Air Polishing

Salim Rayman, R.D.H., M.P.A.
Associate Professor
Dental Hygiene Program
Eugenio Maria de Hostos Community College of the City University of New York
Email: srayman@hostos.cuny.edu
718.319.7945

Elvir Dincer, D.D.S.
Associate Professor
Dental Hygiene Program
Eugenio Maria de Hostos Community College of the City University of New York
Email: edincer@hostos.cuny.edu
718.319.7944

February 11, 2013

Educational Objectives:

1. Discuss the indications for use of airpolishing
2. Review the science of air polishing including advantages and benefits of using air polishing
3. Implement appropriate air polishing technique
4. Understand maintenance of air polishing systems
Introduction

The concept of air polishing is based on a technology developed by Dr. Robert Black in 1945. Dr. Black invented a device called the Air Dent which used compressed air, water and a highly abrasive powder to eliminate pain from cavity preparation, making anesthesia unnecessary. While the Air Dent presented many problems, the technology became the first step in air polishing devices. Air polishing was first marketed in the 1976 and from then forth it became wildly available. Air powder polishing is accomplished by the propulsion of abrasive particles through a mixture of compressed air and water through a handpiece nozzle. The handpiece nozzle through which the slurry is propelled is activated with a foot control. The psi produced depends on the type of air powder polisher being used. Air powder polishers are manufactured hand piece units that attach directly to the air/water connector on the dental unit, as separate units, or in combination with an ultrasonic scaler.

Indications for use

Coronal polishing is a cosmetic procedure designed to remove extrinsic stains from the enamel surfaces of the teeth. This can be accomplished by abrasion and erosion of the extrinsic stain. The most common technique for stain removal is rubber cup polishing. This technique uses an abrasive polishing agent and a slowly revolving polishing cup to abrade stain from the tooth surface. Air powder polishing is accomplished by erosion of extrinsic stains by suspended abrasive particles within a moving fluid. Kinetic energy propels the air powder polishing slurry particles against the tooth surface thus removing stain.
Figure 1- Removal of extrinsic stains (Image courtesy of Yosi Behroozan, DDS/DENTSPLY Professional)

The air-powder polisher is shown to be efficient, safe and effective in removing extrinsic stain and plaque biofilm for tooth surfaces.\(^5\) It is equally effective in decreasing root surface roughness after instrumentation.\(^6\) It is also reported to remove plaque biofilm and staining as effectively as a rubber cup and does so in less time.\(^2\) Patients exhibit extensive staining on root surfaces, specifically on areas of recession and at the cementoenamel junction. Removing those stains with a curet, has shown to have reduced root structure. However, when stain removal is for esthetic reasons, the air-powder polisher is preferable to the curet. The air-powder polisher removes less root structure than the curet in simulated three month recalls for three years. The stain was also removed more than three times faster with the air-powder polisher.\(^5\) Using the air-powder polisher also creates less discomfort for patients who have dentinal hypersensitivity because the sodium bicarbonate particles embed in the dentinal tubules, lessening dentinal hypersensitivity discomfort almost immediately.\(^7\) In vitro, research has shown that there is little or no disruption of enamel, cementum, and dentin surfaces with air-powder polishing.\(^8\) Other research have pointed out that air-powder polishing can render cementum surfaces uniformly smooth, compared to traditional polishing or the use of curets.\(^5\)

The air-powder polisher can remove subgingival bacteria through the Venturi effect. This occurs when the air-water-powder spray is directed at a 90 degree angle to the interproximal spaces so that a
vacuum is created that extracts tissue fluids, including subgingival bacteria from the subgingival space. The air-powder polisher has been used for debridement of Class V abraded areas before placement of glass ionomer cements. When compared to cleaning the area with a rubber-cup polisher, the air powder polished tooth had less microleakage around the enamel-cement interface. Similar results were noted when using the air-powder polisher before sealant application. It was reported to be superior to rubber-cup polishing in preparing enamel for etching and sealants. Deeper resin penetration into enamel and increased sealant bond strength was also reported in comparison with traditional polishing with pumice and water. In addition, clinicians prefer using the air-powder polisher on orthodontic patients and research has shown that it does not affect the bracket adhesive system.

Types of Powder

The most common type of abrasive particle used with the air-powder polisher is sodium bicarbonate, which is treated to be free-flowing with calcium phosphate and silica. Sodium bicarbonate is a food grade material and each particle is approximately 74 mcm in size. The Mohs hardness number for sodium bicarbonate is 2.5, compared to pumice, which has a Mohs hardness number of 6. Sodium bicarbonate is safe for use on enamel, amalgam, gold, porcelain, implants (titanium), and orthodontic materials. However, should be avoided on all types of composites, glass ionomers, and luting agents (cements). When used on implants, air polishing with sodium bicarbonate, should not be directed subgingivally, thus it is the method of choice for decontamination of implants.

A powder for air-powder polishing that is sodium free is available. (Figure 2. Jet Fresh from DENTSPLY, York, Pa). It was developed for patients who are sodium intolerant. This powder is made of aluminum trihydroxide, which has a Mohs hardness number of 2.5 to 3.5 and a particle range in mesh size from 80 mcm to 325 mcm. Aluminum trihydroxide powder is safe for enamel, however, it is too abrasive for use
on other tooth structures and its use should be avoided on all dental materials.\textsuperscript{15} While aluminum trihydroxide use does not cause surface disruption to porcelain, the luting agent can be removed causing a compromise in the margin integrity that could quickly lead to decay.\textsuperscript{4}

Figure 2- Jet Fresh {prophy powder} (Image courtesy of DENTSPLY)

**Patient Assessment**

Due to the various indications and contraindications for use of the air-powder polisher, the patient assessment and treatment planning are critical. Patient assessment include a thorough health history evaluation to rule out patients on a physician-directed sodium restricted diet and hypertension. However, the amount of sodium bicarbonate ingested during air polishing is not sufficient to cause an increase in blood pressure or blood levels of sodium or alkalosis.\textsuperscript{16} Patients that are contraindicated also include those with end-stage renal disease, immunocompromised, communicable infection, Addison’s disease or Cushing’s disease. In addition, patients who have respiratory problems such as chronic obstructive pulmonary disease or any condition that interferes with breathing or swallowing should be avoided. These patients are compromised by the aerosols created by air-powder polishing and they are also vulnerable to the development of pneumonia.\textsuperscript{4} Contraindications for using the air-powder polisher also include patients taking potassium, anti-diuretics or steroid therapy which can disrupt the acid/base balance.
Contraindications for use of the air-powder polisher also extends to the hard and soft tissues therefore, the dental history assessment is paramount. Hard tissue that present with any composite resins, sealants or glass ionomers should be avoided due to susceptibility of surface roughness or pitting. Porcelain margins and margins of all restorations can be altered by extensive exposure of the air-powder polisher which can lead to loss of marginal integrity, surface roughness, staining and pitting.\(^1\) Exposed cementum or dentin are structures that are not as mineralized as enamel therefore more susceptible to abrasion. In addition, patients that presents with active periodontal conditions with soft and spongy tissue, the air-powder polisher can cause air embolism or small blood clots. Lastly, pediatric patients with deciduous teeth or newly erupted permanent teeth are contraindicated.

**Patient Preparation**

It is with utmost importance that before using the air-powder polisher, the clinician must prepare both themselves and the patient. Patient preparation would include a thorough explanation of the procedure, review of medical history and taking of blood pressure. Clinician should place a disposable or plastic drape over patient’s clothing, provide the patient with safety glasses and removal of contact lenses. In addition, position the patient more upright and apply non-petroleum lubricant to the lips to protect from abrasive spray that can dry the lips. When the clinician performs air-powder polishing, aerosols of microorganisms that contaminate surfaces several feet from the operative site have been reported.\(^1^7\) Therefore, instructing the patient to use an antimicrobial preprocedural rinse, such as 0.12% chlorhexidine, reduces bacterial contamination of aerosols.\(^1^8\)

**Air-powder polishing unit and operator preparation**

The clinician should be properly protected when performing air-powder polishing. The use of standard precautions, which include wearing fluid resistant protective apparel, face shield or protective safety glasses with side shield, gloves and well-fitting mask with high filtration capabilities.\(^1^9\) In addition, due
to the high aerosols contamination the use of a high-speed evacuation system is recommended.

Clinicians should always follow the manufacturer’s directions for use specific to the air-polishing unit being used.

Unit preparation includes obtaining all the necessary equipment such as the air-powder polishing unit and abrasive powder according to patient selection. The unit and hand piece nozzle is prepared according to manufacturer’s suggestions and the powder compartment filled with abrasive suggested for the machine being used (Figure 3). The unit should be turned on for at least 15 seconds so to eliminate residual powder or moisture in the lines. Also, water lines need to be flushed before use, according to the recommendations of the Center for Disease Control and Prevention.\textsuperscript{20} When filling the chamber with abrasive powder the unit must be turned off and filled with powder to the top of the center tube. The clinician can place finger over tube in the middle of the chamber to prevent powder from blocking the air line. Next, the clinician needs to use the control on top of the powder chamber cap to adjust the powder flow according to patient’s needs. It is recommended for patients with heavy stains the control knob should be turned to H for heavy powder flow, approximately 12 o’clock position. Patients with light staining, the control knob will be to L for reduced powder flow which is approximately the 6 o’clock position (Figure 4).

Figure 3: Fill the powder chamber with an abrasive recommended by the manufacturer. (Image courtesy DENTSPLY)
An aerosol-reduction device that connects to the saliva ejector or high speed evacuation system to the air-polisher hand piece has been shown to be effective in controlling and reducing air-powder aerosols, thus decreasing the potential for disease transmission. This device which is referred to as an Aerosol Reduction device, reduces or eliminates the visible aerosols normally produced during air-powder polishing. Additionally, the Aerosol Reduction device (Figure 5) eliminates the use of exact angulations with cup/nozzle, use of gauze, hand cupping and patient positioning. Other advantages to the Aerosol Reduction device are that it minimizes the possibility of tooth abrasion since the cup is placed on the tooth as with traditional polishing techniques. When using the Aerosol Reduction device the clinician must follow manufacturer’s instructions on assembling and disassembling. This aerosol reduction device contains two parts, a disposable cup that attaches to the air powder polisher nozzle and clear tube extension which is attached to the saliva ejector or HVE.
Clinical Technique

There is a universal air-powder polishing technique that can be used with all types of systems, however manufacturers may have different instructions for use of their equipment. The recommended technique prevents undue aerosols from deflecting back to the clinician or being directed into the patient soft tissues. The use of high speed evacuation or Aerosol Reduction device is the most efficient control of the aerosol spray. While positioning of the patient and operator are basically unchanged, direct vision and access become elementally important when the polisher is active. Positioning the patient slightly upright at 45 degrees with patient’s head toward operator to access areas and reclining to treat maxillary lingual surfaces provide a better field of vision and increase patient comfort. Placing moistened 2” x 2” gauze square over the tongue or on patient’s lip near the work area will help reduce burning and stinging experienced by some patients. The rheostat has two compressions levels; full compression releases the aerosol powder-abrasive from the tip and halfway compression produces a stream of water for rinsing and cleaning. It is recommended that the clinician check the amount of water and powder coming from the unit before activation in patients’ mouth so to test the sensitivity of the alternating cycles and to confirm the powder to water ratio.

The clinician should establish and maintain a systemic pattern when using the air-powder polisher. The nozzle tip should have an appropriate distant from the tooth surface which is approximately 3 mm to 4
mm. Holding the nozzle further away from the tooth surface is not recommended because it minimizes the abrasive action and increases aerosol production. Cupping the lip with the index finger and thumb to pool water in vestibule minimizes aerosol and eases evacuation. The nozzle tip also should be angled diagonally so that the spray is directed toward the middle third of the tooth. The clinician will use a constant circular motion, sweeping or paint-brush motion from interproximal to interproximal. In addition, a systemic approach by polishing one two teeth at a time will ensure that all tooth surfaces are adequately polished. And alternate cycles of full-compression powder-spray and half-compression rinse every two or three teeth will increase efficiency and patient comfort.\(^{20}\) The clinician must polish each tooth approximately 1 to 2 seconds and to avoid loss of tooth structure by subjecting the tooth to no more than ten seconds of air polish slurry. Root surfaces should also be avoided or less time spent because they abrade more rapidly than enamel.

The Dentsply Cavitron Jet Plus has a Tap-On™ technology (Figure 6) which eliminates the need for the clinician to pump the pedal by automatically cycling between rinse and polish. This Tap-On™ technology works by way of tapping the foot pedal once will enable an automatic air polishing/rinse cycle that lasts for approximately one minute and tapping the pedal a second time disables the automatic air polishing/rinse cycle. On the Dentsply Cavitron Jet Plus™ the autocycles work via short, medium, long settings (Figure 7) and are timed cycles of one minute that automatically alternate between air powder polishing and rinse (water only) without having to use the foot pedal to alternate between the two. A single tap to the foot pedal starts each one minute cycle and each cycle begins with a 2 to 3 second stream of water. The “short” autocycle is a .75 second of air-powder polishing followed by a 1.25 seconds rinse; the “medium” autocycle is a 2 second air-powder polishing followed by a 1 second rinse; the “long” autocycle is a 3 second air-powder polishing followed by a 2 second rinse. The “manual” cycle setting is a manual air-powder polishing using the Tap On™ foot technology control to alternate between air-powder polishing and rinse.
When air-polishing the anterior teeth the tip should be directed at a 60 degree angle to the tooth, posterior teeth an angle of 80 degree and for occlusal surfaces a 90 degree angle is recommended.

Using the Jet Shield the clinician will apply the disposable cup (attached to the nozzle) to the middle third of the tooth with light pressure to flare the cup. The clinician will then pivot the nozzle inside the cup to adapt to all areas of the tooth surface and polish for two seconds of spray for each segment of tooth.
Completion of air-polishing procedure

At completion of the air-polishing procedure the clinician should rinse the teeth thoroughly, floss all interproximal surfaces and inspect the teeth for any remaining stain. Thorough rinsing is essential after air powder polishing because of the basic nature of the sodium bicarbonate. If stain is still present, reinstrumentation and or use of the air powder polisher may be indicated. Any debris should be wiped off the patient’s face with a moist towel and offer additional lip balm. The Aerosol Reduction device should be disposed of and the nozzle should be cleaned with a wire-cleaning tool to prevent clogging. Nozzle tips must be autoclaved after each use and the entire unit should be disinfected with an Environmental Protection Agency approved disinfectant. Using a disposable barrier will help minimize disinfecting time. At the end the day the unit should be turned off, remove powder from chamber and discard the unused powder to prevent clogging of lines. Also, keep powder chamber and air lines free of moisture, which can cause system to fail. The clinician will then remove any residual powder from the chamber with a HVE and activate the unit for approximately fifteen second to clear any powder remaining in the chamber.

Conclusion
Therapeutic polishing is the removal of toxins from the unexposed root surfaces, which results in a decrease in disease parameters. Polishing root surfaces is possible with both the rubber-cup or air-powder polisher, however the rationale for selecting the air-powder polisher is for its effectiveness and efficacy. The clinician should follow the precautions and considerations presented when polishing for therapeutic benefits with the air-powder polisher. The clinician should be aware to direct the air-powder spray against the tooth surface, not the exposed soft tissues. Most importantly the clinician must consider all options; esthetic, therapeutic, and patient goals, when designing a treatment plan that meets the patient specific needs.

References:


Air Polishing Questions:

1) The concept of air polishing is based on a technology that was developed in what year?

A) 1935

B) 1945

C) 1985

D) 2005
2) Which term best describes the removal of subgingival bacteria using the air-powder polisher?

A) Henderson effect
B) **Venturi effect**
C) Doppler effect
D) Retro effect

3) The air-powder polisher has been used for debridement of ________ abraded areas before placement of glass ionomer cements.

A) Class I
B) Class II
C) **Class V**
D) Class VI

4) The most common type of abrasive particle used with the air-powder polisher is?

A) **sodium bicarbonate**
B) sodium chloride
C) potassium nitrate
D) doxycycline hyclate

5) Patients that are contraindicated for use of the air-powder polisher are?

A) End-stage renal disease
B) Immunocompromised
C) Addison’s disease
D) All of the above

6) Air-powder polishing is recommended for use on deciduous teeth?
   A) True
   B) False

7) Which of the following should not be done for a patient about to receive air-powder polishing?
   A) Place a disposable or plastic drape over patient’s clothing
   B) Provide the patient with safety glasses
   C) Removal of contact lenses
   D) Apply petroleum lubricant on lips

8) The clinician should be properly protected when performing air-powder polishing with?
   A) Wearing fluid resistant protective apparel
   B) Face shield or protective safety glasses with side shield
   C) Well-fitting mask with high filtration capabilities
   D) All of the above

9) When using air-powder polishing, positioning the patient slightly upright at _____ degrees with patient’s head toward operator.
   A) 90
   B) 45
   C) 180
   D) 65
10) The clinician will then remove any residual powder from the chamber with a HVE and activate the unit for approximately _______ seconds to clear any powder remaining in the chamber.

   A) 15  
   B) 30  
   C) 45  
   D) 60