirror is very similar to using the endoscope in the nondominant hand, which is not easy at first, but becomes routine for dental providers. In fact, with practice it becomes simple to maintain the hold on the mirror, while simultaneously using the endoscope in the same hand (Figures 6A through 6C).

Endoscopic Treatment Options

Endoscopic treatment options for periodontal disease include the following options:

Secondary use: Patients go through traditional tactile debridement followed by reevaluation; then sites that have not responded are endoscopically debrided.

Primary use: Patients do not go through a separate tactile debridement; they have initial endoscopic debridement followed by reevaluation.

Patient Introduction to Endoscopy

Patients should be educated on their diagnosis, the etiology of their problem(s), and given options. In the case of periodontal disease, patient options typically include: doing nothing, which is not recommended for the health of the teeth or body; non-surgical treatment, which can be accomplished visually with endoscopy; surgical debridement (typically more invasive and more expensive); and/or referral for a second opinion.

Patient Selection and Getting Started

Most practices have existing patients with long-standing periodontal

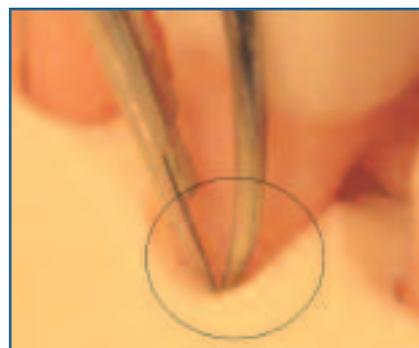


Figure 4—Camera and micro ultrasonics for endoscopic instrumentation.

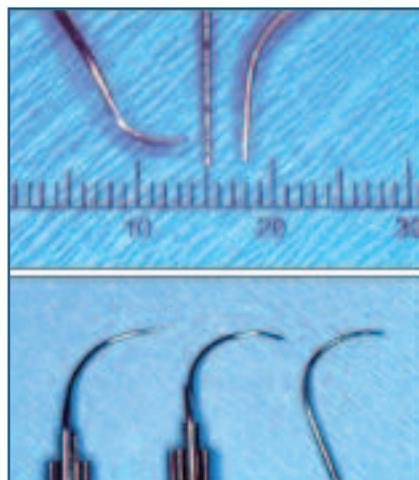


Figure 5—(Top) Scaler, probe, and micro ultrasonic insert. (Bottom) Angled insert, modified curved/angled insert, and furcation probe.

problems, or there may be patients who are resistant or refuse specialist referral. These patients, along with patients who present with localized moderate problems, are good candidates for periodontal endoscopy. It may be prudent to try initial tactile debridement and treat nonresponding sites. Initially, 90- to 120-minute appointments for pocketing in 1 to 2 quadrants is ample time to use the endoscope.

Providers should practice the 2-handed technique on models and focus on the screen to get used to video image interpretation and coordinating movements. Patient care should include adequate topical and local anesthesia. Getting the endoscope and a micro ultrasonic instru-

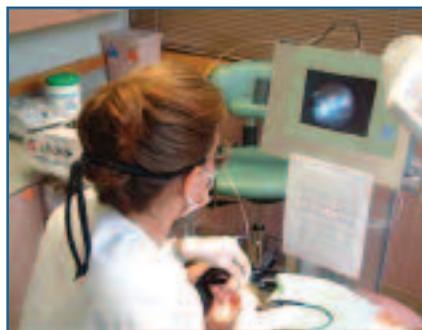


Figure 6A—Eyes on screen.

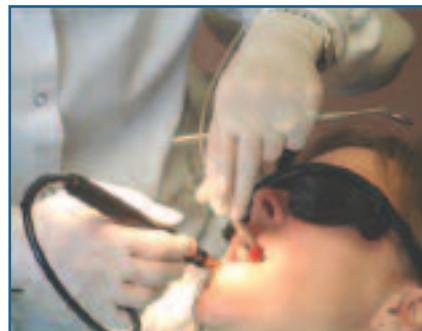


Figure 6B—2-handed technique.



Figure 6C—Bilateral pedal operation.

Table 4—Patient Care with Micro Ultrasonic, Endoscopic Periodontal Debridement

Check functions before seating patient.

Water flow, light source, sheath

Premedicate with over-the-counter nonsteroidal anti-inflammatory drug

Practice preemptive pain management

Use adequate topical and local anesthetic

Allows for comfortable and liberal treatment without pain or sensitivity

Patience

Coordinate hands/feet, pedals/instruments

Simplify

Start and finish with 1 explorer in each segment before starting to use another explorer

Start and finish with 1 instrument in each segment before starting to use another instrument

Use powered instrumentation only

Eyes on screen

Get micro ultrasonic tip and endoscope explorer adjusted; use screen to govern movements

Power

Use medium to medium-plus power with micro ultrasonics

Pressure

Use lateral pressure for more power (This is contrary to most teaching but is very evident when cleaning endoscopically.)

Movement

Use smaller movements over deposits.

Posttreatment phone call

Follow-up call the next day; extends care, exceeds expectations

ment into the small subgingival environment is much easier when the provider and the patient do not have to be concerned about tenderness or sensitivity. Learn the patterns of explorer use (not within the scope of this article). Initially “scope” the areas of interest. Later, start to move around each tooth in the sextant or quadrant. With more experience and more speed, add more teeth to scope, and then consider doing this as initial treatment (Table 4).

As a new provider, try to do at least 1 case per week to get and stay familiar with the equipment and technique. Expect the initial learning curve to take up to 10 patients. A “comfort zone” should start between 20 to 30

patients. Make an effort to get feedback from other endoscope users.

Where Endoscopy Is Difficult

There are areas where endoscopy is difficult. In shallow pockets, the water that is not well contained does not allow for a clear flooding of the area between the tooth and the camera lens. It is helpful to angle the explorer more parallel with the tooth surface to get the camera closer to the tooth. Very inflamed pockets and abscessed areas can have excessive bleeding and boggy soft tissue that can make visualization difficult. It is very important to have adequate water flow to help keep the lens clear. Distal furcations of maxillary molars

tend to be in the middle third of the tooth and access may be more difficult for the instrumentation than for the endoscope. Narrow furcations and class III furcations are difficult to visualize because the explorer will not fit into some of these areas because of size limitations. Curved roots, root proximity, and grossly overcontoured restorations create access problems for the endoscope and instruments. Limited jaw opening creates access problems for any type of instrumentation as well as the endoscope.

Cost Effectiveness for Periodontal Endoscopy

The incorporation of periodontal endoscopy requires financial, time,

training, and new office logistical commitments. Can additional billings cover reoccurring costs of the sheaths and occasionally a new fiber? Can additional billings cover financing and increase profit? Can this technology provide career advancement for the dental hygiene staff? Will use of the endoscope improve patient care? Can this technology enhance referrals into the general or periodontal practice? The answers to these questions should be considered before investing in this technology. If a practice has or can attract patients who can benefit from periodontal endoscopy, and the providers are willing to learn and provide this skill, then the feasibility and profitability of incorporating periodontal endoscopy should be considered.

Case Presentations

Patient No. 1

A 71-year-old woman presented with a diagnosis of generalized moderate to advanced chronic periodontitis. In addition to actual attachment

loss, she presented with notable soft-tissue inflammation. Her medical history was negative with the exception of a history of high blood pressure that was well controlled with medications. Her treatment plan consisted of full-mouth micro ultrasonic debridement, with adjunctive endoscopic debridement, and the removal of teeth Nos. 3, 16, and 31 (No. 3 was fractured; Nos. 16 and 31 were nonfunctional). She was premedicated with an over-the-counter, nonsteroidal anti-inflammatory analgesic drug before the procedure, and all 4 quadrants were anesthetized with local anesthetic. The procedure was scheduled for 2½ hours; the extractions were done as part of the treatment in each respective quadrant. General tactile debridement was done to remove plaque and reduce the level of subgingival calculus, followed by endoscopic debridement in the areas of pocketing. The patient was given a short course of a systemic antibiotic (Zithromax, Pfizer Inc, New York, NY, www.pfizer.com) to serve as an adjunctive disinfectant

to the debridement (further discussion regarding the adjunctive use of local and/or systemic antimicrobials is not within the scope of this article).¹⁰⁻¹⁴ The patient was seen for reevaluation at 6 weeks posttreatment, supportive periodontal treatment consisting of micro ultrasonic debridement was performed at 3-month intervals, and another reevaluation was recorded at 18 months posttreatment. Figure 7 shows the improvement in clinical probing depths.

Patient No. 2

A 76-year-old woman presented with a diagnosis of localized moderate to advanced chronic periodontitis, in the maxillary arch only. Her medical history indicated diagnoses of high blood pressure and osteoporosis, and she was taking appropriate medications for treatment. Her treatment plan consisted of full-mouth micro ultrasonic debridement, with adjunctive endoscopic debridement. She was premedicated with an over-the-counter, nonsteroidal anti-inflammatory analgesic drug before the procedure and both maxillary quadrants were anesthetized with local anesthetic. The procedure was scheduled for 70 minutes. General tactile debridement was done to remove plaque and reduce the level of subgingival calculus, followed by endoscopic debridement in the areas of pocketing. The patient was given a short course of a systemic antibiotic to serve as an adjunctive disinfectant to the debridement. Figure 8 shows the initial clinical probing depths and at the 6-week reevaluation, all areas of pocketing were showing improvement with the exception of tooth No. 12 mesial. This site was re-treated with micro ultrasonic, endoscopic debridement and an adjunctive local delivery antibiotic was placed (Arestin, OraPharma Inc, Warminster, Pa, www.orapharma.com). The patient was seen for supportive

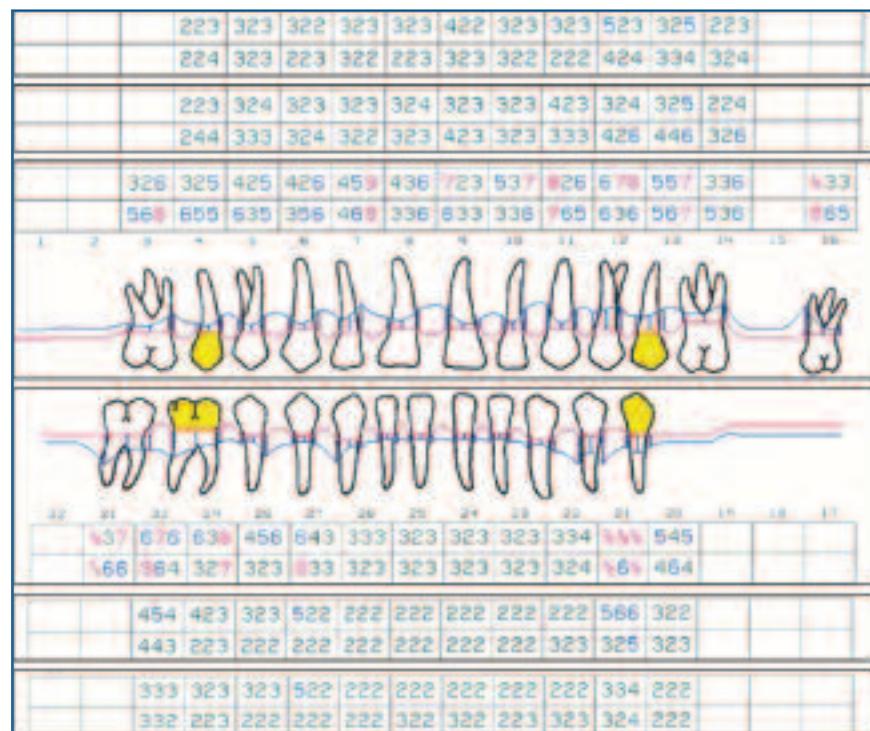


Figure 7—Patient No. 1. Initial, 6-week, and 18-month probings (from inside going out).



Figure 8—
Patient
No. 2. Initial,
6-week, and
14-month
probing (from
bottom to top).



Figure 9A—
Patient No. 2
before treat-
ment.



Figure 9B—
Patient No. 2,
14 months
after treat-
ment.

periodontal treatment consisting of micro ultrasonic debridement at 3-month intervals and was reevaluated clinically and radiographically at 14 months posttreatment. Figures 9A and 9B show her radiographic change from pretreatment to 14 months posttreatment.

Patient No. 3

A 65-year-old man presented with a diagnosis of localized moderate to advanced chronic periodontitis. His

medical history was negative, with the exception of a history of high blood pressure that was well controlled with medications. His treatment plan consisted of full-mouth micro ultrasonic debridement, with adjunctive endoscopic debridement. He was premedicated with an over-the-counter, nonsteroidal anti-inflammatory analgesic drug before the procedure and 3 quadrants were anesthetized with local anesthetic. The procedure was scheduled for 2 hours. General tactile debridement was done to remove plaque and reduce the level of subgin-



Figure 10—
Patient No. 3.
Initial, 6-
week, and 18-
month prob-
ings (from top
to bottom).



Figure 11A—Patient No. 3 before
treatment.

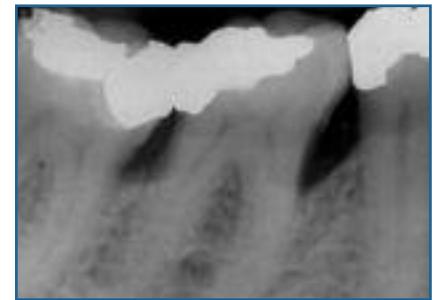


Figure 11B—Patient No. 3, 18 months
after treatment.

gival calculus, followed by endoscopic debridement in the areas of pocketing. The patient was given a short course of a systemic antibiotic to serve as an adjunctive disinfectant to the debridement. The patient was seen for reevaluation at 6 weeks posttreatment, supportive periodontal treatment consisting of micro ultrasonic debridement was performed at 3-month intervals, and another reevaluation was recorded at 18 months posttreatment. Figures 10 through 11B show the clinical and radiographic response on the lower right molars, from pretreatment to 18 months posttreatment.

This small case series provides examples of the positive responses possible with micro ultrasonic, endoscopic periodontal debridement, and adjunctive disinfection. If we can produce a biologically acceptable periodontal environment that is below the threshold for an inflammatory response, healing of the soft and hard tissue is possible with treatment that is efficient, minimally invasive, and with minimal risk of morbidity.

Conclusion

The introduction of periodontal endoscopy has given dentistry the opportunity to provide more thorough debridements in a minimally invasive way. This treatment is accelerated by using powered instrumentation, and additional hand instrumentation is generally not necessary. If,

however, there is a need to visually modify the root surface using some form of cutting or abrasive instrumentation, there are numerous ultrasonic instruments that are sharp or abrasive to help accomplish such a task in less time, and with less operator effort. In fact, the original ultrasonic instruments were simply modifications of existing hand instruments.¹⁵

In 1992 Woodall stated: "Ultrasonic instrumentation is now the first choice over hand instrumentation for most patients. This constitutes a major shift in dental hygiene approach to treatment...This text has placed hand instrumentation secondary to ultrasonic instrumentation..."¹⁶ While this tenet is not new, the current level and amount of training available is less than adequate. Just as the types of hand instruments are too numerous to count, the selection of ultrasonic equipment can be confusing. Instruction on their use is widely variable and must be standardized. It is essential for microscopic techniques such as the use of endoscopy and micro ultrasonics be incorporated by our educational system so their potentials can be realized.

Available controlled studies into the value of periodontal endoscopy are limited at this point. However, case series and anecdotal evidence show that this technology has great promise.^{17,18} Investment costs and the learning curve are issues that create

perceptions, which are limiting the use of the endoscope. Dentistry is just beginning to learn to use this equipment in an effective and efficient way, and is even earlier in the journey into learning how to teach this technology. Micro ultrasonic, endoscopic periodontal debridement will be a major player in the treatment of periodontal disease because it is minimally invasive, highly visual vs tactile, and can be provided by dentists and dental hygienists, in an efficient and effective way. **COH**

Disclosure

The author has received honoraria for providing presentations for Dental View.

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