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Subgingival Airpolishing: A Simple and Cost Effective Medical Insurance

Sayantan Karmakar[1], Deepa G Kamath[2]

[1]Post Graduate Student , [2]Professor and Head

Department of Periodontology, Manipal College of Dental Sciences, Manipal University

Mangalore, Karnataka - 575001

Abstract

The treatment of periodontitis necessitates thorough removal of bacterial biofilm during the initial therapy andperiodontal maintenance phase. However debridement using hand instruments and/ or oscillating scalers is both technically demanding, time consuming, may lead to severe root damage over time and also may cause ulceration of the oral gingival epithelium which allows oral biofilm microbiota to reach the blood stream.Subgingival air polishing has been introduced as a novel approach to removal of biofilm as it causes minimal trauma to the hard and soft tissues. Light micrography studies have shown that with some air polishing powders there is discernible erosion of the oral gingival epithelium with exposure of underlying connective tissue. This inflammation along with the concentrated aerosol micro-environment of the gingival sulcus causes systemic dissemination of the oral biofilm microbiota. Recent developments in subgingival air polishing powders have improved upon their previous drawbacks as with causing no epithelial damage in addition to being antiinflammatory,immunomodualatory and cytoprotective. The introduction of new aerosol reduction devices have resulted in the generation of significantly fewer mean quantity of colony forming units which becomes pertinent in the present scenario of rising cases of peri-implant diseases. The focus of this review article is to discuss the significance of subgingival air polishing as a simple and cost effective medical insurance.

Keywords: biofilm, glycine, periodontal disease

INTRODUCTION

The Glossary of Periodontal Terms (2001, 4th edition) defines periodontitis as "inflammation of the supporting tissues of teeth". This inflammation is a sequelae of accumulation of supragingival as well as subgingival plaque which is a type of pathogenic biofilm[1]. The biofilm is composed of several colonies of microorganisms.

Accumulation of subgingival biofilm can cause peri-implant mucositis as well as peri-implantitis. Oral biofilm can also lead to secondary systemic effects. This can occur through 3 mechanisms: (1) bacteria can spread metastatically, (2) microbes release toxins which enter the circulation and cause metastatic injury and (3) microbes induce immunologic damage which results in metastatic inflammation[2].

Thus the control as well as the removal of oral biofilm is essential in preventing periodontal disease and the systemic implications.

Mechanical removal of subgingival plaque is one of the most important treatment modality of periodontitis[3]. Gracey curettes have been traditionally used for its removal. But it is technically demanding and time consuming. Moreover overzealous instrumentation can lead to cementum removal which in turn results in sensitivity and root caries. The usage of ultrasonic instruments requires less dexterity and is less time consuming. With this patients usually complain of discomfort which reduces their compliance. Thus instrumentation techniques have to be employed which can remove subgingival biofilm safely as well as in an easy manner[4].

Air polishing devices have proven themselves to be 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 around the implants[5,6,7,8,]. They cause a shift in the microbiota with an increase in beneficial species and a decrease in pathogenic microbiota.

MODE OF BIOFILM REMOVAL BY AIRPOLISHING[9]

Abrasion is the mechanism of action by which airpolishing powders remove biofilm.

Water is a very important component involved in the removal of biofilm. It functions as:

1. A carrier for the abrasive particles
2. An accelerator medium
3. Enhances removal of substances by removing embedded as well as loose particles.
4. The kinetic energy of the water jet fragments the particles thus reducing their size and ultimately improves the efficacy of biofilm removal.

Factors which determine the efficacy of airpolishing:

- *Hydropneumatic factors:*
  - Amount of water: water helps in removal of the embedded abrasive fragments and loose particles. The force of water fragments the impacting particles.
  - Air pressure: greater pressure results in greater effectiveness of airpolishing.
- *Clinician factors:*
  - Standoff distance between surface and nozzle: as the distance from the nozzle to the tooth surface increases, the velocity of the water jet declines leading to reduction of the defects caused due to instrumentation.

- Angulation of central beam: although angulation determines the energy transfer
- Instrumentation time: more the instrumentation time better is the airpolishing.
- Type of surface treated

- *Material factors*
  - Emitted powder mass
  - Grain size, shape and hardness
  - Cutting
  - Fatigue
  - Brittle fracture

Different powders for air polishing[10]

Sodium bicarbonate–based powders (NaHCO3) were the primary powders used in air polishing. NaHCO3 powders are prepared to form a powder with a molecule size of up to 250 μm. The safety and viability of the supragingival utilization of NaHCO3 when contrasted with conventional scaling and rubber–cup polishing have been affirmed. No damage to enamel has yet been reported. It has the limitation that it cannot be used over a prolonged period of time on cementum, dentin and certain restorative materials like composite[11].

Calcium carbonate (CaCO3) is available as uniform round shaped crystals. It is believed that usage of these spherical crystals will effectively reduce abrasion as compared to the non-uniform particles in other powders. The particle size of the CaCO3 powder is less than NaHCO3, but similar to that of glycine. In comparison to sodium bicarbonate, calcium carbonate has a greater efficacy and is highly effective in removing stains, but it has been observed that it produces greater defects in root dentin[12]. Still more trials need to be conducted to determine the effectiveness as well as abrasiveness of CaCO3.

Glycine powder air polishing

Historically, use of air polishing has been limited to supragingival surfaces. However, in recent years, in vivo studies have demonstrated the effectiveness of glycine powder in supragingival and subgingival applications. Petersilka et al[13] compared the use of hand instruments and air polishing with glycine powder for subgingival plaque removal and indicated that glycine powder was superior to hand instruments in the removal of subgingival plaque in periodontal pockets of 3 to 5 mm.8 A pronounced reduction in mean colony–forming units (CFUs) of bacteria following its use was attributed to the combination of air, pressurized water and the mildly abrasive powder, with the powder itself being the most important factor in bacterial reduction.

Glycine has been introduced as an air-polishing powder as it has been seen that it efficiently removes subgingival biofilm with minute harm to cementum, root dentin as well as soft tissues.

Glycine is scentless, has no colour and is exceedingly water dissolvable. It has low poisonous quality and doesn't have any allergic properties. Glycine has got a light, sweet taste. Glycine has a mitigating, immunomodulatory and cytoprotective effect in various therapeutic approaches. Glycine suppresses calcium signaling and inhibits inflammatory cell activation thus ultimately decreasing the formation of free radicals[14]. It has been observed that glycine is extremely appropriate for utilization within the oral cavity.

The low-abrasiveness of glycine powder is utilized as a part of monetarily accessible air-cleaning gadgets. It is created by processing glycine precious stones in an agate plate processor. Utilizing sifters, a powder blend with an average molecule size of under 45 μm and a greatest molecule size of 60 μm is acquired. Hence, the glycine powder molecule size is around four times smaller than that of ordinary sodium bicarbonate powder. Exceptionally scattered silicic acids or mist concentrates with a normal molecule size of roughly 0.07 μm, are added from 0.001 to 5.0% by weight to enhance the powder's capacity to stream furthermore to avert obstructing of the air-cleaning gadget unit.

Clinical application

The central beam of the glycine powder air-polishing slurry is to be directed parallel to the root surface to be dealt with. A constant sweeping maneveour of the air-polishing gadget spout should be carried out. An approximate time of 5–10 s is needed to satisfactorily debride one site of a periodontal pocket. In this manner a rough instrumentation time of 20-40 s is required for a solitary tooth bringing about a general cleaning time of around 15–20 min to expel biofilm in a complete dentition with pockets up to 5 mm. Conventional polishing need not be carried out when air-polishing is used for cleaning[9]

Air polishing and Oral implants

Peri-implant contaminations portray an expanding center in dental implantology[15]. The demographic change also upgrades this issue. The predominance of peri-implant mucositis is around 80 % in the implant locales and in around 50 % in patients, while peri-implantitis happens in up to 56 % in the implant destinations and 43 % in patients. With no effective treatment, peri-implantitis can prompt embed loss[16]. The primary component for foundation of peri-implant contaminations is the arrangement and development of bacterial biofilm.

The assigned focus of treatment for peri-implant infection is the expulsion of the bacterial biofilm and the cleansing of the surface of the implant[17.] Due to unique condition of the surfaces and structures, it is harder to expel bacterial biofilms from the surface of the implant than from teeth. Particularly since the threads of the screw and the microroughness of the intraosseous piece of present day dental inserts exasperate the biofilm evacuation. Plastic curettes are anything but difficult to handle yet can't achieve the large scale and smaller scale porosity of these embed surfaces. This is the explanation behind the incapability of these instruments bringing about higher remaining plaque regions post treatment. The utilization of air-abrasive device (AAD) is a successful therapeutic option for just the expulsion of biofilm from surfaces of the implant[18,19] .

Air polishing in maintenance phase

Customarily curettes and/or ultrasonic tips are used to expel calcified and non-calcified bacterial stores. Undesirable impacts of these repeated kind of acts of instrumentation may cumulate over a period of time. They include receding of the gingival margin and loss of tooth structure. Methods less ruinous than instrumentation with steel instruments may be more reasonable as subgingival bacterial stores are not able to mineralize between two visits to form hard calculus. Bacterial stores can likewise be evacuated via "air-polishing", an innovation to perfect or clean a surface with a jet of compacted air containing an abrasive powder[7]. Utilizing a low abrasive operator and a spout that can be brought into a periodontal pocket, it is conceivable to expel subgingival biofilm from root surfaces in lingering pockets. The security, quiet acknowledgment and short-term (7 days) microbiological impacts of this technique were assessed in 50 patients with remaining pockets >4 mm profound, by testing a recently planned spout that permitted the projection of the air powder onto the root surface, and glycine powder with a grain size of 20 μm as the agent[6]. The outcomes showed that this methodology was protected, more satisfactory and additional time effective than SRP.

Adverse effects of glycine powder airpolishing.

3 cases of air-emphysema have been recorded since 2009. Within 1-5 days all of them resolved without any further complications. In the impossible occasion of air emphysema happening as an aftereffect of air-cleaning with glycine powder, therapy ought to be directed towards the seriousness of the side effects. A sudden swelling in the dento-facial region is a symptom of air-emphysema which has to be perceived by the clinician as well as the patient. The diagnosis is confirmed when there is crepitation. Treatment ought to be stopped and the patient educated that an unforeseen, however much of the time non genuine, reaction of the treatment has happened. In the event that the patient is feeling alright and is generally sound, it might be wise to plan the patient for the following day in light of the fact that a large portion of the reported air-cleaning gadget prompted emphysema resolve without inconveniences inside 1–3 days. It is essential to explain to the patients suffering from emphysema to look for medical help quickly in the event that they encounter any issues with gulping, thoracic agony, dyspnoea or any unsettling influence of vision or hearing[21].

CONCLUSION

Biofilm expulsion in the treatment of periodontitis is enabled with glycine powder which has a very low abrasive property. This novel strategy might be utilized for plaque evacuation of periodontal pocket with depth upto 5mm in supportive periodontal therapy. Curettes and/or ultrasonic instrumentation are used to remove tartar. Air polishing with glycine powder for the removal of biofilm in the treatment of periodontal and peri-implant disease is affirmed by clinical, microbiological & histological studies.The utilization of glycine powder for air-polishing to expel dental biofilm can be considered an extraordinary expansion in the war against microbes in the practice of periodontology.

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