**Johnson-Promident University**

**High Speed Handpieces 101**

**Overview**

**What is a High Speed Handpiece?**
A hand held drill, usually air-driven (can also be electric), that spins cutting burs at approximately 400,000 RPM.
- Used for cavity preparation, removal of tooth structure and margin creation.

**How Does a High Speed Handpiece Work?**
- Air turns a turbine located in the head (front) of the handpiece.
- The turbine consists of two miniature bearings, an impeller, and a spindle/chuck assembly that holds the bur.

**How Fast Does the Handpiece Run?**
- The speed depends on the pressure (PSI) of the air supply, the size of the turbine assembly and the configuration of the turbine components (i.e., bearings, impeller, and spindle).
- An average sized turbine (such as a Midwest Tradition) running at 38 PSI should spin at approximately 400,000 RPM.
- Larger sized turbines (such as a KaVo Super Torque) running at 38 PSI should spin at approximately 325,000 RPM but will achieve the same torque as smaller turbines due to their mass.

**Does Head Size Matter?**
- Most brands of handpieces offer small (miniature) and large head versions, and different brands vary (KaVo tends to have larger heads and Star has smaller heads).
- Smaller heads have advantages for providing better visibility and easier access (especially with children).
- Larger heads have the advantage of much higher torque and cutting power.

**How Long Will a Handpiece Turbine Last?**
- The average life span of a handpiece turbine ranges from six to twelve months, depending on the level of use and maintenance procedures. The most common cause of premature failures is infield conditions.

**Top 3 Mistakes**
1. Use of disinfectants to clean or wipe off handpieces
2. Lack of lubrication or improper lubrication
3. Use of too much air pressure

See Page 5 for maintenance tips.
High Speed Handpieces 101
Handpiece Tubing Compatibility

What Are the Types of Tubing Connections?

2 Hole (Borden Connection)
- Usually the standard in developing countries (e.g., all of Latin America).
- Has one large hole, which is air intake to drive the turbine to spin, and a small hole for water to cool the bur/tooth.
- No air exhaust, so the exhaust just blows right out of the handpiece, making it much louder.
- Also, no chip air, so the water comes out more as a stream than as a fine mist.
- A 2/4 adapter can be used to fit this kind of handpiece onto 4 hole tubing, but the handpiece will still not have the chip air or exhaust air features.

3 Hole
- Used very little. In fact, we may be one of the last manufacturers still to offer this style!
- Has the same handpiece thread design as 2 hole, but with the addition of one extra small tube for the chip air line to allow the water to come out as a fine mist.
- Can be converted to 2 hole by simply removing the chip air tube.

4 Hole (Midwest Connection)
- The standard in the U.S. and Europe.
- Has two large air holes (the smaller of the two is air in and the larger is air exhaust out).
- Also has two small holes, a water tube and a chip air tube (which brings air to the head where it either mixes with or hits the water to make a fine mist) to cool the bur/tooth and clear debris.
- A 4/2 adapter can be used to fit this kind of handpiece onto 2 hole tubing, but the handpiece will lose the exhaust and chip air feature.

5 Hole
- Has the same handpiece thread design as 4 hole, but with the addition of a fiber optic rod which transmits light through the handpiece and illuminates the bur and tooth area for better visibility.
- Has all the other features of 4 hole as well.
- A 5 hole handpiece can be used on 4 hole tubing, but the light feature will not function.

Quick Disconnect Coupler Connections
- Couplers can be 2 hole, 4 hole, and fiber optic (2 types).
- 5 hole fiber optic couplers have an internal glass rod that goes onto tubing that has a light source (bulb) either in the tubing or on the dental control unit.
- 6 pin couplers (with 4 holes like a normal 4 hole handpiece plus 2 metal pins to provide electricity) have the light bulb in the coupler itself.

Helpful Hint:
Turn the tubing connector, not the handpiece, to screw the tubing on/off the handpiece.
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High Speed Handpieces 101
High Speed Connections

What Are the Different Types of High Speed Handpiece Connections?
- Handpieces can come with either a fixed back end or a quick disconnect swivel style.
- Both types of back ends can come with 5 different tubing connection configurations (i.e. 2 hole, 4 hole).

Fixed Back
- Does not have a swivel coupler; must be screwed on/off tubing for cleaning and does not swivel.
- Connections are internationally standardized and universal (ISO) so that any brand of handpiece will fit the same tubing connection configuration.

Quick Disconnect
- The handpiece has a hollow back end that can be snapped onto a coupler.
- The coupler is screwed onto the tubing, allowing the handpiece to be quickly attached and removed for cleaning.

What are the Benefits of Quick Disconnect Couplers?
- Easy and fast removal of the handpiece from the tubing.
- Increased dentist comfort, because the swivel reduces the drag of the tubing.

What are the Disadvantages of Quick Disconnect Couplers?
Every major brand of handpiece has its own proprietary connection between the handpiece and the swivel, so handpieces and swivels from different brands are not compatible.

Many manufacturers are beginning to offer handpieces that will fit other brands of couplers, but it appears to us that the KaVo MULTIflex style coupling is winning the battle to become the universal quick connect style.

Chucking Mechanisms

What is a Chucking Mechanism?
The mechanism that allows the handpiece to hold a bur.

What are the Different Types of Chucking Mechanisms?

1. Standard Screw-Type (bur tool-type)
   - The spindle and chuck (the parts of the turbine that hold the bur) are separate.
   - A bur tool is required to insert and remove the bur; it screws the chuck down into the spindle causing the chuck to tighten around the bur.
   - Screw-type chucks can be replaced in repair.

2. Push Button-Type
   - The spindle and chuck are a single assembly.
   - The push button cap on the handpiece presses on the actuator on the top of the spindle which engages an internal spring component to open or close the chucking mechanism.
   - Bur shank size is important – burs with shanks under .0626 or over .0630 cannot be used.

Benefits of Push Button Chucks
- Easy insertion and removal of burs.

Disadvantages of Push Button Chucks
- Do not provide as strong a grip on the bur as screw-type chucks.
- Heavy use can cause the chuck to strip, which will result in poor bur retention.
- Higher cost to purchase.
- Once the chuck fails the whole turbine must be replaced instead of just the chuck.
Debris

- Introduced into the handpiece through dirty air and water every time air pressure is released.
- The best way to remove it is to flush the handpiece between patients using a handpiece cleaner and lubricant.
- Blow out the handpiece using compressed air to remove loose debris, cleaner, and lubricant before sterilization (a handpiece should never be run without a bur!).

Air Pressure

- Excessive air pressure (exceeding 40 PSI) could cause damage to turbine bearings, reducing the performance of the turbine.
- When handpiece performance is reduced at 35 PSI the turbine should be rebuilt or replaced.

Sterilization Tips

- Never exceed 275°F (135°C) during the sterilization cycle; use the lowest temperature possible while still achieving proper sterilization of instruments.
- Subjecting bearings to higher temperatures can cause the materials to break down and crack.
- Handpieces should only be used at room temperature, not hot.
- Never cool handpieces under cold running water; quick cool downs are bad for turbine components.
- If sterilizers are not maintained properly, excessive debris will bake onto the turbine and result in premature failure.
- Never use a dry heat sterilizer; the excessive heat will damage bearings.

Air and Water Supplies

- Must remain free of debris.
- Filters should be used and checked often.
- Compressor oils and carbons must be filtered from the air supply.
- An air dryer should also be used and maintained as required.

Push Button Spindle Maintenance

- Push button spindles are made of metal components and require small amounts of lubricant and periodic flushing for an extended lifespan.
- Use a handpiece cleaner or combination cleaner/lubricant (lubricating alone is not enough).
- Spray handpiece cleaner and lubricant up into the front of the spindle; an adapter may be required.

Lube Free or Maintenance Free Turbines (Beware)

- Only the bearings are maintenance free!
- The bearings are pre-greased at the factory and shielded to help protect them from debris and the removal of lubricants during use.
- Other turbine components still need to be maintained; O-rings will dry out without lubricants and push button spindles require lubrication and flushing.

Ask the Doctor:

1. When was the last time you changed your filters?
2. What do you use to clean your handpieces? (Disinfectants are not allowed, dry heat sterilizers are bad too.)
3. Where do you spray lubricant? (Offices often are lubricating wrong holes, so no lube is getting where it needs to be.)
4. How often do you use a handpiece cleaner in the chuck? (Probably never.)
5. At what air pressure do you run your handpieces? (Many dentists believe more pressure means faster preparations, but it is not true.)
6. Do you elongate the bur, i.e, not put the bur all the way in the chuck to get deeper access? (Sell them surgical length burs or they will be replacing turbines often.)
Instructions for Operation and Maintenance:

In order to always provide the handpiece with clean air, water accumulated in the compressor must be drained out ONCE A DAY. DAILY LUBRICATION IS ABSOLUTELY ESSENTIAL.

Operate the handpiece at pressures of 30 to 35 pounds per square inch. The handpiece is engineered to attain speeds of 350,000 RPM at 30 pounds and 400,000 RPM at 35 pounds.

Use the brush to remove foreign particles. A fine wire is provided for cleaning the water spray hole and to prevent clogging. Particles can be dislodged by blowing air backward from the contra angle head. NOTE: DO NOT attempt to blow particles from the rear end of the handpiece, as larger particles will be blocked in the water tube.

Sterilization Procedures: (Autoclave and Chemiclave Only)

Clean External Surface: Remove bur from handpiece and scrub with a toothbrush or 2” x 2” gauze using warm tap water. DO NOT IMMERSE HANDPIECE.

Dry: Thoroughly dry handpiece using gauze, paper towel or air syringe.

Clean/Lubricate Internal Surface: Using a combination cleaner/lubricant or DCL 90, spray handpiece in drive air hole and in chuck.

Expel Cleaner/Lubricant: Reinsert bur into handpiece head, connect handpiece to tubing and run for 5 seconds to thoroughly expel debris and excess lubricant. THE HANDPIECE MUST BE OPERATED ONLY WITH A BUR OR BUR BLANK. DO NOT OPERATE EMPTY.

Clean Fiberoptic Bundle: Using a cotton swab with isopropyl alcohol, wipe the surface on both ends of handpiece.

Bag and Cycle in Autoclave: Place handpiece into autoclave bag or pouch. Cycle as per autoclave/chemiclave manufacturer’s instructions. DO NOT EXCEED 275º F (135º C).

Cool Down and Lubricate: Allow handpiece to return to room temperature. Lubricate handpiece as per instructions listed above. Expel excess lubricant as per previous instructions.

Do-It-Yourself Handpiece Repair (Simple Stuff)

A. Handpiece has low torque or power (could be lack of lubrication or too much debris)
   1. Try heavily spraying “correct” drive air tube with a combination cleaner/lubricant like DCL-90 and run handpiece for a minute.
   2. Remove turbine and clean out head, lubricate turbine directly, and spin bearings with fingers. Blow compressed air in head of handpiece to clear air tube. Return turbine to handpiece and run.
   3. Check air pressure on dental unit.

B. Burs are sticking inside of turbine or falling out
   1. Flush the spindle with a handpiece cleaner where the bur would normally be inserted.
   2. Ensure that burs are not less than .0625” or greater than .0630” in diameter or are worn, which can damage spindle.

C. Water spray is weak or completely stopped
   1. Insert small wire into water tube from head of handpiece to remove debris.
   2. Use our Smart Cleaner to clear clogged tube.

If these simple solutions fail, more serious problems are likely affecting the handpiece which should be sent to a reputable repair service provider.