SCALERS & CURETTES

All dental instruments follow basic design characteristics. The following diagrams outline the key principles of scaler and curette instrument design.

All instruments have three components:
1. **Handle**: for grasping the instrument.
2. **Shank**: connects the handle to the working end and allows adaptation of the working end to tooth surfaces.
3. **Working end**: carries out the function of the instrument and is unique to each instrument type.

**INSTRUMENT HANDLES**

Instrument handles are available in a variety of shapes and styles. The following factors should be considered when selecting instrument handles:

- **Weight**: Hollow handles increase tactile transfer and minimize fatigue.
- **Diameter**: Large handles maximize control and encourage a lighter grasp.
- **Serration**: Knurled handles enhance control by providing a positive gripping surface.

**THE INSTRUMENT SHANK**

The **terminal shank** extends between the blade and the first bend. The terminal shank position is used to correctly adapt the working end. The length of the terminal shank is a determining factor when selecting curettes for subgingival vs. supragingival access.

The **functional shank** length extends from the working end to the handle. The functional shank can be short, long, or moderate in length.

Moderate to long functional shanks are needed to reach the tooth surfaces of posterior teeth or root surfaces of teeth with periodontal pockets. Short functional shanks are used to remove supragingival calculus deposits or to reach the surfaces of anterior teeth.

**THE SCALER WORKING END**

The working end (blade) is made up of several components: the face, the lateral surfaces, the cutting edge and the back.

A blade that ends with a rounded tip (toe) is classified as a curette. A blade designed with a pointed tip is classified as a sickle scaler.
Instrument shanks are flexible, moderately flexible, or rigid in design. Selecting the appropriate shank design should be based on the objective of the procedure (see chart below).

### SHANK FLEXIBILITY RELATED TO INSTRUMENT USE

<table>
<thead>
<tr>
<th>SHANK TYPE</th>
<th>USES</th>
<th>EXAMPLES</th>
</tr>
</thead>
</table>
| Flexible   | • Detection of subgingival calculus  
             • Removal of fine calculus  
             • Provides the best tactile sensation to the operator’s fingers via the shank & handle | • Gracey curettes  
             • Explorers |
| Moderately flexible | • Removal of moderate or light calculus  
                          • Provides good level of tactile sensation, allowing detection and removal of moderate deposits | • Universal curettes |
| Rigid      | • Removal of heavy calculus deposits  
             • Limited tactile sensation | • Rigid curettes  
             • Sickle scalers  
             • Periodontal files  
             • Hoes |
| Extra Rigid | • Removal of very tenacious calculus  
                          • Limited tactile sensation | • Extra Rigid Gracey curettes |

### INSTRUMENT BALANCE

To function most effectively, an instrument should be balanced. A balanced instrument has working ends that are centered within 2 mm of the long axis of the handle line.

### INSTRUMENT MARKINGS

When the design name and number are labeled along the length of the handle, each working end is identified by the number closest to it. In the illustration below, the working end on the left is the Gracey #1 blade, the right is the Gracey #2 blade.

If the design name and number are labeled around the instrument handle, the first number (on the left) identifies the working end at the top and the second number identifies the working end at the bottom of the handle.
INSTRUMENT SHARPENING
- SCALERS & CURETTES

INSTRUMENT SHARPENING
- SCALERS & CURETTES

SHARP INSTRUMENTS
- Improve calculus removal
- Reduce fatigue
- Save time
- Improve tactile sensitivity
- Minimize patient discomfort

WHEN TO SHARPEN?
Ideally, instruments should be sharpened regularly at the first sign of dullness. Consider the following to help determine when instruments need to be sharpened:
1. The frequency of instrument use.
2. The degree of patient difficulty.
3. Results of evaluating the cutting edge against a plastic test stick.

SHARP CURETTE (CROSS SECTION)
Sharp instruments remove entire deposits

DULL CURETTE (CROSS SECTION)
Dull instruments only “burnish” or remove part of a deposit

HOW TO SHARPEN
The following steps outline the “Stationary Instrument, Moving Stone” sharpening technique:
1. Stabilize the instrument.
2. Apply stone to lateral surface to form a 110° angle with the face.
3. Position the stone to contact the heel of the blade and work toward the tip.
4. Move the stone up and down with short strokes.
5. A sludge will appear on the face of the blade as it is sharpened. It can be wiped clean with sterile gauze.
6. Finish with a down stroke (to avoid a roughened edge).
7. Repeat the procedure to sharpen the opposite cutting edge of sickles and universal curettes.

ANGULATION

CORRECT ANGULATION
When the stone is correctly placed against the blade, the internal angle (70° to 80°) is maintained.

TOO MUCH ANGULATION
When the internal angle is less than 70°, the blade becomes weak and also dulls quickly.

NOT ENOUGH ANGULATION
When the internal angle is greater than 80°, the blade becomes bulky and is difficult to adapt to the tooth.

INSTRUMENTS should be kept sharp and true to their original design. In addition, dental procedures are most effective with sharp instruments.
ROUNDING THE TOE OF A CURETTE

1. Stabilize the instrument.
2. Place stone at a 45° angle to the face.
3. Use up and down strokes, and rotate the stone around the toe.

SHARPENING THE FACE OF DENTAL INSTRUMENTS

Sharpening the face of periodontal instruments is only recommended for removing a roughened edge. The cutting edge should be restored by reducing the lateral side. Excessive grinding of the face weakens the blade.

To sharpen the face of curettes and curved sickles, use a conical or cylindrical stone (SS299, SS2 or SSKC).

1. Stabilize the instrument.
2. Place stone at junction of face and shank.
3. Roll stone across the face, moving toward the tip/toe.
4. Use a few strokes and light, even pressure.

To sharpen the face of a straight sickle, use a flat stone.
1. Apply stone to entire facial surface.
2. Move the stone across the face using a back/forth motion.
3. Use a few strokes and light, even pressure.

INSTRUMENT DESIGN TO CONSIDER WHEN SHARPENING

STRAIGHT SICKLE SCALER

CURVED SICKLE SCALER

UNIVERSAL CURETTE

GRACEY CURETTE

Use the Arkansas stones for everyday instrument maintenance, and the Ceramic and I-Stones for recontouring. Most popular stones: SS3C, SS4
SHARPENING STONES

Sharpening stones restore the cutting edge on dull instruments. Stones are available in various grits, shapes and sizes (see pages D36-D37). The chart below outlines the type of stone to use for various sharpening needs.

After use, wipe with a clean cloth to remove metal particles. Scrub or ultrasonically clean to remove lubricant before sterilization.

After sterilization, lubricate before each use and be sure to use the entire stone to prevent “grooving.” Petroleum jelly is NOT recommended for lubrication as it can clog the stone’s pores and thus reduces effectiveness.

SHARPENING STONE COMPARISON CHART

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORIGIN</th>
<th>METHOD</th>
<th>LUBRICANT</th>
<th>TEXTURE</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arkansas Stone</td>
<td>Natural</td>
<td>Unmounted, mounted or rotary</td>
<td>Oil</td>
<td>Fine</td>
<td>Routine sharpening and finishing</td>
</tr>
<tr>
<td>I Stone</td>
<td>Synthetic</td>
<td>Unmounted</td>
<td>Oil or Water</td>
<td>Medium to Coarse</td>
<td>Sharpening of dull instruments or those requiring re-contouring</td>
</tr>
<tr>
<td>Ceramic Stone</td>
<td>Synthetic</td>
<td>Unmounted</td>
<td>Water or Dry</td>
<td>Fine/Medium</td>
<td>Routine sharpening and finishing</td>
</tr>
<tr>
<td>Composition Stone</td>
<td>Synthetic</td>
<td>Mounted</td>
<td>Water</td>
<td>Coarse</td>
<td>Reshaping of dull instruments</td>
</tr>
<tr>
<td>Diamond Sharpening Cards</td>
<td>Diamond Micron Coated Steel Plate</td>
<td>Unmounted</td>
<td>Dry or Water</td>
<td>Extra Fine, Fine and Medium</td>
<td>Create fine edges on blades, routine sharpening and reconditioning of dull Instruments</td>
</tr>
</tbody>
</table>

SIDEKICK® SHARPENER

SHARPENING MADE EASY!

- Easy-to-read letters indicate Graceys (G) or Sickles and Universals (S/U).
- Position the instrument in the specific channel, with the terminal shank resting on the incline of the channel.
- Position the back of the instrument along the backstop of the guideplate.
- Turn the unit on and glide the instrument within the channel from side to side.
- Repeat 2-3 times or until blade is sharp.

ACHIEVE ACCURATE ANGLES EVERY TIME

SICKLE SCALERS

90°

90°

70°

UNIVERSAL CURETTES

GRACEY CURETTES

Sharpen-Ez® Sharpening Oil (SSO) is a lightweight, medical grade mineral oil which reduces clogging and enhances the stone’s effectiveness. See page D36 for more information.
HOW TO RECOGNIZE A DULL INSTRUMENT
1. The instrument does not grab or bite.
2. More pressure is needed for effective instrumentation.
3. Repeated strokes are necessary to remove the deposit.

HOW TO DETERMINE INSTRUMENT SHARPNESS
A. Plastic test stick: To test sharpness with a plastic test stick, apply the cutting edge to the stick and evaluate the “bite” as the edge takes hold. If there is not a “bite,” the instrument needs sharpening.
B. Visual inspection: To test sharpness by visual inspection, a bright light (and if possible, a magnifying glass) is required. Hold the instrument under the light and rotate until the edge is facing the light. If you can see light reflecting off the cutting edge, then the instrument is dull.

VISUAL INSPECTION

COMMON SHARPENING ERRORS

EDUCATIONAL AIDS
It’s About Time to Get on the Cutting Edge Instrument Sharpening Manual | SHM
It’s About Time to Get on the Cutting Edge Instrument Sharpening DVD (12 minutes) | SDVD
(Sharpening Manual and DVD also available in Spanish)
STAINLESS STEEL INSTRUMENTS

While stainless steel has superior corrosion resistance, it will discolor and corrode when exposed to higher than recommended chemical concentrations or certain chemicals.

Stainless steel should not be exposed to the following chemicals: Sodium Hypochlorite (household bleach), Tartaric Acid (stain and tartar remover), Aluminum Chloride, Barium Chloride, Bichloride of Mercury, Calcium Chloride, Carbofuran, Chlorinated Lime, Citric Acid, Dakin’s Solution, Ferrous Chloride, Lysol, Mercuric Chloride, Mercury Salts, Phenol, Potassium Permanganate, Potassium Thiocyanate or Stannous Chloride.

The following chemicals should NEVER be used with stainless steel: Aqua Regia, Ferric Chloride, Sulfuric Acid, Hydrochloric Acid or Iodine.

COMPOSITE INSTRUMENTS

For all types of composite instruments, always wipe off any composite material from the working end with 2x2 alcohol gauze even if the material is not visible. This will promote easy cleaning in the ultrasonic cleaner and will avoid manual removal of any dried debris which can permanently harm the surface finish.

CLEANING

Composite instruments can be cleaned by the acceptable dental office methods; ultrasonic cleaning, automatic dental washers, manual cleaning. Enzymatic or mild detergents, like Hu-Friedy’s Enzymax® and Enzymax Earth™ products are recommended for the ultrasonic cleaner.

STERILIZATION

All composite instruments can be heat sterilized by the acceptable methods, not exceeding 350°F (177°C).

CARBON STEEL INSTRUMENTS

Carbon steel instruments are NOT compatible with most automated washers, are more sensitive to chemicals than stainless steel and require special handling.

Carbon steel should NOT be exposed to any of the previously listed chemicals for stainless steel.

Separate carbon steel instruments from stainless steel instruments throughout the cleaning and sterilization process. If processed together, the carbon steel instruments will likely create cross-corrosion on the stainless instruments.

Carbon steel instruments should be thoroughly dried prior to sterilization to prevent rusting and/or corrosion.

Use a protective rust-inhibitor before sterilization.

Hu-Friedy recommends Enzymax® Ultrasonic Cleaning Solutions which contain Steelgard™ agents to protect instruments from harmful minerals naturally found in water that contribute to buildup, spotting and corrosion. Enzymax has multipurpose applications including efficient ultrasonic detergent, presoak, linen, spot removal and evacuation cleaner.

HINGED INSTRUMENTS

All hinged instruments – forceps, rongeurs, scissors, pliers, hemostats, orthodontic pliers, etc. – should be kept lubricated. Regular use of proper lubricants, like Hu-Friedy’s Penetrating Oil (IPS) and Instrument Lubricant Spray (ILS), will prevent rust, corrosion and stiff joints to ensure smooth operation. (Household lubricants and handpiece lubricants are NOT recommended.) All hinged instruments should be sterilized in the open position.

RESIN INSTRUMENTS

Resin instruments are easily maintained by ultrasonic or automated cleaning and steam sterilization. Avoid exposure to temperatures above 275°F (135°C). DO NOT expose to phenols. ResinEight® and Resin 8 Colors instruments are NOT compatible with dry heat or rapid dry heat sterilizers. It is highly recommended to use a neutral pH cleaning solution like Enzymax® Ultrasonic Cleaning Solutions.

ANODIZED ALUMINUM

Special care needs to be exercised in cleaning and sterilizing these coated aluminum instruments. Do not clean in an ultrasonic unit. Clean by hand or in some automated washers. Check processing product labels for caution about use with aluminum. Sterilize in autoclave under 350°F (177°C) according to manufacturer’s instructions.

Note: Anodized aluminum instruments, when sterilized with stainless steel instruments, may cause an adverse chemical reaction.
ULTRASONIC INSERTS

Intended for use by dental professionals. Inspect, clean and sterilize (autoclave only). Steam sterilize for at least 4 minutes at 270°F (132°C) or 30 minutes at 250°F (121°C). Do not heat above 275°F (135°C). Recommended 30 minute dry time after sterilization cycle. Do not expose to phenols or iodophors or dry heat sterilization. Inserts with bent, altered or worn tips or other compromising conditions should be removed from service.

PIEZO TIPS

CLEANING & STERILIZATION
Piezo tips should remain in the wrench during the complete cleaning, disinfection and sterilization reprocessing cycle. Clean using ultrasonic cleaner or thermodisinfector. Steam sterilize for at least 4 minutes at 270°F (132°C). Do not heat above 275°F (135°C). Clean, disinfect, inspect and steam sterilize before each use following the respective equipment manufacturers users instructions. Do not expose to phenols, iodophors or dry heat sterilization.

REPLACEMENT OF WORN INSERTS AND TIPS
Scaling efficiency can significantly diminish with worn insert tips. Inferior performance and poor water delivery can result from worn, damaged, bent or altered tips.

1 mm wear diminishes 25% efficiency and 2 mm wear diminishes 50% efficiency. For optimal scaling efficiency, we recommend checking inserts monthly for signs of wear. An Ultrasonic insert wear guide (HF-466) and Piezo Tip Wear Guide (HF-469) are available from Hu-Friedy.

NO RETIPPING OR REPOINTING

Hu-Friedy does not retip or repoint hand instruments. To do so would compromise the construction integrity of our instruments. In addition, there is a high degree of potential risk to all parties inherent in such a service. Therefore, retipping or repointing instruments will void Hu-Friedy’s warranty.

Hu-Friedy takes pride in the manufacturing of the entire instrument. The emphasis of our efforts is to provide a consistently high quality working end. The use of quality Immunity Steel, EverEdge® Steel, numerous manufacturing steps, heat treating, polishing, and finishing a precision cutting edge all result in the finest scalers available. It is simply not safe or cost-effective to retip instruments.

SOME REASONS WHY RETIPPING IS NOT RECOMMENDED
• The raw materials and process controls used to manufacture the tips are often not of Hu-Friedy quality.
• Lesser quality instruments are susceptible to corrosion and premature failure.
• During removal of the tip, the handle may develop small cracks, thereby causing a weakened attachment.
• Repeated retipping increases the chance for cracked handles and the risk that the tip may fall out during treatment.
• The small cracks in the handle can collect debris and interfere with proper sterilization, and can trap liquids from sterilization within the handle.
• Retipped instruments are often unbalanced.
• The stainless steel may vary from lot to lot and the cutting edge may dull easily and wear quickly.
INSTRUMENT CLEANING

All instruments need to be cleaned and thoroughly dried before they are sterilized. They should be washed with a non-corrosive, low sudsing neutral detergent. Instrument cleaning can be accomplished by ultrasonic or automated cleaning, which is preferred to minimize sharps injuries due to hand scrubbing. Hu-Friedy does not suggest the use of any abrasive brushes or materials to clean instruments.

COMPARISON OF CLEANING METHODS

<table>
<thead>
<tr>
<th>METHOD</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Scrubbing</td>
<td>• Effective if performed properly</td>
<td>• Increases chances for operator injury</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increases spread of contamination through splatter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Labor-intensive and time consuming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Need proper care of scrub brush</td>
</tr>
<tr>
<td>Ultrasonic Cleaning</td>
<td>• Safer than hand scrubbing</td>
<td>• Microorganisms may accumulate in cleaning solution. Solutions should be changed at least daily or when visibly solid.</td>
</tr>
<tr>
<td></td>
<td>• Effectively cleans all instruments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reduces chances for spread of contaminants through splatter</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Allows for more efficient use of staff time</td>
<td></td>
</tr>
<tr>
<td>Automated Washer</td>
<td>• Safer than hand scrubbing</td>
<td>• Not all instruments are compatible with automated washers. Please see manufacturer’s instructions for detailed requirements.</td>
</tr>
<tr>
<td></td>
<td>• Effectively cleans instruments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reduces chances for spread of contaminants through splatter and aerosols</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Allows for more efficient use of staff time</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INSTRUMENT STERILIZATION

Sterilization is a process that kills microorganisms. There are three common methods of heat sterilization used in the dental office that can be verified by spore testing (steam autoclave, dry heat and chemical vapor). The following chart outlines sterilization methods:

COMPARISON OF HEAT STERILIZATION METHODS

<table>
<thead>
<tr>
<th>METHOD</th>
<th>ADVANTAGES</th>
<th>PRECAUTIONS</th>
<th>SPORE TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam Autoclave</td>
<td>• Time efficient</td>
<td>• Do not use closed containers</td>
<td>Bacillus stearothermophilus strips, vials, or ampules</td>
</tr>
<tr>
<td></td>
<td>• Good penetration</td>
<td>• May damage plastic and rubber items</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sterilize water-based liquid</td>
<td>• Non-stainless steel metal items corrode</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use of hard water may leave deposits</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dry instruments</td>
<td></td>
</tr>
<tr>
<td>Unsaturated Chemical Vapor</td>
<td>• Time efficient</td>
<td>• Do not use closed containers</td>
<td>Bacillus stearothermophilus strips</td>
</tr>
<tr>
<td></td>
<td>• No corrosion</td>
<td>• May damage plastic and rubber items</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Items dry quickly after cycle</td>
<td>• Must use special solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dry instruments or dip in special solution</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide adequate ventilation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cannot sterilize liquids</td>
<td></td>
</tr>
<tr>
<td>Dry Heat Oven</td>
<td>• No corrosion</td>
<td>• Longer sterilization time</td>
<td>Bacillus subtilis strips</td>
</tr>
<tr>
<td></td>
<td>• Can use closed containers</td>
<td>• Cannot sterilize liquids</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Large capacity per cost</td>
<td>• May damage plastic and rubber items</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Do not open door before end of cycle</td>
<td></td>
</tr>
<tr>
<td>Rapid Dry Heat Transfer</td>
<td>• No corrosion</td>
<td>• Cannot sterilize liquids</td>
<td>Bacillus subtilis strips</td>
</tr>
<tr>
<td></td>
<td>• Short cycle</td>
<td>• May damage plastic and rubber items</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Do not open door before end of cycle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Small capacity per cost</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Unwrapped items become contaminated after cycle</td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Miller CH: Take the safe approach to prevent disease transmission. RDH 95:35, 1989; with permission. See December 19, 2003 MMWR for CDC Guidelines.
IMS allows clinicians to move instruments from cleaning through chairside without touching or damaging the instruments. Optimal infection control and prevention are facilitated by the use of tools that allow for improved efficiency and safety. Instrument integrity is further enhanced by the use of Hu-Friedy’s Instrument Management System (IMS).

1. Chairside: Patient Preview & Presentation
   • Systematically organizes instruments according to procedure type, allowing for more focus on patients and less time spent looking for missing instruments
   • Neatly organized instruments offer more professional appearance and can help enhance referrals

2. Cleaning: Processed & Prepped
   • Instruments are kept together throughout cleaning, rinsing and drying, reducing the potential for breakage or loss
   • Reduces handling of instruments, reducing the chance for sharps injuries

3. Sterilization: Neat & Complete
   • Cassettes with instruments are packaged and placed in autoclave together to help reduce consumable usage
   • Reduced handling by eliminating sorting of instruments provides safer protocol and minimizes liability

4. Storage: Wrapped & Ready
   • Ready for use or storage until needed for increased time savings
   • Complete procedural set-ups for easy set-up and teardown
### INSTRUMENTS

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CAUSE</th>
<th>PREVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spotting</td>
<td>• Insufficient rinsing after ultrasonic cleaning</td>
<td>• Rinse thoroughly under steady stream of water for 30 seconds</td>
</tr>
<tr>
<td></td>
<td>• Insufficient drying after ultrasonic cleaning</td>
<td>• Rinse with hot water</td>
</tr>
<tr>
<td></td>
<td>• Not changing ultrasonic solution</td>
<td>• Solution should be changed at least once a day</td>
</tr>
<tr>
<td></td>
<td>• Sterilizer has not been cleaned</td>
<td>• Sterilizers should be cleaned weekly or per manufacturer recommendations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use only distilled water for reservoir</td>
</tr>
<tr>
<td>Rust</td>
<td>• Corrosion from carbon instruments spreads to stainless steel instruments</td>
<td>• Separate stainless and carbon instruments</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• For carbon steel instruments: Dip in pre-sterilized rust-inhibiting solution as suggested by sterilizer manufacturer</td>
</tr>
<tr>
<td>Pitting</td>
<td>• Chemical attack on instruments</td>
<td>• Rinse and dry instruments thoroughly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use approved cleaning and sterilization solutions only; never use household bleach or stain and tartar remover</td>
</tr>
</tbody>
</table>

### IMS CASSETTES

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CAUSE</th>
<th>PREVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staining (Resin cassettes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>• Amalgam left in carrier</td>
<td>• Thoroughly empty amalgam carrier before returning to cassette</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• If carrier is plugged, sterilize separately and unplug while carrier is warm</td>
</tr>
<tr>
<td>Green</td>
<td>• Chrome breakdown of instruments</td>
<td>• Inspect instruments and replace those with cracked handles or peeled plating</td>
</tr>
<tr>
<td>Yellow/Brown</td>
<td>• Sterilizer has not been cleaned</td>
<td>• Change reservoir water once a week</td>
</tr>
<tr>
<td></td>
<td>• Normal use discoloration</td>
<td>• Regularly clean chamber and filters</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Every 6 months soak resin cassettes (without instruments and not in the ultrasonic) in 2 cups bleach to 1 gallon of water for 5 to 30 minutes</td>
</tr>
<tr>
<td>Broken</td>
<td>• Overloading/ improperly placed instruments</td>
<td>• Instruments should not protrude from cassette</td>
</tr>
<tr>
<td>Hinges</td>
<td></td>
<td>• Only light force is needed to close the cassette</td>
</tr>
<tr>
<td></td>
<td>• Improperly placed rails</td>
<td>• Do not reposition resin cassette rails</td>
</tr>
<tr>
<td>Wet Packs</td>
<td>• Insufficient drying before or during sterilization</td>
<td>• Thoroughly dry cassette after cleaning, before wrapping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Crack open autoclave sterilizer door during dry cycle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Optional: After sterilization cycle, leave cassettes in warm sterilizer for 10 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Do not overpack sterilizer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Keep cassettes slightly separated within the chamber</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Always use sterilizer’s cassette rack</td>
</tr>
</tbody>
</table>
Black's Formula is a system of universally accepted numbers designed by Dr. G.V. Black that describe the shape, size and angle of cavity preparation instruments. Both dentists and manufacturers use Black's Formula to communicate about instrument design.

Black’s Formula is based on the concept of instrument balance. Balance is established by keeping the blade of the instrument within 2 mm of the long axis of the handle line. Proper balance is necessary to achieve optimal cutting with minimal effort.

**BLACK’S INSTRUMENT NUMBERING FORMULA**

The first number (15) represents the width of the blade in tenths of a millimeter. The second number (8) represents the length of the blade in whole millimeters. The third number (12) represents the angle the blade forms with the long axis of the handle expressed in degrees centigrade.

**ABOUT THE FOURTH NUMBER**

Some instruments, such as margin trimmers, are constructed with a cutting edge at an angle other than a right angle. In these cases, a fourth number (in degrees centigrade) is placed in the formula that indicates the degree of angle of the cutting edge to the long axis of the handle.

Example: Margin Trimmer
15-95-8-12

The fourth number is placed between the first and second numbers.

Black's Formula uses a centigrade scale to measure instrument angles.