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Air Polishing–An Overview

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Review Article

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Abstract: Periodontitis requires thorough removal of the bacterial biofilm during the initial therapy and maintenance phase. However, debridement using hand instruments or oscillating scalers is both technically demanding and time consuming, and may lead to severe root damage over time. Air polishing has emerged as one of the safe and effective in the removal of subgingival oral biofilm in moderate to deep periodontal pockets without compromising the host's tissues as well as implants. It works on the principle of propulsion of abrasive particles through a mixture of compressed air and water through a handpiece nozzle. Initially air polishing was used for tooth surface polishing and supragingival biofilm removal, recently with the development in air abrasive powders it is widely used in subgingival surfaces. The focus of this review article is to compare the efficacy of air polishing over traditional methods during maintenance phase.
Keywords: Air polishing, glycine, erythritol, maintenance phase, implants.

INRODUCTION

Periodontitis is a chronic bacterial infectious disease. Plaque control is the most essential element of successful periodontal therapy. Curette, ultrasonic scalers has been traditionally used for the debridement as well as for maintenance therapy. Repeated instrumentation may cause gingival recession and loss of tooth substance, which ultimately reduce patient compliance towards dental treatment. Treatment modalities, which are less harmul and effective in removing biofilm with minimal abrasion on the root surface, would be preferable during SPT [1].

Air polishing has emerged as one of the safe and effective in the removal of subgingival oral biofilm in moderate to deep periodontal pockets without compromising the host's tissues as well as implants[2]. Dr. Robert Black in 1976 introduced first air polishing based on technology of cavity preparation using a highly abrasive powder. Initially, it was used for supragingival stain and biofilm removal. Like many things in dentistry, air polishing has changed since the late 1970s[3]. There are several new air polisher designs and new abrasive powder, and led its use subgingivally.

Mechanism of biofilm removal

The propulsion of abrasive particles through a mixture of compressed air and water through a handpiece nozzle accomplishes air-powder polishing. Air pressure settings and water/powder ratios vary between models. These settings determine the kinetic energy of the abrasive particles. The more kinetic energy, the more effect the particles will exert on the surface they contact[4].

POWDERS USED IN AIR POLISHING

Sodium bicarbonate

Sodium bicarbonate (NaHCO3) were the first powders to be used in air polishing technology, and now consider as Gold standard for comparing other air polishing powder. 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. Sodium bicarbonate was effective for supragingival plaque and stain purpose. However, it was contraindicated for subgingival application, because of its high abrasive quality. Sodium bicarbonate is the material of choice for implant surface decontamination, by directing it away from subgingival surface [3].

Aluminum triydroxide

Aluminum trihydroxide is an alternative air polishing powder for patients on sodium-restricted diets [5]. Aluminum trihydroxide particles are harder but comparable in size to sodium bicarbonate. Aluminum trihydroxide powder is safe for enamel; however, it is contraindicted on other tooth structures, and its use should be avoided on all dental materials.

Recently several new types of air polishing powders have been introduced that include glycine, calcium carbonate, and calcium sodium phosphosilicate and erythritol.

Emerging air polishing powder

Glycine

Glycine is water soluble, naturally sweet taste and biocompatible. Glycine is more gentle on gingival tissue and significantly less abrasive on root structure than traditional air powders. Glycine is ideal for subgingival root surfaces because of its physical properties and particle size. Glycine's deplaquing ability combined with its gentleness makes it an excellent choice for use on orthodontic patients[6].

Erythritol

Erythritol, a noncariogenic sugar alcohol used as a sweetener, is effective in subgingival biofilm removal. Its small particle size (14 μm) is similar to the smaller glycine particles and may limit soft tissue and root damage. Erythritol has a finer grain size and may, therefore, be even more tissue friendly[1]. Erythritol also exerts negative effects on mutans streptococci. It can help reduce periodontal pockets greater than 4 mm when it is mixed with 0.3% chlorhexidine.[14]Erythritol is not available in the United States yet, more research is in progress on this potentially promising new air polishing powder.

Air polishing delivery system and application

There are two basic types of air polishing delivery systems. The self-contained air polishing unit,joins to the compressed air and water lines of the dental unit and requires an electric outlet. An alternative handpiece with dental unit which uses compressed air and water from the handpiece lines. The self unit has a water pressure range of 10-50 whereas dental unit pressure is 60 psi. Angulations varies from 60 degrees to 80 degrees from anterior to posterior teeth. Amid subgingival debridement, the tip is guided at a 90-degree point to the long axis of the root for 5 second with a specific end goal to achieve biofilm removal. The key to control the aerosol spray is the use of the recommended undulations, as well as the use of high-speed evacuation with the exposure time approximately 5 seconds or less on each tooth[7].

Air polishing - clinical use in periodontal maintenance

Today, utilization of air polishing device has been extended from supragingival, using sodium bicarbonate powders, to subgingival air polishing[l]. A capable yet controlled flow of water, air, and fine powder not just cleans all the surfaces of a tooth, plaque, stain, yet additionally reaches deep in periodontal pockets up to 5 mm. The air-powder polisher can evacuate subgingival microorganisms through the Venturi effect by placing tip at a 90-degree to the interproximal spaces with the goal that a vacuum is made that concentrates tissue liquids, including subgingival microscopic organisms from the subgingival space[8]. Air flow polishing is ideal for those who suffer from sensitive teeth. Studies have demonstrated that air polishing is more than three times quicker at expelling stains and plaque than customary techniques. This implies less chair side time and thus less invasive.

Air polishing versus mechanical debridement during maintenance phase

Periodontal maintenance therapy, play a vital part in controlling periodontal disease and prevent further progression. However, as the pocket depth increases, the efficiency of plaque elimination may decrease. Dragoo and Clifford et al. surveyed traditional and 'microultrasonic' scaling tips, regarding their ability to accomplish the most apical extension of the periodontal pockets and results were contradictory. Dragoo reported that only a few of the instruments reached the most apical depth of the pocket. In contrast, Clifford et al. reported that both types of scaling tips could reach and debride dental plaque in pockets with depths of 4-6 mm and 7 mm. These ultrasonic and hand instruments when utilized after phase I completion, may have the undesirable impact. They may cause cause gingival recession and dentintal hypersensitivity if not used judiciously[9,10]. Various study supports the efficacy of subgingival air polishing, demonstrates an equitable reduction in the periodontal pathogens and probing pocket depths. Along with that it has a more docile effect on the soft tissues and causes less gingival recession as compared to ultrasonic scaling[11,12]. Wennstrom JL in a study designed to determine the clinical and microbiological effects, as well as perceived treatment discomfort of root debridement by subgingival air polishing compared with ultrasonic instrumentation during supportive periodontal therapy[13]. Perceived treatment discomfort was lower for air polishing than ultrasonic debridement with the similar reduction in bleeding in probing and probing pocket depth. Flemmig reported significant efficacy in removing subgingival biofilm in shallow as well as deep pockets with low abrasive glycine powder[14,15]. Systematic review by Buhler 2015 glycine powder seems to result in less gingival trauma and fewer surface modifications on dentine compared to sodium bicarbonate and conventional therapy with curettes and ultrasonic devices[16]. Glycine powder air polishing has proven results and considered as safe with no adverse events reported, and was perceived to be more acceptable to patients. In addition, it was more time efficient, but on a microbiological level, it was not superior to the conventional blended instrumental approach (curette /ultrasonic instrumentation)[17].

Effect of air polishing on implants

Plaque biofilm is the most important causative agents for the peri-implant mucositis and peri-implantitis around implant surfaces. Periimplant

mucositis accounts for 80% and periimplantitis 56% around implants. Preventive and therapeutic treatment involves complete removal of plaque biofilm either through traditional plastic curettes or with subgingival air polishing using glycine. Plaque biofilm is difficult to completely remove due to its structure, subgingival air polishing gives a promising option for removal of plaque around an implant. Previous studies found air polishing to be effective on implant surfaces, gives smooth surfaces and also inhibits plaque formation and its colonization[18]. Study evaluating peri-implantits in patient using glycine powder or carbon curette debridement and Chlorhexidine therapy, shows comparable results at the end of 6 months. Also, bleeding reduce significantly with air polishing than mechanical debridement[19]. Treatment of periimplantitis using Er:YAG laser versus an air polishing using glycine powder found comparable results after 6 months[20]. However, recent systematic analysis has pointed to an improved efficacy of glycine powder air polishing in reducing BOP scores over ultrasonic scaling in mild to moderate peri-implantitis[21].

Safety measures

As like other devices, air polishing has advantages and disadvantages that we need to assess as well as patient medical history before taking a decision. Standard infection control procedure should be employed when using air polishing, including the use of protective eyewear for the patients. Additionally, high volume evacuation should be used whenever possible, which prevents both operator and patient from aerosols[18]. Air polishing should be used with caution in patients who have difficulty breathing or swallowing The air polishing should never be used near surgical wound area or area with periodontal pocket with extensive bone loss as it may have risk of facial emphysema[22]. Flemmig discussed findings from Health Device Alerts that found, between 1977 and 2001, there were a total of 9 air emphysema and 3 air embolism incidents related to the use of Air polishing devices. Out of that three cases have been reported of air-emphysema following the use of glycine powder air-polishing, all of which resolved without further problems within 1–5 days. Out of that three cases have been reported of air-emphysema following the use of glycine powder air-polishing, all of which resolved without further problems within 1–5 days[23]. Gutmann suggested following universal precautions, using high volume evacuation instead of a saliva ejector and rinsing with an antimicrobial mouthwash before treatment to prevent any potential health risks[24].

Different literature contraindicates sodium bicarbonate contained air polishing in the condition like, hypertension, respiratory disorder, renal insufficiency, Addison's disease, metabolic alkalosis or patients taking medication like potassium, anti-diuretics or corticosteroids. Despite these contraindications, limited information has been published on the systemic effect of sodium bicarbonate from air polishing powders [24].

CONCLUSION

Subgingival debridement is considered essential in treating periodontitis and has been shown to be pivotal in arresting disease progression. Biofilm formation occurs rapidly in periodontal pockets following instrumentation, and re-establishment of pathogenic microbial flora occurs after a few months following treatment, indicating frequent maintenance is required. Regular and repeated debridement of root surfaces with hand instruments and or sonic/ultrasonic instruments has been shown to lead to root surface loss over time. Plaque removal on enamel surfaces can be accomplished effectively with air-polishing devices with little or no abrasive effects. However, this method is not indicated for root surfaces, because conventional air-polishing powders (NaCOH3) are highly abrasive to root dentine and cementum. When repeatedly performed during maintenance therapy, this cleaning method's cumulative effect may become clinically significant. The advent of a new glycine-based powder for use with air-polishing devices has been shown to be suitable for root surface debridement, causing little or no surface loss, tissue trauma or patient discomfort. Reduction in pathogenic microbial-colony-forming units is greater than with hand instrumentation and is achieved in less time, with less operator fatigue and with greater patient comfort and compliance. 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.

REFERENCES

1. Muller N, Moene R, Cancela JA, Mombelli A. Subgingival air-polishing with erythritol during periodontal maintenance. J Clin Periodontol 2014; 41: 883–889.
2. K Sayantan, G K Deepa , Subgingival Airpolishing: A Simple and Cost Effective Medical Insurance J. Pharm. Sci. & Res. Vol. 9(2), 2017, 199-201
3. Gutmann ME. Air polishing: a comprehensive review of the literature. J Dent Hyg. 1998;72(3):47–56.
4. Pelka M, Trautmann S, Petschelt A, Lohbauer U. Influence of air-polishing devices and abrasives on root dentin-an in vitro confocal laser scanning microscope study. Quintessence Int. 2010;41:e141–148.
5. Johnson WW, Barnes CM, Covey DA, Walker MP, Ross JA. The effects of a commercial aluminum

airpolishing powder on dental restorative materials. Journal of Prosthodontics. 2004 Sep 1;13(3):166-72.
6. Petersilka GJ, Bell M, Häberlein I, Mehl A, Hickel R, Flemmig TF. In vitro evaluation of novel low abrasive air polishing powders. *J Clin Periodontol*. 2003;30:9–13.
7. Horning G. Clinical use of an air-powder abrasive. *Compend Contin Ed Dent*. 1987;8:652-658.
8. Gutmann ME. Air polishing: a comprehensive review of the literature. Journal of dental Hygiene. 1998;72:47-56.
9. Dragoo MR. A clinical evaluation of hand and ultrasonic instruments on subgingivaldebridement. 1. With unmodified and modified ultrasonic inserts. Int J Periodontics Restorative Dent 1992; 12: 310–323.
10. Clifford LR, Needleman IG and Chan YK. Comparison of periodontal pocket penetrationby conventional and microultrasonic inserts. J Clin Periodontol 1999; 26: 124–130.
11. Schwarz F, Ferrari D, Popovski K, Hartig B, Becker J. Influence of different air-abrasive powders on cell viability at biologically contaminated titanium dental implants surfaces. Journal of Biomedical Materials Research Part B: Applied Biomaterials. 2009 Jan 1;88(1):83-918.
12. Simon CJ, Munivenkatappa Lakshmaiah Venkatesh P, Chickanna R. Efficacy of glycine powder air polishing in comparison with sodium bicarbonate air polishing and ultrasonic scaling–a double-blind clinico-histopathologic study. International journal of dental hygiene. 2015 Aug 1;13(3):177-83.
13. Wennström JL, Dahlén G, Ramberg P. Subgingival debridement of periodontal pockets by air polishing in comparison with ultrasonic instrumentation during maintenance therapy. Journal of clinical periodontology. 2011 Sep 1;38(9):820-7.
14. Flemmig TF, Hetzel M, Topoll H, Gerss J, Haeberlein I, Petersilka G. Subgingival debridement efficacy of glycine powder air polishing. Journal of periodontology. 2007 Jun 1;78(6):1002-10.
15. Flemmig TF, Arushanov D, Daubert D, Rothen M, Mueller G, Leroux BG. Randomized Controlled Trial Assessing Efficacy and Safety of Glycine Powder Air Polishing in Moderate-to-Deep Periodontal Pockets. Journal of periodontology. 2012 Apr 1;83(4):444-52
16. Bühler J, Amato M, Weiger R, Walter C. A systematic review on the effects of air polishing devices on oral tissues. International journal of dental hygiene. 2016 Feb 1;14(1):15-28. Bühler J, Amato M, Weiger R, Walter C. A systematic review on the effects of air polishing devices on oral tissues. International journal of dental hygiene. 2016 Feb 1;14(1):15-28.
17. Moëne R, Décaillet F, Anderson E, Mombelli A., Subgingival plaque removal using a new air-polishing device. J Periodontol 2010 Jan; 81: 79-88.
18. Air polishing :A mainstay for dental hygiene,Carles M. Barnes,april 2013.
19. John G, Sahm N, Becker J, Schwarz F. Nonsurgical treatment of peri-implantitis using an air-abrasive device or mechanical debridement and local application of chlorhexidine. Twelve-month follow-up of a prospective, randomized, controlled clinical study. Clinical oral investigations. 2015 Nov 1;19(8):1807-14.
20. Renvert S, Lindahl C, Roos Jansåker AM, Persson GR. Treatment of peri-implantitis using an Er: YAG laser or an air-abrasive device: a randomized clinical trial. Journal of clinical periodontology. 2011 Jan 1;38(1):65-73.
21. Schwarz F, Becker K, Renvert S. Efficacy of air polishing for the non-surgical treatment of peri-implant diseases: a systematic review. Journal of clinical periodontology. 2015 Oct 1;42(10):951-9.
22. Rawson RD, Nelson BN, Jewell BD, Jewell CC. Alkalosis as a potential complication of air polishing systems. A pilot study. Dental hygiene. 1985 Nov;59(11):500.
23. Petersilka GJ. Subgingival air-polishing in the treatment of periodontal biofilm infections. Periodontology 2000. 2011 Feb 1;55(1):124-42.
24. Gutmann ME. Air polishing: a comprehensive review 1. of the literature. J Dent Hyg. 1998;72(3):47–56.