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Kinetic Cavity Preparation: Patient - Friendly Technique: A Literature Review.

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ABSTRACT

Air abrasion as a caries removal technique is less aggressive than conventional techniques and is compatible for use with adhesive restorative materials. Alumina, while being currently the most common abrasive used for cutting, has controversial health and safety issues and no remineralisation properties. Intraoral air abrasion is a technique in which abrasive particles are used to remove or alter tooth structure. Intraoral air-abrasion devices are available as standalone units that offer a variety of customization, such as modifications to air pressure, particle flow rate, and water flow rate, or as attachments to a dental unit, allowing for a smaller footprint in the operatory. Clinical applications for intraoral air abrasion in restorative dentistry include cavity preparation, cleaning of preparations, and removal of plaque and stain prior to restoring a tooth.

Keywords: Air Abrasion, Conservative technique, Non -invasive, patient friendly

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INTRODUCTION

Dental caries is a major public health problem . It is one of the most wide spread diseases in the civilized population[1,2] .Thus Dental caries is defined as an irreversible microbial disease of the calcified tissues of the teeth, characterized by demineralization of the inorganic portion and destruction of the organic substance of the tooth, which regularly leads to cavitation[3].

Major patient reluctance in soliciting caries treatment considered in fear of pain, dental anesthesia, and noise generated by rotary instruments, especially high-speed handpiece[4]. As a reason of which dental specialist are more towards the non invasive procedure for preparing the cavity preparation. It consists of the drill-less technique used to remove decay and also used in other dental application[5].

Minimally invasive dentistry is nothing but adopts to a philosophy that indegrates anticipation , remineralisation and minimal intervention for the placement and substitution of restoration. It reaches the treatment objective using the least invasive surgical approach , with the removal of the minimal amount of healthy tissue[6].Towards non-invasive procedure one such unique technique is termed as Micro Abrasion or Kinetic cavity preparation[7].

Air abrasion is another miniature dentistry procedure that is utilized to treat toothdecay and prepare tooth for restoration, it additionally diminishes the risk of fracturing and chipping of the tooth. As caries removal technique, air abrasion refers to a non-rotary method of abrading a surface using a stream of high speed abrasive particles generated from compressed air[8].

Air abrasion was first described by Black (1945). The principles behind this technique is minimal invasion and tissue preserving. It generates no heat, pressure, or vibration and sometimes also reduced the need for anesthesia if the cavity is shallow[9]. This procedure is relatively simple than other conservative methods. Having this in mind the present article will review principles of air abrasion, how it works and its application with optional accessories of air abrasion system in dentistry.

Principle

The principle behind air abrasion is based on the kinetic energy for the expulsion of caries via air pressure at high speed and the alumina particles abrade the surface when they strike it with no significant heat or noise production. The primary action of air abrasion is end cutting. So, the access has smaller diameter but the cavities produced are deep[10].

Formula for kinetic energy:

$$E = 1/2 MV^2 \text{ where } M = \text{mass}; V = \text{Velocity.}$$

Essentially this equation underscores the fact that the cutting capability of air abrasive is attributable to the energy of mass in motion unlike conventional mechanical method that depends on friction. Rotary instrumentation is a form of mechanical energy and air abrasion is a form of kinetic energy [11].

ABRASIVE PARTICLES

Alumina oxide which is ordinarily utilized for cutting tooth structure is sharp, irregular particles with moderately minimal cost. Alpha alumina is one of the pure biocompatible alumina particle, has been used as one of the prime ingredient in majority of the tooth brightening pastes is also a well known ingredient that has been used in medication and food for years.

On further examination polycarbonate resin alumina hydroxyapatite mixture is used as an alternative abrasive mixture [12].

BASIC CHARACTERISTICS OF AIR ABRASION [13]:

CHARACTERISTICS	NORMAL	SUGGESTED
1.Range	40-160psi	100psi-cutting 80psi for surface etching.
2.Particle size	27 or 50um in width	More than 27um for bigger estimated cavity preparation
3.Operating distance	0.5-2mm	Further separations will produce more diffuse stream that results in a reduced cutting capacity
4.Width angulation	Permit easy placement and direction of the hand piece subsequently dialing the strain down the operators hands	
5.Nozzle measurement	Smaller nozzle measurements can be utilized for zones that are hard to get	
6.Particle flow rate	Higher particle flow rate will permit more particles to abrade the working surface quicker	
7.Speed	Depends on the gas pressure, nozzle diameter, particle size, and distance from the surface	

MECHANISM OF AIR ABRASION DEVICE:

Air abrasion for restoration preparation evacuates tooth structure utilizing a stream of aluminum oxide particles created from compressed air or packaged carbon dioxide or nitrogen gas. The abrasive particles hit the tooth with high speed and evacuate small quantities of tooth structure.



Fig.1 [14]

During air abrasion, an instrument that works like a smaller than normal sandblaster is utilized to spar away decay. During air abrasion, a fine stream of particles is focused on the stained or decayed portion of the tooth. These particles are made of silica, aluminum oxide, or a baking soda mixture and are moved toward the tooth surface by packed air or a gas that goes through the dental hand piece. Small particles of decayed tooth surface are expelled as the flood of particles strikes them. The particles of decayed tooth are then "suctioned" away through a thin tube[5].

Efficiency of air abrasion depends on various parameters, for example, the measure of air abrasion, particle size, amount of particles going through the nozzle, nozzle width of the hand piece, angulation of nozzle of the hand piece, distance from the object, and time of exposure to the object vary the amount of tooth evacuation and removal of depth of penetration[8]

APPLICATION OF AIR ABRASION

Specific signs for utilization of air abrasion incorporates caries evacuation; expulsion of small existing restorations; preparation of tooth structure for cutting or etching for the placement of composites, porcelain and ceramics; and as an aid to the conventional handpiece bur.

Methods of clinical use in certain circumstances where the air abrasion has especially proved a boon to include:

IN CARIES REMOVAL:

- Expulsion of superficial enamel defects – these are much simpler with the air abrasives since they bring about evacuation of less tooth structure than the drill[15].
- Air abrasion gives the rough surface which is adequate for the adhesion of restorative material in case of dental abrasion, erosion and abfraction and leaves a shiny surface layer which is inappropriate for good adhesion[16].
- When the caries is limited distinctly to a small area of the tooth can likewise be prepared utilizing air abrasives for protection of sound tooth structure. Box-preparations for Class II cavities can likewise be prepared.
- The utilization of local anesthesia while working in dentin might be avoided because of their cooling activity through high pressure air[17].

EXPULSION OF EXISTING RESTORATIONS

- The particles of the air abrasives can be utilized at higher pressure for evacuation and repair of composites, Glass Ionomers, and porcelain restorations but not metallic restorations such as silver amalgam restorations

IN PIT AND FISSURES:

- Air abrasion is a fantastic apparatus for the treatment of pit and fissure caries that can be utilized to eliminate the organic debris. Utilization of burs for this procedure would eliminate unquestionably more sound enamel than the couple of micrometers eliminated with air abrasion[18].

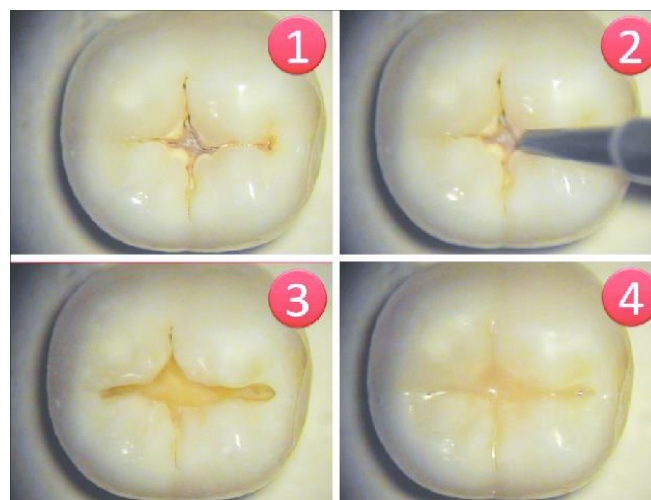


Fig.2 [8]

- In case of the operator not finding any carious lesion, the zone can be filled with pit and fissure sealant. In the event that caries is limited to enamel, at that point the area can be sealed with flowable resin based composite.
- In the event where caries penetrating to dentin, at that point the preventive restoration can be utilized with a heavy filled resin in deep or wide areas exposed to force of mastication. Sealant material might be utilized to cover non-carious pit and fissures. Furthermore, caries detector dyes may likewise be utilized related to air abrasives to detect incipient lesion and treat them appropriately[19].
- Air abrasion can likewise be utilized for the evacuation of pit and fissure surface stain on enamel before placement of resin based composite restoration or porcelain veneers.

IN STAIN REMOVAL



Fig.3 [20]

Stain evacuation which is ideal for extrinsic staining (stained enamel) and generally what most of patients have. Stain evacuation can be accomplished during routine hygiene appointment where the teeth are cleaned with a ultrasonic scaler and hand instruments to eliminate plaque deposits. The teeth are then cleaned with conventional air abrasion. It will eliminate biofilm, surface stains and early calculus rapidly and tenderly. The outcomes are normally instant, leaving teeth smooth, splendid and clean[21]. Hence it removes superficial stains and tooth discolorations[14].

Advantages

1. It eliminates just the decayed tissues with negligible loss of healthy tissues.
2. It wipes out the danger of microfracture and microcrazing at the level of enamel margin[22].
3. It improves bond quality of restorative materials to enamel and dentin.
4. The technique is quick and simple in a regular dental appointments, and several incipient caries can be dealt with in the same appointment [17].
5. Air abrasion is particularly acceptable alternative for children who might fear needle, noise and vibration of standard dental drill[21].

Disadvantages

Each clinical technique conveys some disadvantage with it and same is with air abrasion procedure. They are

1. The particles utilized during air abrasion are sensitive and can't really be liberated from pain .
2. Can't be utilized to treat deep cavities.
3. Crowns, onlays and inlays can't be treated utilizing air abrasion[5].
4. It isn't suggested in subgingival caries.
5. Using disposable mouth mirror is one of the major economical drawback during cavity preparation with air abrasion.

6. High speed suction is needed to eliminate the abrasive powder that accumulates during treatment[21].

Contraindications

- Subgingival caries removal
- In case of any open wounds in oral cavity
- In patients who are suffering from respiratory condition(Asthma, Dust allergy, Chronic pulmonary disease)
- In patients who recently had extraction[24].

SCOPE OF AIR ABRASION IN FUTURE

In this unique circumstance, preparation of hard dental tissues provides an alternative, "nondrill" techniques, which offer special benefits, both for patients and dental professionals. These advances have only been possible because of consistent interdisciplinary cooperation between the field of dental and medicine, which means offering its patients the best possible and least invasive care throughout, and the field of modern technology that produces all the materials and equipment needed for this purpose [22].

This renewed enthusiasm for air abrasion is credited to its capacity to conserve the tooth structure and our ability to bond tooth-shaded restorations to enamel and dentin. Air abrasion strategies accommodate minimally invasive caries expulsion and tooth preparation. With the wide scope of bonded materials (counting flowable composite resins) which is presently accessible, smaller preparations can be reestablished successfully[26].

CONCLUSION

Air abrasion is gaining extra reputation amongst dental offices in modern dental technology. We would especially inspire you to seem to be into it! The most notable advantage of air abrasion over rotary drill is simply the fact that it's not a drill.

It is greater conservative strategy to caries treatment and concurrently provide patients much less invasive therapy who are fearful of dental drill, children, and individuals with minimal tooth decay. It is safe, easy, effective and can get you greater patients, specifically given that you will be capable to ease their pain and provide a greater comfortable experience.

REFERENCES

- [1] U.S. Department of Health and Human Services. Oral health in America: a report of the Surgeon General. [Accessed August 22, 2016].
- [2] Centers for Disease Control and Prevention. Hygiene-related diseases. [Accessed August 22, 2016].
- [3] Rajendran.R , Sivapathasundharam. Shafers Text Book of Oral pathology(2006). Edition
- [4] Freedman G , Goldstep F .Ozone Treatment of Dental Caries: A Paradigm Shift in Conservative Dentistry. Dental Tribune –Asia pacific Edition.2004; 2(6)24
- [5] Michael C.Friedman,DDS-Air abrasion :Dental care without the drill. March10(2019)
- [6] JCDR .Minimal intervention dentistry - a new frontier in clinical dentistry. Journal of Clinical and Diagnostic Research . 2014 Jul;8(7):ZE04-8.
- [7] Rangan,Vinod. Air abrasion in Dentistry. Dental Horizons (2006).
- [8] Hegde VS, Khatavkar RA J Conserv Dent.New dimension to conservative dentistry: Air abrasion.2010 Jan; 13(1):4-8.
- [9] Rinaudo, Cochran, Moore. The effect of air abrasion on shear bond strength to dentin with dental adhesives. Oper Dent 1997;22:254-59
- [10] Imran farooq,Zonera Imran,Umer Farooq.Air abrasion:Truly Minimally invasive technique.July-September 2011;1(2):105-107.
- [11] Robert Reyto. Lasers and Air-abrasion new modalities for tooth preparation.Dental clinics of North America, 2001, 45, 1, 189-213

- [12] Deepak Nayak, Gary Ignatius , Amarnath Shenoy,Shruti D.Nayak.Minimal Intervention Dentistry:Air Abrasion.March-April 2013.
- [13] Banerjee A,Thompson ID,Watson TF.Minimally Invasive Caries Removing using Bioactive Glass Air – Abrasion.J Dent 2011;39:2-7.
- [14] Bio- art microblaster.(April 20,2014)
- [15] White JM, Eakle SW. Rationale and treatment approach in minimally invasive dentistry. J Am Dent Assoc. 2000;131:18S.
- [16] Gerbo LR,Lacefield WR,Barns CM,Russell CM.Enamel roughness after air-powder polishing.Am J Dent.1993;6:96-98
- [17] Shruti M. Conservative Drill less Restoration of Teeth: A New Dimension – Air Abrasion. Mod Res Dent. 1(4).MRD.000519.2018
- [18] Laurel K , Lord W, Beck M. Kinetic Cavity Preparation Effects On Bonding To Enamel And Dentin. J Dent Res 1993;72(Special Issue):283.
- [19] Keen DS , Von Frauhofer JA , Parkins FM. Air-Abrasive “etching” :composite bond strengths. J Dent Res 1994;73:131.
- [20] Ellen Anderson. Dental Air Abrasion: What Dentists Need To Know About This New Dental Tech (March 24, 2016).
- [21] Anna Middleton. Tooth Whitening Versus Stain Removal (November 3,2017).
- [22] Albertine Leon , Luiza Ungureanu and Cristina Puscasu. Air Abrasion: Interdisciplinary Modern Technologies- Approach To Minimally Invasive Treatment of Dental Caries (November 3, 2016).
- [23] Wright G. Z., Hatibovic S-Kofman, Millenaar D.W.,Braverman I. The safety and efficacy of treatment with air abrasion technology. Int. J. Pediatr. Dent..1999;9:133 40.
- [24] Rainey JT. Air Abrasion: An Emerging Standard of Care in Conservative Operative Dentistry. Dent clin N Am. 2002;46(2):185-209.
- [25] Vasudeva, Gaurav & Salil, Pawah. (2009). Dentistry in the 21st Century: A Look into the Future. Journal of Oral Health and Community Dentistry. 3. 9-14.