Types of Powered Instrumentation for Scaling and Root Planing

There are two main types of powered scalers: Sonic and Ultrasonic.

Sonic (Titan):

-Air driven
-3,000-8,000 CPS
(cycles per second)
-Linear or elliptical tip motion
-High intensity noise

Ultrasonic:

1. Magnetostrictive (Cavirton)

-Electrically stimulated metal stack
-18,000-45,000 CPS
-Linear to Circular tip motion

2. Piezoelectric (Ultradent)

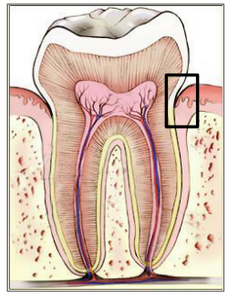
-Electrically stimulated crystals
-25,000-50,000 CPS
-Linear tip motion

Ultrasonic instrumentation in dentistry was first proposed by Catuna in 1953 for cutting teeth. Further work by Zimmer in 1955 showed that ultrasonic instruments could remove deposits from the teeth. By 1960, ultrasonic scaling was shown to be acceptable for calculus removal (Szmyd and McCall). Research also supports removal of deposits not just through mechanical tip movement against the offending agent, but also through high energy shock waves and acoustic microstreaming which help to loosen the deposits from the root surface.* In addition, the water irrigation from the unit also aids in flushing out loosened deposits from the subgingival area.

A Constant Battle

As long ago as 1683, when the first microscope was created, it was discovered that bacteria are in dental plaque. There are over 300 different bacteria which inhabit the mouth, some more virulent than others. Periodontitis is a bacterial infection, which requires the presence of bacteria to cause disease.

The teeth make up a very special environment in the body. Where else do you find a situation where bone is protruding through the epithelium? A tooth in the bony socket is surrounded by blood vessels and nerves, which need to be kept separated from the bath of bacteria a few millimeters away. The gingival sulcus is a battle ground where oral bacteria fight to get into the connective tissue, while the gingival crevicular fluid is constantly pushing them out. If the bacteria do manage to invade, then the blood vessels release a barrage of inflammatory mediators: Tumor Necrosis Factors, Prostaglandins, Collagenases, Interleukins, and C-Reactive Proteins among others, to stop the advancing bacteria. These mediators also result in attachment loss and bone loss.



It is not always possible to accurately predict or fully control the host response, but we can at least reduce the bacteria as a factor as much as possible by mechanically removing them.

This ProbeTips newsletter will review the history, benefits, and drawbacks of powered subgingival plaque removal in the fight against Periodontitis.

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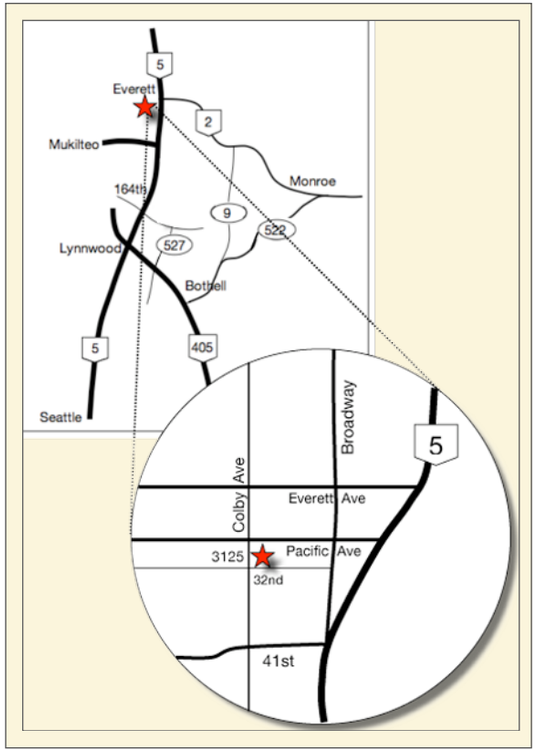

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Probe Tips

A Quarterly Periodontal Newsletter

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Powered Scaling and Root Planing

Taken from Google Images

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Powered Scalers in Dentistry

General Considerations

Manual scaling and root planing was designed to remove pathogenic congregations of bacteria from on or within the surface of the root both supra- and sub-gingivally. Bacteria can repopulate supragingivally within a matter of hours after the biofilm is disrupted, and within a matter of weeks subgingivally. The periodic removal of these bacterial accumulations, both manually and with powered assistance, is necessary for controlling inflammation and infection in those most susceptible.

Benefits of Powered Instrumentation:

Bleeding on Probing and Pocket Depth Improvement

Powered and hand instrumentation have similar clinical results. "Improvements in clinical parameters are nearly equal for all mechanical instrument techniques as long as sufficient time is spent to thoroughly debride the roots." ** In fact, a combined approach is likely the best way to achieve the best outcomes as certain instruments are better adapted for certain root areas, or better suited to operator preference.

Plaque Removal

Studies have shown that sonic and ultrasonic instrument tips can reach deeper into pockets than manual instrument tips, apart from the extended reach through the cavitation and microstreaming.

Powered instruments have an additional advantage over manual instruments through cavitation and microstreaming capable of disrupting cell walls. This allows the powered instruments to 'reach' further than the instrument tip to clean deeper in the pockets than manual instruments.

Calculus Removal and Root Surface Alteration

Research is inconclusive regarding a benefit of powered scalers over manual scalers for calculus removal. There is also no instrument that is worse than another regarding damage to root surfaces.

Both of these parameters are dependent on operator use. If there is a 'heavy-handed' clinician, both an ultrasonic and hand instrument can cause significant root surface removal. Research currently indicates that endotoxins on the root surface are easily removed and excessive removal of cementum or dentin are not necessary to achieve a clean root surface to allow for reattachment and pocket reduction. Therefore, root planing is not necessary to remove endotoxins, and planing of the root is useful only when the root surface is undulating or has significant gouges or excessive cementum which may prevent reattachment and pocket reduction.

Efficiency

Studies indicate that powered instruments can achieve reduced debridement time per tooth because of increased speed of calculus removal. In addition, because of the cavitation and microstreaming allowing for easier calculus removal, there is reduced physical demand on the operator. This also means that the learning curve is shorter and operator skill is less important with the use of a powered scaler versus hand instrumentation. Patients also benefit from less chair time and possibly less discomfort post-operatively.

Disadvantages of Powered Instrumentation:

Aerosols

Aerosols are indeed generated during use of powered scalers. High vacuum suction can reduce the amount of aerosol by 93%. In addition, pre-treatment mouth rinse with Essential Oil based rinses or Chlorhexidine rinses reduces bacterial counts in the aerosols by 92% and 97% for 40 and 60 minutes respectively when used for 2 rounds of 30 seconds. Aerosols can be suspended in the air for 30 minutes, so it is good practice to reduce the amount of bacteria available to cause disease not just for ourselves, but also for any other patients who may be more immunocompromised than others. However, there is no evidence that any serious diseases have been contracted in this manner.*

Pacemakers

Piezoelectric devices have not been reported to cause problems. However, a study from 1998 showed that magnetoscrictive ultrasonics (ex: Cavitron) can cause interference with pacemakers if they come within 1 foot of the pacemaker leads. Even though modern pacemakers are shielded and there is reduced risk, literature from 2016 still recommends that such devices should not be used in patients with cardiac pacemakers.

Heat Generation

Ultrasonic devices cause heat generation through friction between the scaler and the tooth or soft tissue, and acoustic energy from the scaler absorbed by the tissues. Without water coolant, significant damage can be cause to the gingiva, and even to the pulp. The literature recommends a minimum of 20ml/min of irrigation when using an ultrasonic device.

Auditory Changes

Use of ultrasonic scalers includes the noise generated from the vibration, particularly when it touches the teeth. Apart from the fact that it can be annoying to some, there is no evidence of permanent hearing damage from the use of such devices.

Summary

Scaling is intended to achieve a clean root surface with as little damage to the root as possible. It is thought that an ultrasonic scaler on medium power with adequate water flow and the tip at as close to an angle to zero as possible would be most effective and efficient at calculus removal while causing the least amount of damage to the root surface or pulp. Use of pre-procedural oral antimicrobial rinses and high volume suction will reduce the risk of bacteria in the air. Avoiding the use of magnetoscrictive devices in patients with cardiac pacemakers is advised.

References

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Complete references available on request.