

An introduction to subgingival ultrasonic scaling

Forget what you learned in school. The ultrasonic scaler (not the curette) is your most potent weapon against periodontal disease.

by Larry Burnett, DDS

There's a massive change occurring in the treatment of periodontal disease ... a shift in philosophy so profound that it will change the way hygienists and dentists treat their patients.

I teach periodontal therapy to hygienists and dentists. Six years ago my course consisted primarily of traditional hand-instrumentation technique. (Which curette to select. The proper way to hold it. How to minimize iatrogenic damage to the tooth and tissue.)

Today I still teach hand-instrumentation, but only as an adjunct to ultrasonic scaling. In my practice, in my courses, and increasingly in dental offices throughout the country, ultrasonics supplemented by antimicrobial therapy has become the nucleus of a new periodontal regimen.

The ultrasonic scaler has been around now for about 30 years. In most practices it's used (assuming it's used at all!) primarily for gross removal of supragingival calculus. That's a

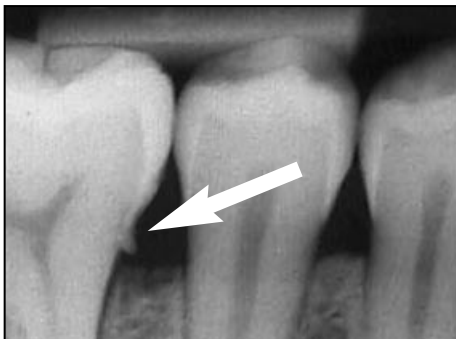


Illustration 1: New research supports what creative periodontists like Drs. Sam Lowe and Thomas Holbrook have been reporting for years ... that the ultrasonic scaler is the instrument-of-choice for removal of subgingival calculus like this.

shame. Because new research suggests that the lowly ultrasonic scaler may be our most potent weapon against periodontal disease.

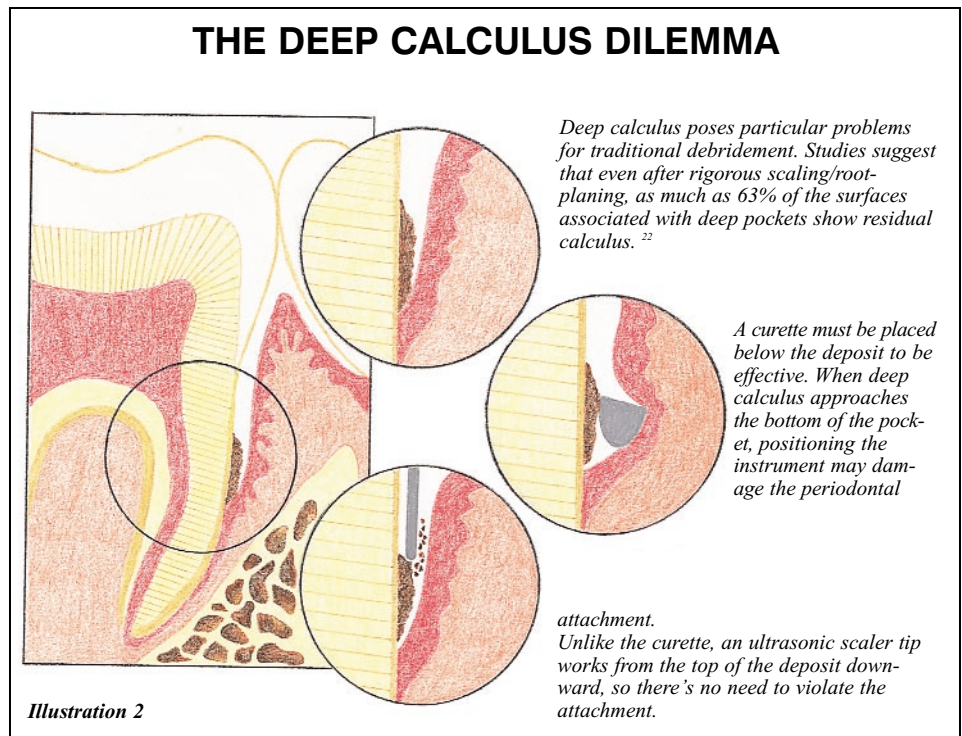
But first we have to "unlearn" much of what we know about ultrasonic scaling.

Oral hygiene is no longer the art of calculus removal.

As recently as the 1960's we believed that periodontal disease was due primarily to irritation caused by rough calculus deposits.

We were wrong.

Periodontal disease is caused by pathogens. Bugs. It's not caused by calculus ... or pockets ... or bony defects. If you focus on those bugs, you can often arrest severe periodontitis, without extractions or surgery. If you ignore the



There's a profound change occurring in the use of ultrasonics to treat periodontal disease.

Irene Woodhall - 1985

"The primary criterion for patient selection for ultrasonic scaling is that the patient exhibits large amounts of tenacious calculus ... It is NOT indicated for patients who have only light calculus, since most investigators still advocate root planing following ultrasonic scaling."

(Woodhall I. Tuning to ultrasonics. RDH, p12, June 85)

Irene Woodhall - 1992

"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 ..."

(Woodhall I. et al. Comprehensive dental hygiene care, 4th ed.)

bugs, surgery generally won't help ... at least not long term. (In fact, as you can see in Table 1, all the etiological factors normally cited as contributing to periodontal disease are pathogen-related.)

If you examine plaque from a healthy mouth under a phase-contrast microscope, you almost always see bacteria. That's natural.

But at some point, certain types of bacteria may reach a critical mass and begin behaving in a very destructive manner.

If you examine plaque from an inflamed pocket, you usually see far more motile pathogens. Here, the balance between microflora and the patient's immune system has been disturbed, and the microflora are winning.

If you disrupt the pathogens or reduce their number below the critical level, the immune system often reasserts itself. The patient stops deteriorating. The bone stops receding. And the

tissue regains the firm, pink glow of health.

Putting calculus in perspective.

Today, everybody accepts the bacterial foundation of periodontal disease.

Yet many practices continue to treat patients as if calculus were the primary enemy. To some, calculus removal has become almost an obsession. In their attempt to create smooth roots, free of any deep accretions, they tear into the fragile periodontal ligament and vigorously scrape off tooth structure, creating countless cases of hypersensitivity.

Don't misunderstand. I don't mean to disparage well-intentioned attempts to remove subgingival calculus. Calculus provides sanctuary to the real villains (bacteria), so it certainly is a contributing factor in the progression of disease. But it's one of many contributing factors. Fact is, periodontal health does not require cal-

culus-free roots.

This is fortunate, because creating calculus-free roots is virtually a clinical impossibility.^{1,2,3}

The new role of ultrasonics in periodontal therapy.

Ultrasonic scalers were developed back in the days when calculus was seen as the primary enemy. In the war against calculus, early ultrasonic scalers were like a bazooka ... powerful, but imprecise.

Experts cautioned against using the devices on regular maintenance patients who did not have gross supragingival deposits.⁴

Things have changed dramatically in the past few years. New superthin tips are now available that fit into deep pockets and small furcal areas where a standard curette is ineffective. Some manufacturers are now designing machines with a far wider power range, so they can create effective cavitation at the low power settings needed for subgingival use.

In my opinion (and that of a number of other researchers in periodontal therapy)^{5,6,7,8} ultrasonic scalers are now the preferred method for subgingival debridement. Research has shown that subgingival ultrasonic scaling not only removes calculus as well as (maybe better than!) traditional hand instrumentation, but that it also kills bacteria and reduces the level of endotoxins.

Ripping bacteria to shreds.

The water that flows through an ultrasonic scaler's handpiece doesn't just cool the tip ... it actually destroys bacteria.

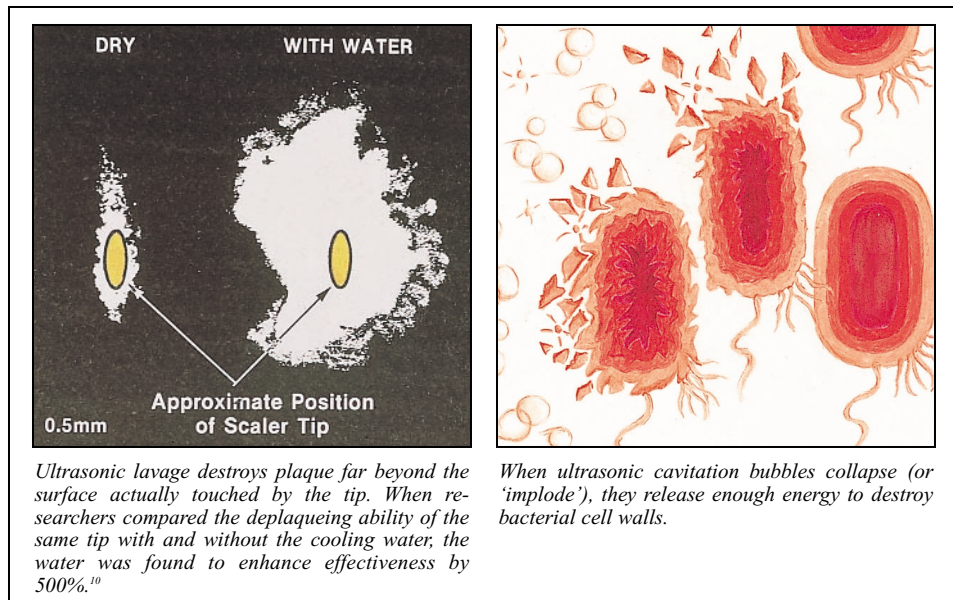
Back in the early 70's researchers noticed that an ultrasonic scaler's cleaning ability dropped significantly when the waterflow was interrupted. They speculated that this was due to the irrigating effect of the water. The vibrating tip loosened the plaque ... the water washed it away. Sort of like using a hand scaler and Water-Pik® at the same time.⁹

In England a few years ago, a team of researchers carefully examined the area cleaned when an ultrasonic scaler tip simply touched the tooth. First they used the scaler dry. Then with water.

In every case ... no matter which tip was used, and no matter at what angle it touched the tooth, the amount of plaque-free surface increased by 500% to 800% when the water was turned on.¹⁰

The dry tip removed plaque only where it actually contacted the tooth. But the water-cooled tip didn't have to touch the plaque in order to destroy it ... surfaces as much as a half-millimeter away from the tip were completely plaque-free.

The energy carried in that water spray acts exactly like your office ultrasonic cleaner. The tip's high-frequency vibrations create cavitation bubbles. When the energized spray from the handpiece contacts the tooth surface, these bubbles collapse (or "implode") and release short bursts of energy. The energy in any one bubble is negligible, but the effect of millions of these cavitation bubbles is to literally BLAST the plaque from the surface and tear apart bacterial cell membranes in the process.



Ultrasonic lavage destroys plaque far beyond the surface actually touched by the tip. When researchers compared the deplaqueing ability of the same tip with and without the cooling water, the water was found to enhance effectiveness by 500%.¹⁰

When ultrasonic cavitation bubbles collapse (or 'implode'), they release enough energy to destroy bacterial cell walls.

SO WHAT?

My point isn't that you should always use the water spray with your scaler. Everybody does that anyway. My point is that you don't have to actually touch plaque with the tip in order to destroy it.

And this has some heavy implications for subgingival scaling, where you're often attempting to deplaque surfaces that are hard to reach and virtually impossible to see even on a radiograph.

Take furcation involvements, for example. Research has shown that more than half the furcas (58%) are smaller than the smallest curette.¹¹ Now how do you debride a surface manually, when you can't even get a hand instrument in there (let alone activate the working tip at the proper angle!)? The answer, of course, is you don't use a hand instrument. You use your ultrasonic scaler fitted with one of the new superthin Perio tips. The tip slides into the furca, and the energy from ultrasonic streaming destroys the

plaque.

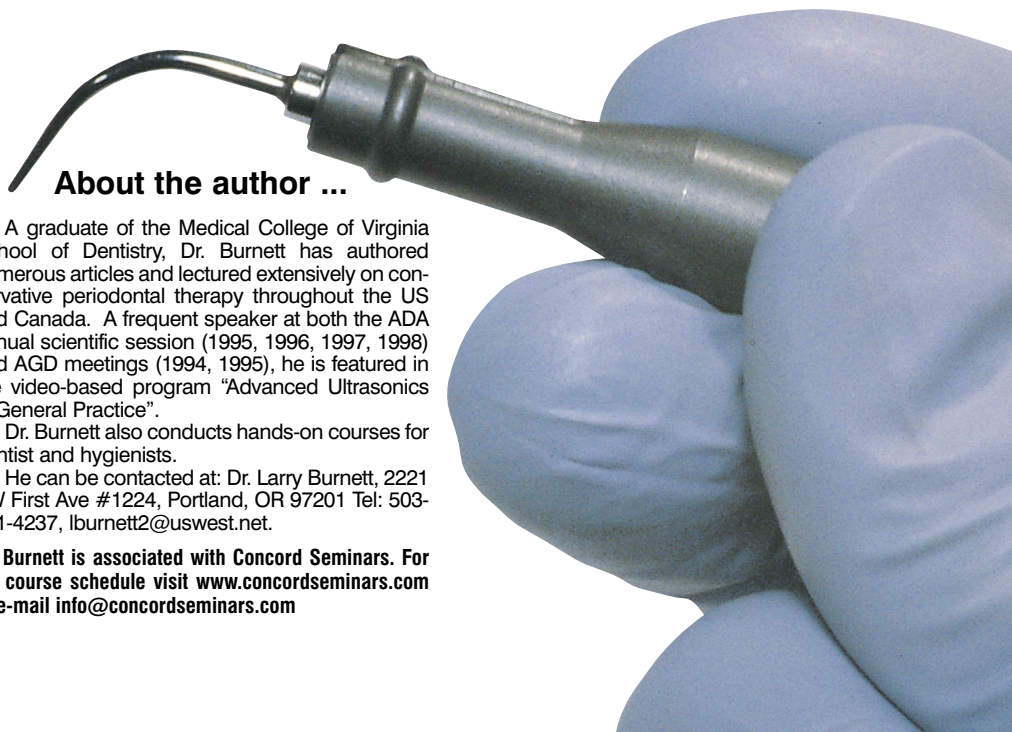
Forget what you learned in school about ultrasonics and subgingival calculus.

Don't kid yourself. No matter how good you are with a Gracey® curette, you're not removing all the subgingival calculus. A recent study found that more than half the root surfaces that had been rigorously hand scaled (57%) still supported residual deposits.¹²

The belief that hand instrumentation is more effective than ultrasonic scaling in removing subgingival calculus is a myth.

It's probably rooted in our Puritan work ethic. After all, how could anything as easy as ultrasonic scaling possibly be as effective as hand instrumentation? There is a subtle, unspoken belief that REAL HYGIENISTS actually prefer going home at the end of the day with fingers numb and arms aching. "Cavitron® Queen" is not generally used as a compliment.

But the truth is, if you use a thin periodontal tip that slides easily into pockets, ultrasonic



About the author ...

A graduate of the Medical College of Virginia School of Dentistry, Dr. Burnett has authored numerous articles and lectured extensively on conservative periodontal therapy throughout the US and Canada. A frequent speaker at both the ADA annual scientific session (1995, 1996, 1997, 1998) and AGD meetings (1994, 1995), he is featured in the video-based program "Advanced Ultrasonics in General Practice".

Dr. Burnett also conducts hands-on courses for dentist and hygienists.

He can be contacted at: Dr. Larry Burnett, 2221 SW First Ave #1224, Portland, OR 97201 Tel: 503-221-4237, lburnett2@uswest.net.

Dr. Burnett is associated with Concord Seminars. For his course schedule visit www.concordseminars.com or e-mail info@concordseminars.com

scaling is every bit as effective in removing calculus as hand instrumentation. And that's not just one person's opinion. There's a library of supporting documentation.^{13,14,15}

I subscribe to the MedLine computerized database, which allows me to quickly survey thousands of scientific papers in hundreds of journals. Since 1980, every published study that has compared hand instrumentation to ultrasonic debridement has found either that there is no difference in effectiveness ... or that ultrasonic scaling has a slight edge. And, as I mentioned, ultrasonic scaling wins hands down when debriding class II and class III furcation areas.

Ultrasonics: Gentler to the periodontal tissue.

The deeper the calculus, the harder it is to remove with a curette and the greater the chance of tissue damage.

Hand instrumentation isn't a problem if you're working just 2 or 3 mm into a 5 mm pocket. But what do you do if you're attacking calculus that's 4 mm deep or (worse!) right at the apex of the pocket? Since pockets taper, the deeper you go, the less room there is for your instrument. As you descend, it becomes harder and harder to manipulate the curette without damaging the sulcular epithelium.

It is impossible to remove calculus at the bottom of a pocket using a hand instrument without violating the periodontal attachment. It cannot be done! (Illustration 2) That's because a curette must be placed apical to the deposit in order to be effective.

An ultrasonic scaler breaks up calculus using high-frequency vibrations. You never apply pressure. Just a light tapping at the coronal edge as you work your way down is generally all that's necessary to disintegrate even tenacious, old deposits.

In contrast to a curette (which works from the bottom up), an ultrasonic tip works from the top down, so there's less chance of damaging the tissue.

A number of studies have confirmed that ultrasonic scaling is kind to soft tissues.^{16,17} After periodontal surgery, patients seem to heal faster if the hygienist debrides with an ultrasonic scaler rather than hand instruments.^{18,19}

After ultrasonic debridement, should roots be planed?

Traditionally, we've planed roots for two reasons: (1) To eliminate toxins and (2) to create a smooth, glasslike surface.

It used to be common knowledge that cementum absorbed bacterial endotoxins like a sponge. It followed that the only way to restore health to a diseased periodontium was to scrape off this toxic reservoir. Cementum was the tonsils of the alveolar process.²⁰

This "common knowledge" was just flat wrong.²¹

We now know that toxins are only superficially involved in the cementum. A number of studies have shown that they are easily diluted and rinsed off by the cavitation provided by an ultrasonic tip. (In fact, root planing may actual-

ly increase complications due to endotoxins. As it strips off the root's protective cementum, root planing exposes tubules and reduces dentin thickness. This may increase the danger that bacteria and their toxins will irritate the pulp.)

The second reason for planing was correct ... but only partially. Cementum has an irregular contour. Since plaque prefers rough surfaces, we believed that planing off the cementum would deny the plaque a happy home.

I've seen plenty of ceramic crowns just covered with plaque. Now you can't get any more "glasslike" than a ceramic crown, so obviously bacteria will attach to a smooth surface. Furthermore, we now know that regular subgingival ultrasonic debridement blasts plaque from both smooth and rough surfaces.

Though a smooth surface may be somewhat more hygienic, it's hard to justify the hundreds of thousands of cases of hypersensitivity we've created over the past decades in our dedication to "glass-like surfaces."

While I often use a curette as an explorer after ultrasonic scaling, I no longer plane roots to achieve glasslike dentinal surfaces. In my opinion, this rigorous planing can be overtreatment.

Subgingival calculus ... a different beast.

Depending on the patient, supragingival calculus can form in a matter of days.

But subgingival calculus is much more deliberate. Though I haven't seen any studies documenting the rate of deep calculus formation, it's been my experience that accretions take at least seven months to show up on the radiograph.

The slow rate of subgingival calculus formation has some significant implications for the periodontal maintenance program.

For one thing, it means that once you get the root surfaces relatively clear of calculus, the patient on a normal 3-to 6-month recall is returning primarily for plaque removal ... not calculus removal. The patient is in the chair not for you to scrape the roots ... but for you to kill bugs!

Of course you may discover a bit of old calculus missed at earlier appointments. But at each recall you should discover less ... because new calculus doesn't have time to form.

This makes the recall appointment more effective too. Periodontal disease is episodic and site-specific. When you don't waste your time scraping non-existent calculus, you can spend more time looking for sites suffering recurrence or reinfection.

Proper periodontal maintenance is much more than simply scraping teeth every three months. It's an ongoing process that involves continual diagnosis, prevention and treatment. It includes subgingival deplaquing to prevent recurrence, as well as detection and treatment of small flare-ups at specific sites. In my opinion, the recall appointment is the most important part of periodontal therapy.

Ultrasonics and the periodontal maintenance program.

TABLE 1: Etiological Factors in the Development of Periodontal Disease

Though often listed as separate factors affecting the progression of periodontal disease, they have one thing in common: They all affect the bacteria's ability to attach and reproduce.

Bacterial Plaque

This is the sine qua non of all periodontal problems. No bugs. No disease. It's that simple.

Tooth Position

Crowding or severely tipped teeth make it difficult to debride surfaces, so bacteria can attach and flourish.

Mouth Dryness

Saliva is a major delivery mechanism in the body's defense against problems.

Calculus

Like a microscopic coral reef, calculus provides a safe haven for bacteria.

Iatrogenic factors

The number-one iatrogenic cause of periodontal problems is marginal overhang. Like calculus and tooth position, overhangs offer sanctuary to bacteria and can permit the microflora to change from a state of health to one of disease.

Immune System response

This is the wild card in treating periodontal disease. Individual patients can vary dramatically in their ability to resist the colonization by oral bacteria. Immune system response is probably the reason why one patient responds beautifully to simple ultrasonic debridement, while another may require more extensive periodontal therapy.

Ultrasonic scaling using the new probe-like tips can make the recall appointment easier and more effective. My primary instrument for the maintenance appointment is an ultrasonic scaler and several Perio inserts with fine tips that slip deep into pockets and furcation areas. (Traditional tips are far too big for this.)

I adjust the power way down, because low power is all you need to wash away toxins and destroy the bacterial cell walls. Then I lightly run over all the root surfaces. At this low power there isn't much heat generated, so there's no need to anesthetize the patient. If I see some localized bleeding, I look closer to see if there's a bit of residual calculus. If so, I either turn up the power on the scaler, or switch to a hand curette. In severe cases, particularly when the patient is immuno-compromised, I combine ultrasonic debridement with antimicrobial agents ... but space is limited, so that's the subject of another article.

The bottom line.

In too many practices "periodontal therapy" consists largely of scraping roots with assorted sharp instruments. This treatment is based on the misconception that calculus is the ultimate enemy in the war against gingivitis and periodontitis. In our obsessive fixation on calculus, we may forget that the real enemy is bacteria.

New research has shown that calculus-free roots are not necessary for periodontal health,

and in fact, are impossible to achieve.

Exciting new developments in ultrasonic scalers and tips, have made subgingival ultrasonics the foundation of a modern, conservative approach to periodontal therapy.

Ultrasonic debridement is ...

- 1.) Highly effective in eliminating plaque and toxins, the causes of periodontal disease.
- 2.) Faster and at least as effective as hand scaling in removing deep calculus.
- 3.) Gentler to the soft tissue than hand scaling.
- 4.) More comfortable for the patient.
- 5.) And significantly less stressful for the dentist or hygienist.

If you're using your ultrasonic scaler as an adjunct to hand instrumentation, you've got it backwards.

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