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Air Polishing: A Mainstay for Dental Hygiene

A Peer-Reviewed Publication
Written by Caren M. Barnes

Abstract

This continuing education course provides a comprehensive review of air polishing. The initial portion of the course reviews the history of air polishing. The course includes a description of how air polishing removes dental stain and plaque and the clinical techniques used for air polishing, and the Mohs hardness number of abrasive particles. The course material includes the identification of medical conditions that exclude patients from being candidates for air polishing and a description of facial emphysemas and how they can be a sequela from use of an air polisher. Surfaces of teeth and the types of dental restorative materials that can be effectively treated with air polishing procedures are also identified.

Educational Objectives:

1. Identify the origins of air polishing.
2. Compare and contrast the advantages of air polishing.
3. Describe the symptoms of facial emphysema and identify the method for treatment.
4. Identify the clinical techniques that can be used to best control the inherent aerosol spray produced during air polishing.

Author Profile

Caren M. Barnes received her BS in Dental Hygiene in 1973 and her MS in Dental Hygiene Education and Research from UMKC School of Dentistry in 1974. She currently serves as a Professor and researcher at the University Of Nebraska Medical Center College Of Dentistry. Caren has conducted a wide range of research projects and serves as a research consultant and key opinion leader to many dental manufacturers in the US and Europe. Caren is regarded as an expert in airpolishing and traditional polishing both nationally and internationally. Professor Barnes has over 175 publications and has received many prestigious honors. She can be reached at cbarnes@unmc.com.

Author Disclosure

Caren M. Barnes discloses that she has served as a key opinion leader and consultant to DENTSPLY. In addition she has participated in a number of research studies conducted on behalf of DENTSPLY.

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Abstract

This continuing education course provides a comprehensive review of air polishing. The initial portion of the course reviews the history of air polishing. The course includes a description of how air polishing removes dental stain and plaque and the clinical techniques used for air polishing, and the Mohs hardness number of abrasive particles. The course material includes the identification of medical conditions that exclude patients from being candidates for air polishing and a description of facial emphysemas and how they can be a sequela from use of an air polisher. Surfaces of teeth and the types of dental restorative materials that can be effectively treated with air polishing procedures are also identified.

Introduction

In June 2013, the American Dental Hygienists' Association will formally celebrate the 100th anniversary of the dental hygiene profession. We will be celebrating a profession created by two individuals; Dr. Alfred C. Fones and Miss Irene Newman. In the first decade of the 1900s, Dr. Fones recognized that keeping teeth clean by removing plaque and calculus could actually aid in the prevention of dental diseases. This may seem like an extremely basic concept at this point in time, but it was a radical concept in the early twentieth century.[1] He recognized that keeping patients' teeth free from dental plaque and calculus build-up could help patients retain their teeth instead of succumbing to extractions. He put his beliefs into action and in 1906 Dr. Fones began to train the very first dental hygienist, Miss Irene Newman, so that she could provide oral prophylaxes for Dr. Fones' patients.[1] While Dr. Fones did not enjoy a groundswell of support from his dental colleagues initially, by 1913 Dr. Fones opened the Fones School of Dental Hygiene in Bridgeport, Connecticut.

As the dental profession celebrates such an important milestone this year, there will no doubt be a great deal of focus on the future and reflection on the past. The myriad of changes that have occurred regarding the central role that dental hygienists play in the prevention of oral diseases as well as providing therapeutic procedures that play a key role in healing and arresting oral diseases are truly amazing. In a short period of time, dental hygienists' impact on the delivery of care has fundamentally changed the dental profession. At the same time, reflections will be made on how many things have not changed. Notably, the oral prophylaxis has remained fundamental to the preventive and therapeutic healthcare services that dental hygienists provide and to Dr. Fones' vision. The very definition of the term, "oral prophylaxis" has remained basically unchanged. The American Dental Hygienists' Association states that an oral prophylaxis should consist of "supragingival and subgingival removal of plaque, calculus, and stain.[2] The American Academy of Periodontology defines an oral prophylaxis as the "removal of plaque, calculus and stain from exposed and unexposed surfaces of the teeth by scaling and polishing as a preventive measure for the control of "local irritational factors."[3]

While the procedures that are fundamental to an oral prophylaxis (scaling and polishing), have not changed, there have been prodigious changes in the instruments and equipment dental professionals use to perform these procedures. The most significant areas of change in the armentarium for performing an oral prophylaxis involve the use of powered equipment. The first powered equipment that had an impact on the delivery of the oral prophylaxis was a belt driven motor for powering the slow-speed handpiece. Polishing of teeth to remove dental plaque and stain no longer had to be the laborious task it had been with the use of a porte polisher (see Figure 1). A much greater impact on scaling and polishing procedures occurred with the introduction of the ultrasonic scaler in 1957.[4] Heavy, tenacious calculus and some heavy stains almost impossible to remove with hand scaling, could be accomplished in seconds or minutes rather than hours. Several decades passed before powered devices were available that had a major impact on dental hygiene practice.

Figure 1. A porte polisher. Prior to the advent of powered polishing equipment, teeth were polished by applying the polishing paste with the disposable wooden tip on the porte polisher. The polishing agent was applied with circular, vertical, diagonal or horizontal strokes.

The focus of this continuing education course is air polishing, also known as air powder polishing, which has been in existence long enough to receive widespread acceptance. Critical for the acceptance of air polishing is the requisite research necessary to establish scientific evidence

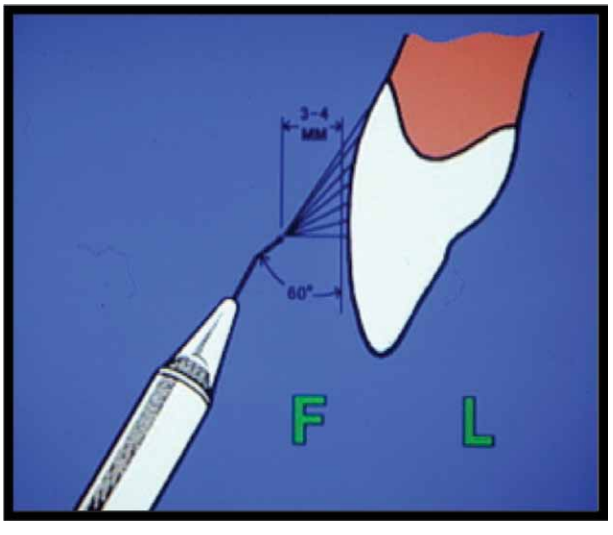
on which to base its use in oral prophylaxis polishing procedures. A significant body of knowledge exists for air polishing and it is now a mainstay in the oral prophylaxis armentarium.

Air Polishing—The Invention

Like so many inventions, air polishing was borne out of an invention that had nothing to do with polishing teeth. On the contrary, air polishing was born out of an invention that was meant to use abrasives to cut cavity preparations in teeth.

In the early 1940's, Dr. Robert Black, a dentist-inventor was in search of a technology that would allow dentists to provide "painless" dental treatment.[5] Dr. Black was very sensitive to the fact that so many people went without dental treatment due to their fear of the pain and discomfort that was associated with dentistry. Dr. Black's vision was to invent a method to cut cavity preparations that would be painless and not require the administration of anesthesia. He felt that if he succeeded at that, then dental treatment would be much more acceptable to society. What he devised and introduced in 1945 was the Air Dent, a very large cumbersome machine that utilized highly abrasive particles (dolomite, crushed walnut shells, and aluminum oxide)[6] that were propelled under highly compressed air pressure combined with water.

Figure 2. Illustration of the correct angulation for airpolishing anterior teeth.



While it was ultimately determined that the Air Dent was not the answer to "painless dentistry" as Dr. Black had hoped, it was not quickly disregarded. There were many dentists who liked the Air Dent and wanted to see the problems with it resolved, so they assisted Dr. Black in trying to make improvements. Somewhat surprisingly, the Air Dent had gained enough support that it was required to be taught in the curriculum of US dental schools and was even covered in an article in *Time* magazine.[6]

Dr. Black never gave up on the idea of using compressed air mixed with abrasive particles. Over the years he made observations while compiling data on the Air Dent. Unknown to him at the time, his most significant observation was during the use of the Air Dent for a cavity preparation. Heavily stained teeth adjacent to the tooth in which the cavity preparation was being made, became stain free after the use of the Air Dent. But the Air Dent was not the answer for stain removal — the abrasive agents he used not only removed stain, but also removed calculus and outer enamel of the teeth.

Dr. Black revisited his invention in the late 1960's and early 1970's and focused on stain removal with the device. The abrasives he used for cutting cavity preparations with the Air Dent were much too abrasive for use as polishing agents. After trying numerous types of abrasives Dr. Black discovered that a specially processed sodium bicarbonate could be utilized to remove stain and plaque, and thus air polishing became a reality. There are a number of air polishing equipment manufacturers that are commercially available to dental professionals worldwide. Like any new innovation, it took time for air polishing to gain widespread acceptance. Dental hygienists and other clinicians had to learn the concepts behind air polishing and most importantly, the appropriate technique for use. It has been no coincidence that the dental providers who were the most accepting of air polishing were the ones that took the time to learn the correct techniques for use.

Air Polishing—The Science

It is more important than ever for dental professionals to understand the scientific principles related to polishing and the use of abrasive agents. Two examples that highlight the need for appropriate polishing procedures and products are (1) the unparalleled demand for esthetic restorations[7] and (2) a burgeoning population of senior citizens with issues related to dentinal hypersensitivity and root exposure due to gingival recession.

The primary goal of dental polishing, regardless of method used, is removal of stain and/or dental plaque while preserving the enamel surface and preserving the surface characterization of dental restorations. From a material science perspective, polishing is intended to produce intentional, selective and controlled wear.[8-12] Polishing used in dental procedures is accomplished by two types of wear; abrasion or erosion. Traditional polishing with a rubber cup and polishing paste is accomplished by abrasion; which is the process of creating finer and finer scratches with a series of finer and finer abrasives, until the microscopic scratches are smaller than the wavelength of visible light (<.05 μm), producing gloss and luster. Air polishing is accomplished by erosion, which is the recession of surfaces, in this case dental stain and plaque, by suspended abrasive particles within a moving fluid. Specifically, air polishing is accomplished by

the propulsion of abrasive particles through a mixture of compressed air and water through a handpiece nozzle. Kinetic energy propels the air polishing abrasive particles against the tooth surface, thus removing stain and/or dental plaque.

For any type of polishing the following factors determine the rate of abrasion: speed, pressure, quantity of abrasive applied, size of the abrasive particle, shape of abrasive particle and hardness of the abrasive particle.[8-12] However it is the hardness of the abrasive particle and particle size that truly determines the stain removal capacity of the abrasive agent.[13] The abrasive capacity of commercially prepared prophylaxis polishing pastes can only be identified by the manufacturer's designation as fine, medium or coarse. It is interesting to note that there is no industry standard that determines the size, type or hardness of the agents in the commercially prepared prophylaxis polishing pastes.[14] Likewise, there is no index to determine the abrasiveness of air polishing powders, although research is currently underway to create an air polishing abrasive index.[15] Therefore, dental professionals must turn to the significant body of air polishing research on tooth structures and restorative materials to determine which air polishing powders are best suited for natural tooth surfaces and /or restorative materials. There are many widely used indices to indicate material hardness or resistance to indentation, among which are the Knoop Hardness Test, Vickers Hardness Test, Brinell Hardness Test and the Mohs Scale of Hardness. These indices provide at least some comparative information regarding abrasive potential of various abrasive agents utilized in prophylaxis polishing pastes and air polishing powders. For simplification, the Mohs hardness numbers will be used in this continuing education course. The Mohs Hardness Scale ranges from 1-10. On the Mohs Hardness Scale, talc has a Mohs number of 1, while diamonds have a number of 10. The Mohs hardness number for the hydroxyapatite for enamel ranges from 5.5-6. It is confusing because some references to the Mohs Hardness Scale indicate that tooth enamel has a Mohs hardness number of 6, which may not be an accurate representation of the hardness of enamel if the hardness number actually refers to the hydroxyapatite structure of enamel.

Air Polishing—Clinical Use

There are two basic types of air polishing delivery systems. The self-contained air polishing unit attaches to the compressed air and water lines of the dental unit and requires an electric outlet. An alternative type of air polisher attaches to the handpiece connection on the dental unit, obtaining the compressed air and water from the handpiece lines. No electrical connection is required for the handpiece connection type of unit. In general, self-contained units have a range of water pressure of 10-50 psi. The inlet air pressure from the dental unit is approximately 60 psi. The outlet air pressure, which is delivered out of the nozzle, is set between 58-60 psi.

While manufacturers of air polishing equipment may have instructions for use that are unique to their equipment, there is a universal air polishing technique that can be used with all air polishing systems (see Figures 2, 3, 4, 5).[5] The nozzle of the air polishing unit should be kept 3-5 mm away from the surface being polished and the handpiece should be kept in a constant circular motion. With proper technique, the average tooth receives .5 seconds of exposure to the air-powder-water stream during air polishing procedures.

Figure 3. Illustration of the correct angulation for airpolishing posterior teeth.

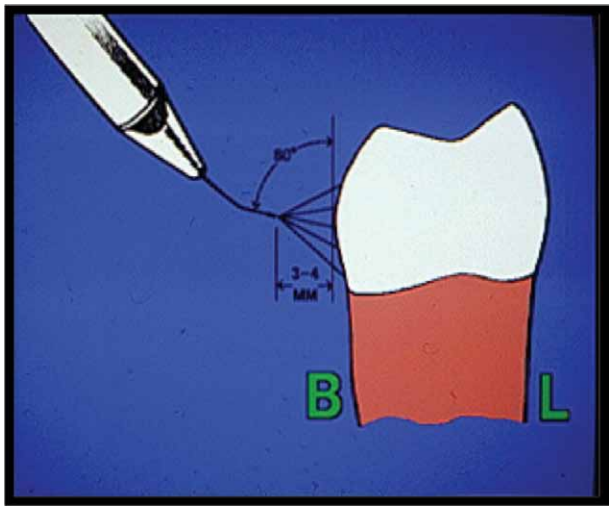


Figure 4. Illustration of the correct angulation for airpolishing occlusal surfaces.

Figure 5. Illustration of the incorrect angulation of an airpolishing handpiece. The airpolishing spray should never be directed into soft tissues, into the gingival sulcus or a periodontal pocket, an extraction site or into an open oral wound.

The angulation for the handpiece nozzle to anterior teeth should 60 degrees, while the angulation for the handpiece nozzle to posterior teeth should be 80 degrees. The only time the handpiece nozzle should be directed at a 90 degree angle is for polishing the occlusal surfaces of the teeth. The key to controlling the aerosol spray is use of the recommended angulations as well as the use of high-speed evacuation.[16]

Standard infection control procedures are followed when using air polishing. Patients should be asked to remove their contact lenses and the use of protective eyewear is mandatory. Clinicians should wear a high filtration mask and a preprocedural rinse should be used to lower the microbial loads that will be in the inherent aerosols created during air polishing procedures.[16]

The health history of patients should be carefully evaluated prior to using air polishing systems, including patients with a physician-directed sodium restricted diet or hypertension (if a specially processed sodium bicarbonate powder is to be used). Sodium free air polishing powders that are safe for use with patients on a sodium restricted diet are commercially available. However, research has indicated that the amount of sodium bicarbonate ingested during air polishing is not sufficient to cause elevated blood pressure, alkalosis in the blood stream or an increase in blood levels of sodium.[17, 18]

Additionally, use of air polishing should be avoided on patients with respiratory problems such as chronic obstructive pulmonary disease, or any other condition that interferes with the patient's ability to breathe or swallow. Air polishing should not be utilized on patients that are immunocompromised, have a communicable infection, or are taking potassium anti-diuretics or steroid therapy.[5] The use of air polishing should be avoided on patients with end-stage renal disease, or who have Addison's disease or Cushing's disease.[5]

The air polishing handpiece nozzle should never be directed into or near a surgical wound site, traumatic lacerations, gingival sulcus or periodontal pocket, especially periodontal pockets with extensive bone loss. To do so would risk the creation of an iatrogenic facial emphysema, which is the entrapment of air into subcutaneous tissue spaces and can occur even in small areas open to subcutaneous tissues.[5, 19-30] Facial emphysemas associated with dental procedures usually result in facial swelling and the patient may experience a "crackling" sensation when the affected tissues of the head and neck area are touched. Additional symptoms may include tenderness and pain.

While the occurrence of facial emphysemas related to use of air polishing equipment is uncommon they must be recognized and treated. It is important to note that emergency medical personnel may not be familiar with them and they may be difficult to diagnose. If facial emphysemas are detected early, the patient will require observation, analgesia and antibiotic therapy, and are usually resolved within a few days. The sequelae that can develop from facial emphysemas can be life-threatening and can result in bilateral pneumothorax, cerebral air embolism, cervicofacial emphysema, facial emphysema, mediastinal emphysema, pneumomediastinum, pneumothorax and retropharyngeal emphysema.[19-32]

Air Polishing—The Evidence

With over thirty years of experience and research on air polishing, there is a significant body of evidence behind the use of air polishing as well as a wealth of clinical experiences. Like any product or equipment, uninformed use or misuse can cause clinicians to blame the product or equipment for its failure to perform satisfactorily. The following is a list of information about air polishing that is supported by scientific evidence when using an air polishing powder with a Mohs hardness number of 3 or less:

- Air polishing removes stain and dental plaque in half the time it would take using traditional polishing, and stain can be removed 3.15 times faster than with a curette[33-35]
- Air polishing is less abrasive than prophylaxis polishing pastes (the Mohs hardness number for pumice, which is the primary ingredient in commercially prepared polishing pastes is 6)[5]
- Air polishing is not painful if the air/water/powder stream is not directed at soft tissues
- Any soft tissue trauma that may occur from air polishing usually dissipates within 24 hours[36]
- Air polishing can be safely used on titanium implants and is the method of choice for orthodontically banded

and bracketed teeth, preparation for sealant placement and bacterial removal from root surfaces[37-39]

- Air polishing can produce uniformly smooth root surfaces and remove 100% of bacteria and/or bacterial endotoxins from cementum[33-36]

Air Polishing Powders

Dr. Black solved the manner in which the abrasive particles should be delivered for stain removal. It could be delivered with compressed air and water in a new device modeled after the Air Dent, but in a small unit that had an appropriate reduction in the air pressure which delivered the stream of abrasive particles without removal of tooth enamel. Dr. Black had previously identified abrasive agents that were too abrasive for use in stain removal. The issue that remained was the type of abrasive agent that could remove stain safely. Dr. Black had to identify an air polishing powder that would remove heavy tooth stains, yet leave surface enamel intact. The abrasive powder could not injure soft tissues or tooth structure in the oral cavity and had to be physiologically compatible with the digestive system as well. Furthermore, the abrasive particle could not become embedded as a foreign body in soft tissues of the oral cavity. After many trials, Dr. Black found the first acceptable air polishing powder that met all these criteria: specially processed sodium bicarbonate.

Sodium Biccarbonate

Dr. Black collaborated with a variety of scientists including chemists, pharmacists and engineers, and came up with the formula that has now become the "gold standard" for air polishing powders—specially processed sodium bicarbonate. The powder is free-flowing, food grade, contains calcium carbonate, and may contain scant amounts of silica as a flow aid. The Mohs hardness number for sodium bicarbonate is 2.5 and the particles average 74 µm in size.[5, 37-45]

Specially processed sodium bicarbonate for use in air polishing procedures is safe for use on enamel, amalgam, gold, porcelain, orthodontically banded and bracketed teeth and dental implants. Specially processed sodium bicarbonate should not be used on any type of composite or tooth-colored restoration.[37-50]

Aluminum Triydroxide

In the early 2000's, some dental hygienists called for an alternative to sodium bicarbonate air polishing powder due to the concern that the sodium bicarbonate powder could not be used on patients on a physician-directed sodium restricted diet, patients with chronic kidney disease and patients with hypertension. Aluminum trihydroxide air polishing powder was developed to address this issue. Aluminum trihydroxide is much more abrasive than sodium bicarbonate, with a Mohs hardness value of 2.5-3.5[51] and the particle size is 80-325 µm. Johnson et al investigated the effects of aluminum trihydroxide on restorative materials and results revealed that it is quite abrasive and should only be used on heavily stained enamel.[52] The use of aluminum trihydroxide should be avoided on exposed cementum and dentin, composites, porcelain and gold restorations.

New Powders

In the past few years there have been several new air polishing powders available for use. Those include glycine, calcium carbonate, and calcium sodium phosphosilicate. While research on these air polishing powders is in progress there is insufficient evidence at this point to make recommendations as to which restorative materials can or cannot be treated with these air polishing powders. Until there is sufficient scientific evidence, it would be prudent to avoid the use of these air polishing powders on any restorative materials. Clinicians should be aware that usage of an air polishing powder that does not come with the unit, or one that is not recommended by the manufacturer, could void the warranty on the air polishing equipment.[5]

Glycine

Glycine is an amino acid used in powders. Glycine crystals are grown using a solvent of water and sodium salt. Glycine particles for use in air polishing have a Mohs hardness number of 2 are 20 µm in size.[52] Glycine is currently being investigated for subgingival use in Europe by Petersilka and Fleming.[53-55] It is important to note that the subgingival application is not recommended with the air polishing handpiece and nozzles on currently available equipment. Subgingival application of air polishing in Europe is accomplished using a specially designed subgingival application tip.

Calcium Carbonate

Calcium carbonate is a naturally occurring substance that can be found in rocks. It is a main ingredient in antacids, and is also used as filler for pharmaceutical drugs. Calcium carbonate has a Mohs hardness of number of 3.

Calcium Sodium Phosphosilicate

The latest air polishing powder introduced to the market is calcium sodium phosphosilicate. Calcium sodium phosphosilicate is a bioactive glass and has a Mohs hardness number of 6, making it the hardest particle used in air polishing powders. The particles vary from 25-120µm in size. With a Mohs hardness number of 6, the abrasive potential for this product is too extreme for use on natural or restored surfaces until more research is conducted.[56, 57]

Air Polishing And Air Abrasion

Air polishing and air abrasion are not the same. Air abrasion uses greater air pressure and more abrasive particles and is intended for procedures such as removing decayed enamel and roughening enamel surfaces prior to bond-

ing. The standard abrasive particle used in air abrasion is aluminum oxide which has a Mohs hardness number of 9, which is four to five times more abrasive than air polishing agents.[5]

Conclusion

With over thirty years of use in in the dental profession, air polishing has become a mainstay in the armentarium for polishing. It has proven to be a significant labor-saving device, providing clinical results that would be difficult to achieve without its use. Improvements in air polishing equipment design, powder and particle technology and proper usage to maximize clinical efficacy and minimize unintended consequences have all contributed to the widespread acceptance of air polishing. There is a large body of research being conducted at the present time on air polishing and it will be exciting to follow the findings. As is the case with virtually every aspect of the dental profession, advances in knowledge lead to enhancements in the manner in which we take care of our patients. It is likely that there will be many new developments that will enhance the use and efficacy of air polishing in the very near future.

References

1. Zayan M. History of Dental Hygiene, Connecticut Dental Hygienist's Association, Inc. http://www.cdha-rdh.com/home/historyofdentalhygiene.html, accessed October 5, 2012.
2. American Dental Hygienist's Association. Position Paper on the Oral Prophylaxis, Available at: www.adha.org/profissues/prophylaxis.htm. Accessed November 5, 2012.
3. Glossary of Periodontal Terms., 3rd ed, Chicago: American Academy of Periodontology; 1992:40. Accessed November 5, 2012.
4. Barnes CM. An in-depth look at air polishing. Dimensions in Dental Hyg 2010; 8(3): 32, 34-36, 40.
5. Medicine: Airblasting Teeth. Time August 6, 1945. Available at: http://www.time.com/time/subscriber/article/0,33009,803704,00.html. Assessed November 5, 2012.
6. Barnes CM. Polishing esthetic restorative materials, Dimensions in Dental Hyg 2010; 8(1): 24, 26-28.
7. Hutchings IM. Abrasion process in wear and manufacturing. Proceedings of the Institution of Mechanical Engineers. Part J: Journal of Engineering Tribology. 2002;216:55-62.
8. Remond G, Nockolds C, Phillips M, et al. Implications of polishing techniques in quantitative x- ray microanalysis. J Res Natl Inst Stand Technol. 2002;107:639-662.
9. Williams JA. Wear and wear particles—some fundamentals. Tribiology International. 2005;38:863-870.
10. O'Brien WJ. Dental Materials and Their Selection. 3rd ed. Carol Stream, Ill: Quintessence; 2002:156-160.
11. Wilkins EM. Clinical Practice of the Dental Hygienist. 10th ed. Philadelphia: Lippincott Williams and Wilkins; 2009:727-740.
12. Ferracane JL. Materials in Dentistry Principles and Applications. 2nd ed. Philadelphia: Lippincott Williams and Wilkins; 2001:288-289.
13. Barnes CM. The science of polishing. Dimensions of Dental Hyg 2009; 7(11): 18-20, 22.
14. Barnes CM, Covey DA, Watanabe H. An in vitro comparison of the effects of various air polishing powders on enamel and selected esthetic restorative materials. Unpublished research 2013.
15. Barnes CM. The management of aerosols with air polishing delivery systems. J Dent Hyg 1991; 65:250-252.
16. Gutmann ME. Air polishing: a comprehensive review of the literature. J Dent Hyg 1998; 73: 47-56.
17. Snyder JA, McVay JT, Brown FH, et al. The effect of air abrasive polishing on blood pH and electrolyte concentrations in healthy mongrel dogs. J Periodontol 1990; 61: 81-86.
18. Karras SC, Sexton JJ. Cervicofacial and mediastinal emphysema as the result of a dental procedure. J Emerg Med. 1996; 14:9-13.
19. Fruhauf J, Weinke R, Pilger U, Kerl H, Mullegger RR. Soft tissue cervico facial emphysema after dental treatment. Arch Dermatol. 2005; 141:1437-1440.
20. Snyder MB, Rosenberg ES. Subcutaneous emphysema during periodontal surgery: report of a case. J Periodontol. 1977; 48:790-791.
21. McDonnell DG. Surgical emphysema in the subcutaneous tissues of the face following restorative procedures. J Irish Dent Assoc. 1983; 29:20-21.
23. Tan WK. Sudden facial swelling: subcutaneous facial emphysema secondary to use of air/water syringe during dental extraction. Singapore Dent J. 2000;23(1 Suppl):42-44.
24. Arai I, Aoki T, Yamazaki H, Ota Y, Kaneko A. Pneumomediastinum and subcutaneous emphysema after dental extraction detected incidentally by regular medical checkup: a case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2009; 107:33-38. Epub 2009 Feb 8.
25. Sekine J, Irie A, Dotsu H, Inokuchi T. Bilateral pneumothorax with extensive subcutaneous emphysema manifested during third molar surgery. A case report. Int J Oral Maxillofac Surg. 2000; 29:355-357.
26. Uehara M, Okumura T, Asahina I. Subcutaneous cervical emphysema induced by a dental air syringe: a case report. Int Dent. 2007; 57:28628-8.
27. Yamada H, Kawaguchi K, Tamura K, Sonoma T, Iida N, Seta K. Facial emphysema caused by cheek bite. Int J Oral Maxillofac Surg. 2006;35:188-189.

28. Finlayson RS, Stevens FD. Subcutaneous facial emphysema secondary to use of the Cavi-Jet. J Periodontol. 1988; 59:315-317.
29. Liebenberg WH, Crawford BJ. Subcutaneous, orbital, and mediastinal emphysema secondary to the use of an air-abrasive device. Quintessence Int. 1997; 28:31-38.
30. Frühauf J, Weinke R, Pilger U, Kerl H, Müllegger RR. Soft tissue cervicofacial emphysema after dental treatment: report of 2 cases with emphasis on the differential diagnosis of angioedema. Arch Dermatol. 2005;141;1437-1440.
31. Yang SC, Chiu TH, Lin TJ, Chan HM. Subcutaneous emphysema and pneumomediastinum secondary to dental extraction: a case report and literature review. Kaohisiumg K Med Sci. 2006;22:641-645.
32. Bavinger JV. Subcutaneous and retropharyngeal emphysema following dental restoration: an uncommon complication. Ann Emerg Med. 1982; 11:371-374.
33. Berkstein S, Reiff RL, Mc Kinney JF, Killoy WJ: Supragingival root surface removal during maintenance procedures utilizing an air-powder abrasive system or hand scaling. J Periodontol. 1987; 58:327-333
34. Atkinson DR, Cobb CM, Killoy WJ. The effect of an air-powder abrasive system on in vitro root surfaces. J Periodontol. 1984; 55:13-18.
35. Gilman RS, and Maxey BR. Effect of root detoxification on human gingival fibroblasts. J Periodontol. 1986; 57:436-440.
36. Weaks LM, Lescher NB, Barnes CM, Holroyd SV. Clinical evaluation of the Prophy-Jet as an instrument for routine removal of tooth stain and plaque. J Periodontol. 1984; 55:486-488.
37. Brockmann SL, Scott RL, Eick JD. The effect of an air-polishing device on tensile bond strength of a dental sealant. Quintessence Int. 1989; 20:211-217.
38. Barnes CM, Russell CM, Gerbo LR, Wells B, Barnes DW. Effects of an air-powder polishing system on orthodontically bracketed and banded teeth. Am J Ortho. 1990; 97:74-81.
39. Gerbo LR, Barnes CM, Leinfelder KF. Applications of the air-powder polisher in clinical orthodontics. Am J Orthod Dentofacial Orthop. 1993; 103:71-73.
40. Barnes CM, Hayes EF, Leinfelder KF. Effects of an airabrasive polishing system on restored surfaces. Gen Dent. 1987; 35:186-189.
41. Lubow RM, Cooley RL. Effect of air-powder abrasive instrument on restorative materials. J Prosthet Dent. 1986; 55:462-465.
42. Cooley RL, Lubow RM, Brown FH. Effect of air-powder abrasive instrument on porcelain. J Prosthet Dent. 1988; 60:440-443.
43. Carr MP, Mitchell JC, Seghi RR, Vermilyea SG The effect of air polishing on contemporary esthetic restorative materials. Gen Dent. 2002; 50:238-41.
44. Gutmann MS, Marker VA, Gutmann JL Restoration surface roughness after air-powder polishing. Am J Dent. 1993; 6:99-102.
45. Yap AU, Wu SS, Chelvan S, Tan ES. Effect of hygiene maintenance procedures on surface roughness of composite restoratives. Oper Dent. 2005; 30:99-104.
46. Barnes CM, Fleming LS, Mueninghoff LA. SEM evaluation of the in-vitro effects of an air-abrasive system on various implant surfaces. Int J Oral Maxillofac Implants. 1991; 6:463-469.
47. Augthun M, Tinschert J, Huber A. In vitro studies on the effect of cleaning methods on different implant surfaces. J Periodontol. 1998; 69:857-864.
48. Mengel R, Buns CE, Mengel C, Flores-de-Jacoby L. Instruments. Int J Oral Maxillofac Implants. 1998; 13:91-96.
49. Matarasso S, Quaremba G, Coraggio F, Vaia E, Cafiero C, Lang NP. Maintenance of implants: an in vitro study of titanium implant surface modifications subsequent to the application of different prophylaxis procedures. Clin Oral Implants Res. 1996;7:64-72.
50. Meschenmoser A, d'Hoedt B, Meyle J, Elssner G, Korn D, Hämmerle H, Schulte W. Effects of various hygiene procedures on the surface characteristics of titanium abutments. J Periodontol. 1996:67:229-235.
51. Niknam Chemicals Private Limited
52. Johnson WW, Barnes, CM, Covey DA, Walker MP, Ross JA. an in vitro investigation of the effects of an aluminum trihydroxide air polishing powder delivered via the Prophy Jet ™ on dental restorative materials, J Prosthodont, September, 13:1-7, 2004
53. Petersilka G, Faggion CM Jr, Stratmann U, Gerss J, Ehmke B, Haeberlein I, Flemmig TF. Effect of glycine powder air-polishing on the gingiva. J Clin Periodontol. 2008; 35:324-332.
54. Flemmig TF, Hetzel M, Topoll H, Gerss J, Haeberlein I, Petersilka G.Subgingival debridement efficacy of glycine powder air polishing. J Periodontol. 2007;78:1002-1010.
55. Frankenberger R, Lohbauer U, Tay FR, Taschner M, Nikolaenko SA. The effect of different air-polishing powders on dentin bonding. J Adhes Dent. 2007; 9:381-389.
56. Bakry AS, Tamura Y, Otsuki M, Kasugai S, Ohya K, Tagami J. Cytotoxicity of 45S5 bioglass paste used for dentine hypersensitivity treatment. J Dent. 2011 Sep; 39(9):599-603.
57. Greenspan DC. Novamin and tooth sensitivity—an overview. J Clin Dent. 2010; 21(3):61-5 Hardness-CALCE-University of Maryland www.calce.umd.edu/TSFA/Hardness_ad_.htm

Author Profile

Caren M. Barnes received her BS in Dental Hygiene in 1973 and her MS in Dental Hygiene Education and Research from UMKC School of Dentistry in 1974. She currently serves as a Professor and researcher at the University Of Nebraska Medical Center College Of Dentistry. Caren has conducted a wide range of research projects and serves as a research consultant and key opinion leader to many dental manufacturers in the US and Europe. Caren is regarded as an expert in airpolishing and traditional polishing both nationally and internationally. Professor Barnes has over 175 publications and has received many prestigious honors.

Author Disclosure

Caren M. Barnes discloses that she has served as a key opinion leader and consultant to DENTSPLY. In addition she has participated in a number of research studies conducted on behalf of DENTSPLY.

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Questions

1. Air polishing removes dental stain and plaque by which one of the following actions?
   a. Abrasion
   b. Controlled wear
   c. Erosion
   d. Attrition
2. Which one of the following is not a symptom related to facial emphysemas?
   a. Tenderness
   b. Internal Bleeding
   c. Pain
   d. Swelling
3. Which one of the following air polishing powders is considered the "gold standard" for air polishing powders?
   a. Calcium carbonate
   b. Calcium sodium phosphosilicate
   c. Sodium bicarbonate
   d. Aluminum Trihydroxide
4. Which one of the following angles is universally recommended for removing stain and plaque from posterior teeth?
   a. 60 degrees
   b. 70 degrees
   c. 80 degrees
   d. 90 degrees
5. When polishing with an air polisher, how far should the nozzle of the handpiece be kept from the surface being polished?
   a. 1-4 mm
   b. 2-3 mm
   c. 3-4 mm
   d. 3-5 mm
6. The Mohs Hardness Scale has a range of:
   a. 1-10
   b. 1-100
   c. 1-1000
   d. 1-10,000
7. The air polishing handpiece nozzle should be:
   a. Held in a stationary position for 3 seconds prior to moving it to another area
   b. Moved back and forth in a horizontal direction from the cervical area of the tooth to the occlusal or incisal area
   c. Moved up and down in a vertical direction from the cervical area of the tooth to the occlusal or incisal area
   d. In constant circular motion
8. Which one of the following factors can be effectively used to control aerosols inherent with air polishing?
   a. Reduce the amount of water used in the air/powder/waster spray
   b. Hold the handpiece in a stationery position
   c. Decrease the amount of powder used in the air/powder/waster spray
   d. Use of high-speed evacuation
9. Which one of the following is a symptom of facial emphysema?
   a. Affected tissue is marked with bruising
   b. Affected tissue feels is tender and painful
   c. Affected tissue is erythematous
   d. Affected tissue is covered with waxy bumps
10. Which one of the following statements about air polishing is not true?
    a. Air polishing removes dental stain and plaque in approximately half the amount of time it would take to polish the same area with traditional polishing.
    b. Air polishing is more abrasive than traditional commercially prepared polishing pastes.
    c. Air polishing can remove 100% of bacteria and endotoxins from cementum.
    d. Air polishing with specially processed sodium bicarbonate can be safely used on titanium implants.
11. Which one of the following abrasive particles is utilized for air abrasion?
    a. Aluminum trihydroxide
    b. Glycine
    c. Calcium Carbonate
    d. Aluminum oxide
12. Which one of the following air polishing powders has the highest Mohs hardness number?
    a. Calcium sodium phosphosilicate
    b. Specially processed sodium bicarbonate
    c. Calcium carbonate
    d. Aluminum trihydroxide
13. Which one of the following surfaces should not be polished with specially processed sodium bicarbonate?
    a. Porcelain
    b. Amalgam
    c. Composite
    d. Gold
14. Of the following physical factors, which one has the greatest impact on the rate of abrasion?
    a. Size
    b. Shape
    c. Amount of abrasive used
    d. Hardness
15. What type of energy propels air polishing abrasive particles to the surface to be polished?
    a. Kinetic
    b. Thermal
    c. Gravitational
    d. Sound waves
16. Which one of the following abrasive powders is not utilized for air polishing?
    a. Special processed sodium bicarbonate
    b. Aluminum trihydroxide
    c. Dolomite
    d. Calcium carbonate
17. Which one of the following angles is universally recommended for removing stain and plaque from anterior teeth?
    a. 60 degree angle
    b. 70 degree angle
    c. 80 degree angle
    d. 90 degree angle
18. The first commercially available air polishing device was introduced in which one of the following years?
    a. 1920
    b. 1945
    c. 1957
    d. 1962
19. Which one of the air polishing powders has a primary particle that is an active bioglass?
    a. Glycine
    b. Calcium carbonate
    c. Aluminum trihydroxide
    d. Calcium sodium phosphosilicate
20. Which one of the following air polishing powders was professionally available as the first alternative to specially processed sodium bicarbonate air polishing powder?
    a. Glycine
    b. Calcium carbonate
    c. Aluminum trihydroxide
    d. Calcium sodium phosphosilicate
21. Traditional polishing removes dental stain and plaque by which one of the following actions?
    a. Attrition
    b. Erosion
    c. Chemical dissolution
    d. Abrasion
22. Which one of the following surfaces should not be treated with air polishing, regardless of the type of air polishing powder?
    a. Composite restorations
    b. Dental implants
    c. Porcelain
    d. Enamel
23. Prior to powered polishing devices professional tooth polishing was accomplished with which one of the following?
    a. Over-the-counter sodium bicarbonate
    b. Porte polisher
    c. Toothpaste
    d. Belt drive slow-speed handpiece
24. According to results of research, which one of the following statements about air polishing with specially processed sodium bicarbonate is true?
    a. It is used as a method of choice for polishing orthodontically banded and bracketed teeth.
    b. The use of air polishing improves the uptake of sodium fluoride.
    c. Air polishing is a method of choice for teeth affected with exposed dentin.
    d. Air polishing is contraindicated for polishing dental implants.
25. Identify which one of the following conditions that is not a contraindication for the use of air polishing.
    a. End-stage renal disease
    b. Cushing's Disease
    c. Addison's Disease
    d. Type II Diabetes
26. Based on research findings, which one of the following statements about the use of specially processed sodium bicarbonate is true?
    a. The use of special processed sodium bicarbonate can cause elevated blood pressure.
    b. The use of specially processed sodium bicarbonate should only be used on heavily stained enamel.
    c. The use of specially processed sodium bicarbonate will not elevate blood levels of sodium.
    d. The use of special processed sodium bicarbonate can cause alkalosis of circulating blood.
27. Any soft tissue trauma that is incidental to the use of air polishing will usually dissipate and heal within approximately which one of the following amounts of time?
    a. 72 hours
    b. 48 hours
    c. 24 hours
    d. 8 hours
28. Which one of the following medications is typically prescribed for patients who have facial emphysema?
    a. steroids
    b. antibiotics
    c. diuretics
    d. anti-emetics
29. Air polishing can remove which of the following amounts of bacteria and bacterial endotoxins?
    a. 25%
    b. 50%
    c. 75%
    d. 100%
30. The following is a list of air polishing powders and their Mohs hardness scale number. Which one of the air polishing powders is listed with the wrong Mohs hardness scale number?
    a. Specially processed sodium bicarbonate; Mohs hardness scale 2.5-3.0
    b. Aluminum trihydroxide; Mohs hardness scale number 4.0
    c. Calcium sodium phosphosilicate: Mohs hardness scale 8.0
    d. Calcium carbonate: Mohs hardness scale 3

ANSWER SHEET

Air Polishing: A Mainstay For Dental Hygiene

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Educational Objectives

1. Identify the origins of air polishing.
2. Compare and contrast the advantages of air polishing.
3. Describe the symptoms of facial emphysema and identify the method for treatment.
4. Identify the clinical techniques that can be used to best control the inherent aerosol spray produced during air polishing

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1. Were the individual course objectives met? Objective #1: Yes No Objective #3: Yes No
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Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

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7. Was the overall administration of the course effective?	5	4	3	2	1	0
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4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		19.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		21.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		22.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		23.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		24.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		25.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		26.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		27.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		28.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		29.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
15.	Ⓐ	Ⓑ	Ⓒ	Ⓓ		30.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

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