



# Handpieces: The Drill on High Speeds



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The direction of handpieces have taken during the last several years is toward lighter and sleeker designs that can withstand autoclaving and surface disinfectants. With the advent of autoclaving, the durability of the handpieces' finish after each use has become a concern for the manufacturers as well as the clinicians. Smoother surfaces have replaced the rough textures of older handpiece designs eliminating areas that may trap bacteria and debris. Manufacturers have also minimized the seams between the outer casing segments aiding in the process of sterilization.

Chrome-plated outer sleeves have been replaced with titanium providing a more durable finish. The finish is less sensitive to the chemicals used during disinfection that may lead to corrosion. When considering an electric handpiece, titanium also provides an ultra light handpiece which may be a concern. Electric handpieces are larger at the connector and therefore heavier than their air driven counterparts. Titanium handpieces can demonstrate a 30% decrease in weight compared to chrome-plated handpieces.

## Understanding Speed vs Torque

Two factors to understand and compare when shopping for a new high-speed handpiece are speed and torque.



Figure 1—A-dec/W&H: Synea TA-98 LC (air) (top) and Synea WA-99 LT (electric) (bottom).

### Speed

Speed is expressed in revolutions per minute (rpm). Whereas, torque is expressed in watts (W) and is an indication of the handpieces' cutting power, air-driven high-speed handpieces typically will have speeds between 250,000 rpm and 420,000 rpm. Although, electric handpieces



Figure 2—BienAir: Bora LK (air) (top) and CA 1:5 L (electric) (bottom).

the air pressure is insufficient to maintain the speed of the turbine's rotation. So selecting an air-driven handpiece based on top speed will not reflect actual speed during tooth preparation.

Electric systems alternatively offer smooth, constant torque that does not vary as the bur meets resis-



Figure 3—Brasseler USA/NSK: Ti-Max NL-95S (air) (top) and Ti-Max Ti95L (electric) (bottom).

for tooth preparation. Low-speed handpieces are also available for other dental treatments procedures.

### Torque

Torque is more applicable to how efficient the handpiece will be then speed. With regard to air-driven handpieces, the larger the handpiece head, the larger the turbine within the head. The larger the turbine the more torque can be delivered. Depending on the size of the head, air-driven handpieces will provide between 12W and 18W of cutting power. These handpieces are offered in mini-head, standard-head, and high-torque heads. A mini-head will offer almost 14W and is ideal for pedodontic restorations, endodontic access, and treatment of second or third molars because of the restricted clearance and composite/amalgam restorations. Standard heads provide more power (15W to 17W) but need greater clearance and obscure more of the field than a mini-head. These are good overall handpieces suited for crown and bridge preparation

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have speeds around 200,000 rpm, this may imply that air-driven handpieces are faster than an electric handpieces. But with regard to air-driven Handpieces, as soon as the bur make contacts with the material to be cut, the speed typically drops by 40% or more depending on the material's hardness. This is because as resistance builds during cutting,

Because the speed and torque are constant, removing difficult crowns, bridges, and restorations become easier. Electric motors also offer accuracy by enabling the end user to set precise speeds for procedures, rather than the conventional 'feathering' of the rheostat. When considering an electric handpiece you will need a 1:5 gear ratio

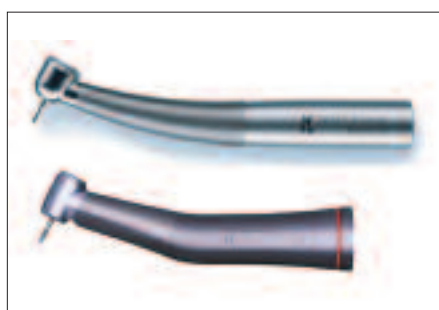


Figure 4—Kavo America Corporation: Gentleforce LUX 6000B (air) (top) and Gentlepower LUX 25LPA (electric) (bottom).



Figure 5—Sirona Dental Systems: T2 Racer (air) (top) and T1 C 200 L (electric) (bottom).



Figure 6—StarDental: Solara (air) (top) and Titan E-lectric (electric) (bottom).



Figure 7—Dentsply Professional: Midwest Stylus (air) (top) and Midwest e-Stylus (electric) (bottom).



**Table 1—Examples of High-Speed Handpieces Manufacturers**

Companies	Phone	Web site	How to Buy
A-Dec/W&H	800.547.1883	www.a-dec.com	Sold through dental dealers
BienAir	800.433.2436	www.bienair.com	Sold direct and through dealers
Brasseler USA/NSK	888.675.1675	www.nskamerica.com	Sold direct only
Kavo America Corporation	800.323.8029	www.kavousa.com	Sold through dental dealers
Sirona Dental Systems	800.659.5977	www.sirona.com	Sold only through dental dealers
StarDental	866.383.4636	www.stardental.com	Sold through dental dealers
Dentsply Professional	800.989.8825	www.dentsply.com	Sold through dental dealers

**Table 2—Air-Driven High-Speed Handpieces**

Product	Company	Speed (rpm)	Power (watts)	Warranty (yr)	Connector (available)
Synea TA-98 LC	A-dec/W&H	350k	19	1/5**	1, 7
Bora LK	BienAir	310k	18	1/5**	2, 4, 5
Ti-Max NL-95S	Brasseler USA/NSK	430k	18	1/3/5*	3, 4, 7
Midwest Stylus	Dentsply Professional	400k	15	1	4, 7
Gentleforce LUX 6000B	Kavo America Corporation	380k	18	1/5**	4, 7
T2 Racer	Sirona Dental Systems	400k	17	2/5***	1, 2, 3, 4, 5
Solara	StarDental	430k	18	1/5**	6, 7

\* 1 year handpiece, 3 year sheath, 5 year optics

\*\* 1 year handpiece, 5 year fiber optics

\*\*\*2 year handpiece (able to extend to 5 year), 5 year optics

**Table 3—Electric High-Speed Handpieces**

Product	Company	Speed (rpm)	Power (watts)	Warranty (yr)	Connector
Synea WA-99 LT	A-dec/W&H	200k	37	1/5**	E
CA 1:5 L	BienAir	200k	38	1/5**	E
Ti-Max Ti95L	Brasseler USA/NSK	200k	38	1/3/5*	E
Midwest eStylus	Dentsply Professional	200k	38	1	E
Gentlepower LUX 25LPA	Kavo America Corporation	200k	33	1/5**	E
T1 C 200 L	Sirona Dental Systems	200k	45	2/5***	E or 8
Titan E-lectric	StarDental	200k	37	1/5**	E

\* 1 year handpiece, 3 year sheath, 5 year optics

\*\* 1 year handpiece, 5 year fiber optics

\*\*\*2 year handpiece (able to extend to 5 year), 5 year optics

and most treatments provided in an average practice. For more demanding tasks such as removing nonprecious crowns or heavy amounts of crown and bridge, a high torque head may be better suited for those tasks. These will offer almost 18W but have larger heads than a standard head on an air-driven handpiece. Power with an air-driven handpiece is delivered to the bur via a turbine that is regulated by air less than 30 to 45 pounds per square inch (psi). Air-driven handpieces will also generate more noise than an electric handpieces because of the whine of the turbine.

### Electrifying Restorative Dentistry

Electric handpieces have been slow to replace traditional air-driven high-speed handpieces in the United States. The dental industry estimates indicate 10% of practices use an electric handpiece for

restorative treatment [QA: Please provide a reference for this statement]. Whereas, in the European market more than 80% of restorative practices are employing electric handpieces to prepare teeth for restorations, practitioners who have tried electric handpieces become quick converts to the benefits of preparing a tooth for a crown with an electric handpiece [QA: Please provide a reference for this statement]. There is a slight learning curve when comparing how an electric and air-driven handpiece cuts tooth structure. When we feel resistance with an air-driven handpiece we tend to apply more pressure to increase our perceived feeling that the bur is cutting. With its constant torque unlike an air-driven handpiece, when an electric handpiece encounters a hard structure, there is no loss of power and the bur will continue to cut the material. If we apply increasing pressure

with the bur the electric handpiece will cut deeper faster into the tooth.

Electric handpieces do not have the same limitations to power as an air-driven handpiece. The bur is connected through gears in the head of the handpiece to a central drive shaft that is physically turned by the motor. Because of the absence of air, these handpieces are quieter and chance of air embolism in a surgical site is eliminated. Power output with electric handpieces is greater than with air-driven handpieces. These will offer, depending on the handpiece and head configuration, 33W to 45W of cutting power.

Cutting efficiency is actually a balance between the speed and torque delivered to the bur. Air-driven high-speed handpieces provide higher speeds but their torque is much lower than what is offered in electric handpieces so their cutting efficiency is lower. A good way

to demonstrate this when shopping for or considering switching from air to electric is the “penny test.” Take a penny and grasp one end with a pair of locking hemostats to stabilize the penny. Next, using a carbide bur in the handpiece cut a slot in the penny. Typically, the air driven handpiece will bog down as it attempts to cut the slot and may stall as increasing pressure is placed on the bur. The electric handpiece will demonstrate smooth even cutting without bogging down. This test is a good demonstration how the handpiece work clinically when preparing a tooth with an amalgam core or cutting a slot in a nonprecious crown to aid in its removal. Other factors to consider when looking at air vs electric are vibration and heat generation during cutting. The less efficient the handpiece the more heat is generated. As it cuts, the operator must apply greater force to cut the material. As force is increased frictional resistance also increases and heat generated is increased. These can both add to patient discomfort during the procedure and pulpal trauma after the clinical treatment.

### Couplings and Connectors

The standard connector for air-driven handpieces has been the 4-hole connector. With the recommendation in the past few years for autoclaving handpieces between patient uses, handpiece manufacturers have developed quick disconnect couplings. This allows staff to quickly snap the handpiece off the connector at the end of the tubing when cleaning up the operator. Unfortunately, most manufacturers have developed different connectors that are not intercompatible with other manufactures. But, each manufacturer does offer a choice of connectors compatible with other manufacturers’ handpieces. Before purchasing a new air-driven handpieces check which connector is compatible with your current quick disconnect coupling. Manufacturers also offer quick disconnect couplings that thread onto a standard 4-hole connector allowing the office to switch to quick disconnects. If you are considering this and are in the market for a new

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## Most handpiece companies will warrant the handpiece including the turbine in the case of air-driven handpieces for at least 1 year.

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handpiece, you may want to consider upgrading to an electric.

Currently all electric handpieces feature the standardized ISO coupling between motor and attachment (also called electric or universal coupling). The abbreviation for this universal electric connector is termed an “E” connector. The benefit of this is all electric handpieces will fit any manufacturers motor. The exception is Sirona Dental Systems also offers a propriety connector in addition to the standard E connector. But, before switching to a different brand handpiece then the motor’s manufacturer, make sure that the handpiece is lighted that the optics connection in the coupling will work with your current motor cable.

### Warranties

The warranty offered can be confusing to understand what exactly is covered and for what time. Most handpiece companies will warrant the handpiece including the turbine in the case of air-driven handpieces for at least 1 year. Sirona Dental Systems offers a 2-year standard warranty and Bräse USA/NSK will cover the handpieces sheath for up to 3 years on either an air or electric handpiece. Warranties may be extended and the manufacturer should be contacted for further information on the details.

One aspect to understand is the warranty on the handpieces optics. Current glass-rod technology (fused bundle) is very durable. Most manufacturers provide a 5-year warranty on the optics. Glass rods basically do not deteriorate under repeated sterilization cycles. But, if you drop the handpiece and the rod breaks, typically manufacturers will consider this a void in the warranty and the owner of the handpiece will need to cover any repair costs.

Therefore extended warranties on the glass rods is more or less a marketing tool.

### Conclusion

If you are considering replacing the handpieces in your practice or wish to refine your restorative treatment, consider moving toward electric high-speed handpieces. The

high pitched whine of the air-driven handpiece is eliminated providing a quieter dental experience for your patients. With their high constant torque, whether it is preparation of tooth structure, core buildups or the sectioning of non-precious crowns, providing restorative treatment has become easier for you and your patients. ■