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Drill-Less Dentistry(Air Abrasion)

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ABSTRACT:
Air abrasion dentistry has evolved over a period of some time from a replacement concept of an alternate means of cavity preparation to a crucial means of providing truly conservative preparation for preservation of maximal sound tooth structure.The development of bonded restorations along side air Abrasion dentistry provides truly minimal intervention dentistry.This article reviews the event of air abrasion,its clinical uses and thus the essential accessories required for its use.

KEYWORDS: Air abrasion,Aluminum oxide,conservative cavity preparation.

INTRODUCTION:

Air abrasion for restoration preparation is used to urge obviate tooth structure employing a stream of alumina particles generated from gas or bottled CO2 or nitrogen gas. The abrasive particles strike the tooth with high velocity and deduct small amounts of tooth structure[1].

Development Of Air Abrasion:

The father of concept of air abrasive microdentistry is an american dentist,Dr.J.Tim Rainey from Texas,USA.He was a student and friend lately Dr.Robert Black,who actually invented and unsuccessfully introduced first air abrasive machine within the 1950's Dr.Rainey was able to improve & combine this technology with the use of recent adhesive restorative material[2].The first instrument was developed by Dr.Robert black in 1941.In 1951-s.s.white technology introduced Airdent the first commercially available unit for preparing cavities in teeth with air abrasion.New technology for the 1990's-Air abrasion resurfaced as an exciting "new technology" that acts in synergy with evolution of adhesive dentistry,which has changed tooth preparation requirements and eliminated the need for mechanical retention[3].

It took a brief time to catch on because the materials used to complete fillings and other procedures weren't compatible with air abrasion[4]. Air abrasion itself has not changed much through the years; rather, the techniques used to perform fillings, sealants, bonding, and other procedures became more sophisticated, making them compatible with the abrasion technology[5]

Before composite fillings, amalgam fillings needed clearly defined walls and margins to fill, something air abrasion couldn't provide. the arrival of high-velocity suction made cleanup after air abrasion much easier, further boosting its feasibility.

Air abrasion:

An instrument that works kind of a mini sandblaster is used to spray away decay. During air abrasion, a fine stream of finely graded 27.5micron alumina powder is run undercompressed air through a very fine tip and thus the particles are then aimed toward the decayed portion of the toosurfaceare removed because the stream of particles strikes them. The particles of decay are then"suctioned away[5,6].

Working principle:

Air abrasion for restoration preparation removes tooth structure employing a stream of alumina particles generated from gas or bottled CO2 or nitrogen gas. The abrasive particles strike the tooth with high velocity and deduct small amounts of tooth structure[7].

Efficiency of removal is relative to the hardness of the tissue or material being removed and thus the operating parameters of the air abrasion.A number of parameters just like the quantity of air pressure , particle size, quantity of particles passing through the nozzle, nozzle diameter of the handpiece, angulation of nozzle of the handpiece, distance from object, and time of exposure to the thing vary the amount of tooth removal and depth of penetration[8].

Mechanism Of Action:

Air abrasion utilizes K.E. for the removal of caries and alumina particles which are expelled by air pressure at high velocity and thus the particles abrade the surface once they strike it with none significant heat or noise production.The formula for K.E. is 1/2 mv^2, where m represents mass and v represents velocity[9]. If the surface is hard ,the particles deduct little bit of surface and, if it's soft, energy is captured by the material and thus the particles bounce off.The principal action of air abrasion is end cutting.So, the access has smaller diameter but the cavities produced are deep.This action is kind of different from conventional burs as they produce wider access with shallow cavities.Air abrasion produces a surface roughness which is true for the materials that bond on to the tooth surface[10].The use of air abrasion also can remove the necessity for etching the enamel surface with acid when fissure sealants are used.A total of 27 µm alumina particles are only second to diamond in terms of abrasivity.The hardness of the alumina particles is 16 to 18 GPa.

Motisuki C et al (2006) performed a study on extracted human teeth to assess which particle size in air abrasion system removes carious dentine with maximum conservation of toothstructure. 27, 50 and 125 µm alumina particles were used and it had been concluded that 27 and 50 µm alumina particles removeless sound tissue as compared with 125 µm particles, when carious dentine is removed using air abrasion.If water is added to the air abrasion system, it creates a water shroud and thus the water shroud not only prevents dust formation but also decreases the number of alumina attached to the tooth surface after the procedure[11].

Control of Cutting Efficiency:

Cutting efficiency depends on various factors, like particle size and shape, distance of the tip of the handpiece from the tooth surface, feed rate (powder flow), length of cutting time and air pressure .Horiguchi et al (1998) used alumina powder, glassbeads, crushed glass powder and crushed polycarbonate resin powder to guage the cutting ability of air abrasion when it had been used to cut intact enamel and dentine and concluded that crushed glass powders which were angular shaped cut 3 times more efficiently, as compared with glass bead particles which were spherical in shape.Banarjee A et al (2008) administered a study using four different air abrasion units to research the effect of powder fill on the flow and cutting efficiency and concluded that the flow was different for every air abrasion unit when the quantity of alumina powder was changed[12]. It was, therefore,proposed that a continuing level of alumina powder should be maintained to achieve a continuing cutting.It is suggested that atmospheric pressure for tooth preparation should be between 40 to 60 psi (2.75-11.03 Bars).Alumina particle sizes for air

abrasion range from 27 to50 µm in diameter. The operating distance should be between 0.5 to 2 mm. If the space is quite 2 mm, it leads to decreased cutting.Kinetic energy of the transferred particles is decreased,when the speed is decreased which ends up in reduced abrasiveness of the surface.Increasing the alumina particle size (mass) from 27 to 50 µm increases the K.E. being transferred to the surface by an element of 8. Although this canincrease the cutting efficiency, it also can cause increased patient discomfort. Particle size of 34 µm should be wont to remove enamel and 27 µm should be wont to remove caries[13,14].

Rotary Cutting vs Air Abrasion:

Rafique S et al (2003) proposed that patients feel reduced pain with air abrasion as compared with other conventional methods.Rotary cutting instruments can increase the temperature of the tissue by 300 to 400ºC;however, the temperature changes with air abrasion are minimum (± 2 ºC), therefore the risk of cracking is additionally decreased.The shape of the bur used with high-speed handpiece is additionally important as, if it's less then concentric, it'll cause enamel cracking.Hicks MJ et al (2001) studied the event of secondary caries after using conventional handpiece and an air abrasion technique for cavity preparation in teeth. The teeth were restored with composite resin and caries were introduced by exposing the teeth to a man-made caries medium[15]. Polarized light microscopy was wont to assess the presence and extent of the lesion and it had been concluded that both techniques offer similar defence against secondary caries.Christensen (1996) compared the utilization of air abrasion and rotary cutting for cutting cavities in teeth and suggested that air abrasion has various advantages over rotary cutting, like reduced noise production, no vibration and fewer need for anesthesia. of these advantages make this system particularly useful for youngsters and for the patients who have a fear of anesthesia and noise. due to these indications, air abrasion has a foothold over rotary cutting because it's in line with the principles of minimally invasive dentistry[16].

Specific Indications Of Air Abrasion Technique:

Air abrasion is especially important in certain areas. it had been suggested that air abrasion are often wont to diagnose and treat early lesions. it had been also proposed that the cavities prepared with air abrasion are better for bonded restorations as they provide rounded contours which decrease the danger of fracture of restorations[17].This technique is especially useful for the removal of defects that are presented on superficial surface of enamel because it leads to decreased loss of normal tooth structure in comparison with a high-speed handpiece.This technique also can reduce the microleakage of the sealants because it provides a really rough enamel surface which improves the retention of bonding materials[18].Air abrasion also can be wont to remove old restorations by increasing the atmospheric pressure .When air abrasion is employed , the necessity for local anaesthesia is additionally minimized.A total of 80 to 95% of the patients treated with air abrasion don't need anesthesia. This not only saves valuable clinical time of the practitioner but patient visits also can be decreased as multiple quadrants of patients mouth are often treated during a single visit.Air abrasion is extremely useful for the removal of composite and glass ionomer cement restorations.Cook RJ et al (2001) called air abrasion, the technique of choice for the removal of faulty composite restorations[19].

Limitations Of Air Abrasion Technique:

Air abrasion isn't very effective for the removal of amalgam restorations. Also, there are concerns regarding the quantity of mercury released during the removal of amalgam restoration Practitioners should remain careful once they use air abrasion as there's loss of touch and it can readily cut hard tissues.Air abrasion cannot remove deep carious lesions because it cannot cut soft substances.Banerjee et al (2000) has, however, proposed that softened dentine are often removed with air abrasion, when a mix of alumina and hydroxyapatite is used[20]].

Use of rubber dam and high vacuum suction for the patientand eye wear for the practitioner is very recommended to stop the dust from being inhaled and causing an injury to the attention respectively.

Bioactive Glasses And Air Abrasion:

Many dental practitioners are concerned about the toxicity of alumina particles which may be inhaled during the procedure.

Bioactive glasses can replace alumina in air abrasion system.But bioactive glasses are brittle and that they fracture after coming in touch with hard dentine surface. The hardness of bioactive glasses is a smaller amount than alumina but they will cause remineralization of the surface unlike alumina. Therefore, bioactive glasses of various composition and hardness should be produced to testtheir cutting efficiency[21].

CONCLUSION:

Minimally invasive dentistry is that the need of the hour, and airabrasion may be a technique that's truly in line with the minimalintervention philosophy. Air abrasion is now getting used bymany dental practitioners in USA and it's still gaining popularity in Europe[22].

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