Retraction and Drawback: Key differences and solutions

The COVID-19 pandemic has awoken a sense of urgency and concern in the dental world. Dental practices and schools are changing the way they operate by enhancing their cross-contamination response. Dental equipment manufacturers are moving quickly to provide customers with reliable solutions to help them respond to this new normal. One of those solutions has been to reduce the generation of aerosols during dental procedures.

AIR-DRIVEN VERSUS ELECTRIC MOTOR HANDPIECE

Eliminating aerosols is nearly impossible with the use of air-driven handpiece and electric contra-angle motor attachments. In general, contra-angle attachments generate fewer aerosols than air-driven handpieces since they do not rely on drive air to run the impeller. Many practitioners like them for their stable and high torque. This may be a good solution to reduce aerosol generation but the costs of converting to electric motor driven attachments are not trivial. Also, one must consider that electric motor handpiece is heavier than the air-driven counterpart.

WHAT TO LOOK FOR IN AIR-DRIVEN HANDPIECES?

Assuming that the users are not willing to go the electric motor route, choosing the right air-driven handpieces can be challenging. There has been a lot of talk about anti-retraction and anti-suck-back features but with little clarification about what they are and how they work.

RETRACTION, ANTI-RETRACTION VALVES, AND FLUSHING

Retraction is essentially related to water being pulled back into the system through the water lines. It is strictly related to fluids and debris.

Many manufacturers, including Morita, have already solved this problem by introducing anti-retraction valves throughout the system. Essentially, these valves use a duckbill shape which blocks fluids from getting back into the water lines. These can be present in the treatment unit and even in the handpiece itself. Usually, users can find multiple anti-retraction valves as fail-safes. Most major manufacturers include them within handpieces, couplings, and the treatment unit. This technology has been around for a while and the ISO 7494-2 standard requires the treatment unit to include it.

One study revealed that high-speed dental handpieces without anti-retraction valves may aspirate and expel debris and fluids during the dental procedures. More importantly, the microbes, including bacteria and virus, may further contaminate the air and water tubes within the dental unit, and thus can potentially cause cross-infection.

Should retraction occur, users can still flush and disinfect their waterlines as needed. In summary, the potential for cross-contamination here is quite low.

DRAWBACK, QUICK STOP, AND ZERO-DRAWBACK

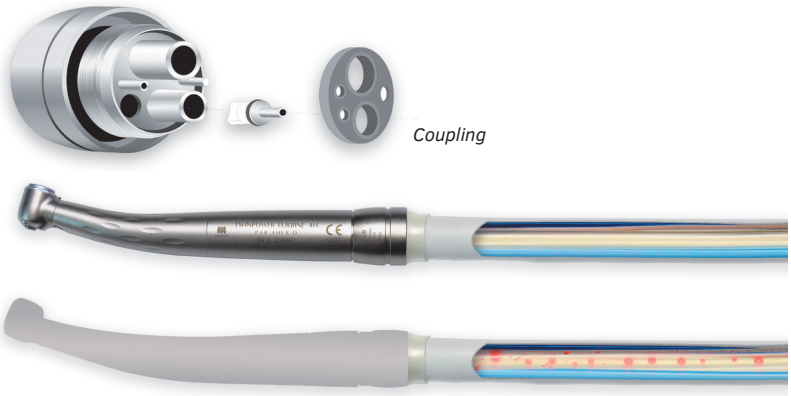
Unlike retraction, a drawback is related to the air lines. Aerosols created during dental treatment are drawn back into the air lines of the handpiece and eventually into the treatment unit. When the drive air stops, the turbine continues to spin. This creates negative pressure in the system and begins to draw aerosols back into the system, kind of like a vacuum. This is also known as suck-back.

The effect is cumulative. Each time users activate the drive air, the drawback forces any contaminates further into the handpiece, past the coupling, and eventually into the air lines and the treatment unit. It is important to note that users cannot disinfect and flush the airlines of the treatment unit.

Many manufacturers will include a braking system to reduce the spinning motion of the turbine once the drive air stops. Terminol-

Air-driven handpiece and electric motor handpiece

TwinPower Turbine™ handpiece



Zero-Drawback

Front view of TwinPower Turbine™

ogy for these types of braking systems may vary but at Morita, it is called Quick Stop.

A Quick Stop braking system can help reduce drawback but not eliminate it. The turbine continues to rotate after the drive air stops and, like any braking system, manufacturers cannot force the turbine to stop instantaneously. During that fraction of time, a drawback is still possible. Additionally, smaller head size creates a less inertial force which also contributes to reducing stopping times.

Smaller head sizes or Quick Stop braking mechanisms will help stop the turbine faster and reduce the number of possible contaminants from being drawn back into the system.

According to one study, some manufacturers introduced a labyrinth system to reduce drawback, but it is not enough to eliminate the drawback effect. Only the Zero-Drawback system was found to eliminate drawback.

DEMONSTRATING DRAWBACK

The marketing, and the research and development departments of Morita company partnered up to conduct a direct comparison of different handpieces available in the market. The team was inspired by the methodology used by Ozawa et al. in 2010 with their in vitro study of anti-suck-back ability of new high-speed air turbine handpieces[1].

In 2015, another study was done by Quan et al. reconfirmed the results[3].

The team used a sealed environment for drawback comparisons. They used a rubber stopper to create an airtight seal at the top of a cylinder so that the only way air can get out is through the handpiece itself. The whole handpiece head was put in observation as drawback can occur anywhere on the area.

The vacuum, created by the drawback effect, will pull water up through a centre tube. The stronger the drawback the higher the water will rise.

For handpieces, they compared newer models from other top tier manufacturers with Morita's TwinPower Turbine™. Using the method above, the TwinPower Turbine™ was the only handpiece to demonstrate a complete lack of negative pressure in comparison with four other models*.

Brand A performed well because of the presence of an effective braking mechanism but still showed slight drawback.

Having seen the efficacy of braking systems on the drawback, they also compared the differences between braking systems of different manufacturers.

The test* revealed that TwinPower Turbine™ performed with braking times under two seconds. Their standard head surprised them with a stopping time of approximately 0.55 seconds which is the fastest time they recorded. Brand B uses an effective braking system and was faster to stop than their high torque model. This same brand also performed well in the drawback comparison but could not eliminate it. Brands A, C, and D had significantly longer stopping times.

**Videos of the tests are posted on Morita's website.*

TAKEAWAYS

As the field of dentistry is continuously evolving, it is important to understand different phenomena that could affect dental practice. Understanding Zero-drawback feature on handpieces is paramount in addressing cross-contamination issues that the practice is facing today. **DA**

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