Fundamentals of Ultrasonic Instrumentation for Complete Debridement Procedures

COURSE DESCRIPTION

This course is based on current scientific literature providing the clinician with evidence based tools and strategies which include the use of periodontal risk assessment protocols, salivary diagnostics, incorporation of the dental exam and progressive treatment planning. Advantages of ultrasonic instrumentation will be examined as demonstrated in the current research for obtaining successful clinical outcomes while providing comprehensive patient care.

COURSE OBJECTIVES

Upon completion of this course, participants will be able to:

• Differentiate the advantages and limitations of the various technologies which drive power scaling units

• Compare and contrast the three E’s and the three A’s of hand, sonic, and ultrasonic instrumentation techniques: E’s effectiveness, efficiency, and ergonomics - A’s - Adaptation, angulation and activation

• Describe the technology of ultrasonics and define key terminology, including acoustic streaming, acoustical turbulence, cavitation, lavage, frequency, power and stroke pattern

• Identify and assess pretreatment considerations for the use of ultrasonic instrumentation to include patient’s medical history, clinical indications, and contraindications

• Identify various modifying factors which influence and/or change instrumentation protocols such as root anatomy, furcations and oral conditions.

• List criteria for the appropriate selection of ultrasonic inserts, both standard and modified.

• Demonstrate the correct technique for utilization of the ultrasonic scaler to include insert and power selection, lavage flow, grasp, fulcrum, tip adaptation, and stroke

• Implement ultrasonic instrumentation to facilitate thorough periodontal debridement and enhance clinical outcomes.
Fundamentals of Ultrasonic Instrumentation for Complete Debridement Procedures

Evidence Based Approach

Evidence Based Approach: A decision making process which integrates
- Best available scientific evidence
- Clinician’s experience & expertise
- Patient’s treatment needs and preferences
to make the best possible decision about appropriate care for specific clinical circumstances.

Ref: ADA Position Statement on Evidence Based Dentistry

Accessing and Utilizing

Evidence Based Research
- Where to Find the Research – “There’s an APP for that”
  - Mobile Apps – search by name below
    - Ebsco  iTunes
    - Pub Med
    - Systematic Reviews
    - Links to PubMed
    - Critical Summaries

The Assessment Process

Risk Based Approach
- Recognizes patients at higher risk for periodontal disease
  - Patients who are more likely to develop perio
    - Modifiable – ex. smoking
    - Non-modifiable - genetics
  - Patients with systemic conditions that can be significantly affected by oral inflammation
    - Diabetics
    - CVD
    - Pregnancy
- Biofilm and Host Response
  - Biofilm formation and Role
  - Inflammatory Response

Comprehensive Periodontal Therapy

Research published 1982-1991 initiated instrumentation paradigm shift from definitive root planing to periodontal debridement based on findings that:
- Endotoxins are loosely adherent to root surface
- Extensive cementum removal is unnecessary
- Cell-activating proteins which stimulate attachment are found within cementum

Periodontal Debridement
- Creates a biologically-acceptable root surface that favors healing
- Objective of instrumentation is to disrupt/remove biofilm, calculus, endotoxins from root surface & subgingival environment (vs. removing part of root surface itself)
- Success of instrumentation is defined by positive tissue response (vs. smoothness of root surface)

Debridement Therapy - Definition
- Includes
  - Scaling: hard deposit removal
  - Root Debridement: biofilm and entotoxin removal
- Preventive or Therapeutic intervention
  - Preventive before perio destruction initiates
After initiation of periodontal destruction, it is a therapeutic intervention
- Definitive or complete treatment
- Preparatory or initial therapy prior to surgery

Successful Debridement ↔ Thoroughness of Instrumentation

Criteria for thorough instrumentation:
- Ability of instrument to make contact with involved root surface
- Ability of instrument to disrupt/remove deposits
- Ability of instrument to maintain integrity of root surface
- Accomplishment of the above in a manner that is comfortable to patient and ergonomic for clinician

Successful debridement can be accomplished by manual or ultrasonic instrumentation; however, ultrasonic instrumentation is superior to hand instrumentation in meeting most of this criteria

### Ultrasonic Instrumentation

<table>
<thead>
<tr>
<th>Mechanisms of Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td>Rapid movement of tip mechanically removes deposits</td>
</tr>
<tr>
<td>Irrigation</td>
<td>Lavage created by water flow facilitates removal of biofilm &amp; endotoxins</td>
</tr>
<tr>
<td>Cavitation</td>
<td>Implosion of minute bubbles releases energy which has potential to disrupt cell wall of bacteria</td>
</tr>
<tr>
<td>Acoustic Microstreaming</td>
<td>Forceful flow of cavitating fluid, Enhances debridement of root surface beyond area actually contacted by tip</td>
</tr>
<tr>
<td>Frequency</td>
<td>Number of cycles (one complete stroke path) per second, Frequency correlates to the active tip area, Example: 30k = 4.2mm of active tip area</td>
</tr>
<tr>
<td>Power</td>
<td>Length of the stroke path, As the power increases, the stroke becomes longer, increasing amplitude, Lowest Effective Power should be used</td>
</tr>
<tr>
<td>Piezoelectric technology</td>
<td>Electrical energy activates piezo-ceramic disks in handpiece, 25,000 to 42,000 cps, Linear movement, Only lateral sides active</td>
</tr>
<tr>
<td>Magnetostrictive technology</td>
<td>Electrical energy is applied to metal stack, 25,000 to 30,000 cps, Elliptical movement, All sides are active</td>
</tr>
</tbody>
</table>

### Sonic Technology

- Compressed air runs handpiece to activate tip
- 2500 to 16,000 cps
- 1 power level
- Circular movement
- All sides are active
## Ultrasonic Instrumentation Guidelines

<table>
<thead>
<tr>
<th>Magnetostrictive Inserts</th>
<th>Standard Diameter</th>
<th>Slim Diameter</th>
<th>Perio Specialty Design</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inserts</strong></td>
<td><strong>Power – Low to High</strong></td>
<td><strong>Power – Low to Medium</strong></td>
<td><strong>Furcation</strong></td>
</tr>
<tr>
<td>Single bend (#10)</td>
<td>Gross removal of mod-hvy calculus &amp; stain</td>
<td>Light calculus and/or biofilm debridement in pockets less than 4mm</td>
<td>Furcation access power – Low to Medium</td>
</tr>
<tr>
<td>Slim Diameter</td>
<td>Supragingival or Subgingival use</td>
<td>Light calculus &amp; biofilm debridement in anterior teeth with pockets &gt; 4mm</td>
<td></td>
</tr>
<tr>
<td>Double bend (#100)</td>
<td>Gross removal of mod-hvy calculus &amp; stain</td>
<td>Curved light calculus and/or biofilm debridement in pockets greater than 4mm</td>
<td>Implant (SofTip™) implant debridement power - Low</td>
</tr>
<tr>
<td>Furcation</td>
<td>Supragingival or Subgingival use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triple bend (#1000)</td>
<td>Gross removal of moderate to heavy tenacious calculus &amp; stain</td>
<td></td>
<td>Dental Specialty Inserts</td>
</tr>
<tr>
<td>Dental Specialty Inserts</td>
<td>Improves access to line angles and interproximal areas</td>
<td></td>
<td>1. Endodontic – canal debridement, cleansing, irrigation; for dental use only</td>
</tr>
<tr>
<td>Beavertail (#3)</td>
<td>Heavy supragingival calculus &amp; stain</td>
<td></td>
<td>2. Diamond Coat – removal of tenacious calculus and soft tissue in surgical treatment settings; for surgical use only</td>
</tr>
</tbody>
</table>

### Clinical Application – 3 A’s of Instrumentation

1. **Adaptation**
   - A. Subgingival Technique “Vertical Adaptation”
     - Positioned like a probe
     - Facilitates access of active area to depth of pocket
     - Predominantly horizontal strokes on buccal/lingual surfaces
     - Oblique strokes on interproximal surfaces
   - B. Contact Area/Subgingival & subgingival Technique “Oblique/Transverse Adaptation”
     - Positioned like a hand instrument
     - Predominantly oblique strokes
     - Vertical strokes thru contact area
   - C. Adaptation of terminal end of insert/tip
     - The terminal 2-4 mm’s are adapted during ultrasonic instrumentation; the 1-3 mm’s are best utilized during activation of the stroke
2. **Angulation – 0 -15 degrees**

Angulation similar to the probe (Note ACTIVATION IS NOT LIKE THE PROBE – DO NOT WALK THE ULTRASONIC INSERT)

3. **Activation**

Short 1 – 2 mm overlapping strokes utilizing channeling to ensure thorough removal

- **Deplaquing**
  - Instrumentation in Healthy Sulci
    - Biofilm Removal
    - Less traumatic
  - Perio Maintenance
    - Biofilm Removal
    - Ultra Thin Insert

- **Medical and Dental considerations**
  - Medical –
    - Respiratory problems
    - Swallowing difficulties
    - Transmissible diseases
    - Pacemaker considerations
  - Dental
    - Exposed Dentin
    - Demineralization
    - Implants

- **Ergonomic Considerations**
  - Cord and insert–
    - Grasp
    - Research Evaluated
    - Cord Control
• Water Control
  Suctioning Options/Techniques – Isolite/Isodry – Mr. Thirsty – Small or ½ length HVE – Blue Boa
  Cupping – Gehrig
  Clock positions and max vs mand patient seating/chin up or down/turn patient towards or away.

### Bibliography


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Centers for Disease Control and Prevention. Guidelines for Infection Control in Dental Health-Care Settings – 2003. MMWR 2003; 52(No. RR-17):[inclusive page numbers].


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