The concept of air polishing is based on a technology developed by Dr. Robert Black in 1945. 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 represented the first step in air-polishing devices. Air polishing was first marketed in 1976, and from that time forward it became widely 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 air pressure produced, measured in pounds per square inch (psi), depends on the type of air-powder polisher being used.

Air-powder polishers are manufactured as separate handpiece units that attach directly to the air/water connector on the dental unit as a separate device 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 (Figs. 1a, b).

The air-powder polisher is shown to be efficient, safe and effective in removing extrinsic stain and plaque biofilm from tooth surfaces. It is equally effective in decreasing root surface roughness after instrumentation. It is also reported to remove plaque biofilm and staining as effectively as a rubber cup and does so in less time. Patients often exhibit extensive removal of extrinsic stains after air polishing.

**Fig. 1a, b**. Removal of extrinsic stains. (Photo/Provided by Yosi Behroozan, DDS, DENTSPLY Professional)
staining on root surfaces, specifically on areas of recession and at the cementoenamel junction. Removing these stains with a curet has been shown to reduce 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.

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. In vitro, research has shown that there is little or no disruption of enamel, cementum and dentin surfaces with air-powder polishing.

Other research has shown that air-powder polishing can render cementum surfaces more uniformly smooth, compared with traditional polishing or the use of curets.

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 with 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' scale hardness number for sodium bicarbonate is 2.5. In comparison, Pumice has a Mohs' hardness number of 6.

Sodium bicarbonate is safe for use on enamel, amalgam, gold, porcelain, implants (titanium) and orthodontic materials. However, its use 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 sodium-free powder for air-powder polishing is available (Fig. 2) (Jet Fresh from DENTSPLY Professional, York, Pa.). 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. While using aluminum trihydroxide does not cause surface disruption to porcelain, its use can remove the luting agent, causing a compromise in the margin integrity that can quickly lead to decay.

---

**Fig. 2** Jet Fresh prophy powder. (Photos/Provided DENTSPLY Professional unless otherwise noted)

**Fig. 3** Fill the powder chamber with an abrasive recommended by the manufacturer.

**Fig. 4** Powder control knob.
**Patient assessment**

Because of the various indications and contraindications associated with use of the air-powder polisher, patient assessment and treatment planning are critical prior to use. The patient assessment process should include a thorough health history evaluation to identify and possibly rule out patients who have hypertension and/or are on a physician-directed, sodium-restricted diet. However, the amount of sodium bicarbonate ingested during air polishing is not sufficient to cause alkalosis or an increase in blood pressure or sodium levels in the blood.

Other patients who are contraindicated include those who have end-stage renal disease, are immunocompromised, have a communicable infection or have Addison’s or Cushing’s disease. In addition, patients with respiratory problems, such as chronic obstructive pulmonary disease or any condition that interferes with breathing or swallowing, should be treated with an alternative approach. Such patients could be compromised by the aerosols created by air-powder polishing, and they are also vulnerable to the development of pneumonia. Contraindications for using the air-powder polisher also include patients taking potassium, anti-diuretics or steroid therapy—all of which can disrupt the acid/base balance.

Contraindications for use of the air-powder polisher also extend to the hard and soft tissues; therefore, the dental history assessment is paramount. Hard tissue that presents with any composite resins, sealants or glass ionomers should be avoided because of susceptibility of those materials to surface roughness or pitting.

Porcelain margins and margins of all restorations can be altered by extensive exposure of the air-powder polisher, and this can lead to loss of marginal integrity, surface roughness, staining and pitting. Exposed cementum or dentin, because they are not as mineralized as enamel, are more susceptible to abrasion. In addition, patients who present with active periodontal conditions with soft and spongy tissue are contraindicated because 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, clinicians must prepare themselves and their patients. Patient preparation would include a thorough explanation of the procedure, review of medical history and taking of blood pressure. The clinician should place a disposable or plastic drape over the patient’s clothing, provide the patient with safety glasses and confirm removal of contact lenses. The clinician should make sure the patient is in a more upright position. A non-petroleum lubricant should be applied to the patient’s lips to protect them from the abrasive spray, which can dry the lips.

Research has confirmed that when the clinician performs air-powder polishing, aerosols of microorganisms can contaminate surfaces several feet from the operative site. Instructing the patient to use an antimicrobial preprocedural rinse, such as 0.12 percent chlorhexidine, can reduce risk of bacterial contamination from these aerosols.

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

The clinician should be properly protected when performing air-powder polishing. Standard precautions include wearing fluid-resistant protective apparel, using a face shield or protective safety glasses with side shield and wearing gloves and a well-fitting mask with high filtration capabilities. In addition, because of the risk of contamination from the aerosols, the use of a high-speed evacuation system is recommended. Clinicians should always follow the manufacturer’s user directions that are specific to the air-polishing unit being used.

Unit preparation includes obtaining all necessary equipment, such as the air-powder polishing unit and abrasive powder, according to patient selection. The unit and handpiece nozzle is prepared according to manufacturer’s directions, and the powder compartment is filled with the appropriate abrasive recommended for the machine being used (Fig. 3).

The unit should be turned on for at least 15 seconds to eliminate residual powder or moisture in the lines. Also, water lines need to be flushed before use,
The patient assessment process should include a thorough health history evaluation to identify and possibly rule out patients who have hypertension and/or are on a physician-directed, sodium-restricted diet.

According to the recommendations of the Centers for Disease Control and Prevention. When the unit's chamber is being filled with abrasive powder, the unit must be turned off. It needs to be filled with powder to the top of the center tube. The clinician can place a finger over the 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 the patient's needs. For treating patients with heavy stains, it is recommended that the control knob should be turned to "H" for heavy powder flow, which is approximately the 12 o'clock position. For patients with light staining, the control knob will be set to "L" for reduced powder flow, which is approximately the 6 o'clock position (Fig. 4).

An aerosol-reduction device that connects to the saliva-ejector or high-speed-evacuation system used with the air-polisher handpiece has been shown to be effective in controlling and reducing air-powder aerosols, thus decreasing the potential for disease transmission. The aerosol-reduction device reduces or eliminates the visible aerosols normally produced during air-powder polishing. Additionally, the aerosol-reduction device (Fig. 5) eliminates the need for exact angulations with cup/nozzle, use of gauze, hand cupping and patient positioning.

Another advantage to the aerosol-reduction device is that it minimizes the possibility of tooth abrasion because the cup is placed on the tooth — as in traditional polishing techniques. When using the aerosol-reduction device, the clinician must follow the manufacturer's instructions for assembling and disassembling. The aerosol-reduction device contains two parts, a disposable cup that attaches to the air-powder polisher nozzle and a clear tube extension that is attached to the saliva ejector or high volume evacuator (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 the aerosol-reduction device is the most efficient way to control 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 the patient’s head toward the operator to access areas — and reclining to treat maxillary lingual surfaces — provides a better field of vision and increase patient comfort. Placing moistened 2-by-2-inch 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. Before the polisher is activated in the patient’s mouth, it is recommended that the clinician check the amount of water and powder coming from the unit, test the sensitivity of the alternating cycles and 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 maintain an appropriate distance from the tooth surface (approximately 3 to 4 mm). Holding the nozzle farther away from the tooth surface is not recommended because that reduces 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 should use a constant circular motion, sweeping or paintbrush motion from interproximal to proximal. In addition, a systematic approach of polishing one or 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. The clinician must polish each tooth approximately one to two seconds; and to avoid loss of tooth structure, not subject any tooth to more than 10 seconds of air-polish slurry. Root surfaces should be exposed to slurry for even less time or entirely avoided because they abrade more rapidly than enamel.

The DENTSPLY Cavitron Jet Plus™ has Tap-On™ technology (Fig. 6) that automatically cycles between...
Rinse and polish, thus eliminating the need for the clinician to pump the pedal. Tapping the foot pedal once activates the Tap-On automatic air polishing/rinse cycle, which lasts for approximately one minute. Tapping the pedal a second time disables the automatic air polishing/rinse cycle.

The autocycles work in short, medium or long settings (Fig. 7) within timed cycles of one minute. Each cycle begins with a two- to three-second stream of water. The “short” autocycle is 0.75 seconds of air-powder polishing followed by a 1.25-second rinse; the “medium” autocycle is two seconds of air-powder polishing followed by a one-second rinse; and the “long” autocycle is three seconds of air-powder polishing followed by a two-second rinse.

The “manual” cycle setting enables the clinician to use the Tap On foot technology control to alternate manually 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; for posterior teeth the angle should be 80 degrees; and for occlusal surfaces, a 90-degree angle is recommended. Using the aerosol-reduction device, 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.20 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. A re-application of lip balm should be offered.

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 EPA-approved disinfectant. Using a disposable barrier will help minimize disinfecting time.

At the end of the workday, the unit should be turned off, powder removed from chamber and unused powder discarded to prevent clogging of lines. Also, keep the powder chamber and air lines free of moisture, which can cause the system to fail.22 The clinician then needs to remove any residual powder from the chamber with a HVE and activate the unit for approximately 15 seconds 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.20

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 individual patient’s specific needs._

_References_


_about the authors_

Salam Rayman, RDH, MPA, is an associate professor in the dental hygiene program at Eugenio Maria de Hostos Community College of the City University of New York. He can be contacted by email at srayman@hostos.cuny.edu.

Elvir Dincer, DDS, is an associate professor in the dental hygiene program Eugenio Maria de Hostos Community College of the City University of New York. He can be contacted by email at edincer@hostos.cuny.edu.