CLINICAL

Ultrasonics: types, techniques, terminology and tips

Reena Wadia delves into the world of ultrasonics to explore more about this popular tool for periodontal therapy

The term ‘ultrasonic’ refers to anything above the frequency of audible sound and nominally includes frequencies more than 20,000 Hz (Figure 1). Ultrasound has a range of popular medical uses including imaging, ultrasonic heat treatment for muscle strain as well as the treatment of gallstones and kidney stones.

The ultrasonic scaler is one of the most popular tools used amongst all dental professionals. Scientific evidence supports the use of powered instruments as an integral and important part of periodontal debridement. Ultrasonic instrumentation is as effective as hand scaling for plaque and calculus removal and the successful healing of diseased periodontal tissues (Capullos et al, 1993; Schenk et al, 2000). Ultrasonic scalers are available as either magnetostrictive or piezoelectric devices.

This article will provide an overview on the differences between magnetostrictive and piezoelectric devices, general principles of ultrasonic instrumentation, definitions of the buzzwords and a few tips to help ensure optimal use.

Magnetostrictive vs Piezoelectric – what’s the difference?

Magnetostrictive scalers

The first magnetostrictive ultrasonic scaler was released in 1957 by Cavition, Dentply (Figure 2).

Electrical energy is applied to the handpiece of the device and this generates magnetic energy. The magnetic energy is applied to the insert’s stacked metal strips, which converts energy from the handpiece into mechanical oscillations that activates the tip.

Piezoelectric scalers

The first piezoelectric device was put on the market in 1970 by Sateltec (Figure 3).

In piezoelectric units, the electrical energy is applied to ceramic crystals. This causes changes in the crystal lattice shape and the alternate expansion and compression of the ceramic discs results in micromovement of the tip.

Piezoelectric scalers rely upon linear movement. Given the linear fashion in which the tip moves, it is the tip’s two lateral surfaces that are the most active. Piezoelectric devices generally operate at frequencies ranging from 15-50 kHz.

Techniques: general principles of ultrasonic instrumentation

- The angulation of the insert to tooth is much less than for hand instrumentation – 0-15°
- Inserts should be activated prior to insertion into the pockets
- Adapt the surface of the instrument that best conforms to the anatomy of the treatment site (Figure 4) (Nield-Gehrig, 2008). Particularly with magnetostrictive technology, you are not limited to a lateral surface
- In contrast to hand scaling, which requires the cutting edge to be below the deposit, the ultrasonic tip removes deposit as it encounters it, therefore strokes should initiate at the gingival margin
- The tip should be used in a constant erasing type of motion, using short, overlapping horizontal, oblique, and vertical strokes to completely cover the root surface. It is important to implement strokes that are equally distributed (ie, don’t use a hand scaling stroke that is predominant in one direction)
- A tapping stroke with the point of the tip can be used to remove tenacious supragingival deposits
- Only a light grasp is required. A light grasp increases tactile sense of deposits, allows the tip to move freely over the tooth surface, enhances patient comfort and reduces operator fatigue
- It is important to keep the tip moving and maintain the integrity of the contact between the active area of the tip and the tooth surface for optimal results
- The fulcrum is needed only to stabilise the instrument rather than provide leverage for force and therefore a number of alternative fulcnums can be utilised.

Terminology: buzzwords

Frequency and amplitude: the frequency is the number of times the tip travels back and forth per second. The amplitude is the distance the tip travels with each stroke. Frequency and amplitude determine power. Power determines stroke length; lower power equals shorter, less powerful strokes; higher power equals longer, more powerful strokes (Figures 5a and 5b) (Nield-Gehrig, 2008).

Cavitational: this is the formation of pulsating bubbles that are powered by an ultrasonic field (Figure 6) (Nield-Gehrig, 2008). The bubbles collapse inwards, releasing energy. It enhances biofilm removal and potentially disrupts bacterial cell walls.

Acoustic microstreaming: this describes the fluid flow generated by ultrasonic oscillations. The forceful flow of the
Tips for using ultrasonics

- Always use the lowest effective power setting and increase as required. Optimal function of the tip and a well maintained tip should reduce the need for increased power settings.
- Scaling efficiency is significantly diminished with worn, damaged or bent tip inserts. Two millimetres of wear can result in 50% efficiency loss. Therefore, it is important that tips are regularly checked for wear with the help of a wear guide.
- As ultrasonics have evolved, new designs in straight and curved tips have included designs that reflect the site-specific benefits of Gracey curettes (Walmsley et al, 2008). Pick the most appropriate tip for the tooth surface in question.
- Ultrasonic scalers are considered superior to hand instruments for the treatment of teeth with furcation involvement (Drisko, 1998). When entering the furcation, rotating the insert enables the tip to reach the roof of the furcation.
- There are benefits to both hand and ultrasonic instrumentation. Therefore, the use of both with a blended approach is ideal for non-surgical periodontal therapy (Cobb, 1996).

Nurturing fluid enhances the effectiveness of biofilm removal beyond the surface directly in contact with the tip. Fluid lavage: flushing ability created by a continuous fluid stream within the pocket. The flushing action washes debris, bacteria and unattached plaque from the periodontal pocket. The fluid also cools the handpiece and tip. An adjustable flow rate allows the operator to select the optimal flow. DH&T

References

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