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Air Abrasion In Orthodontics

A Project Submitted to The College of Dentistry, University of Baghdad, Department of Orthodontics in Partial Fulfillment for the Bachelor of Dental Surgery

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بِسْمِ اللَّــهِ الرَّحْمَـٰنِ الرَّحِيمِ

وَيَسْأَلُونَكَ عَنِ الرُّوحِ ۖ قُلِ الرُّوحُ مِنْ أَمْرِ رَبِّي وَمَا أُوتِيتُم مِّنَ الْعِلْمِ إِلَّا قَلِيلًا

صدق الله العظيم

Certification of the Supervisor

I certify that this project entitled " Air Abrasion In Orthodontics " was prepared by the fifth-year student “Ayesha Ali Samir Mohamed Arif ” under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Supervisor’s Name

Assist. Prof. Layth Mohammad Kareem

Dedication

I dedicate this project to my father,my mother,my husband and friends for their love & support along this journey...

Acknowledgements

First and foremost, praises and thanks to **Allah** Almighty for helping me fulfill my dream, for his blessings throughout my work to complete it successfully.

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LIST OF ABBREVIATIONS AND ACRONYMS

HF	Hydrofluoric acid
SBS	Shear bond strength
QMAT3	Novel bioactive glass
APDs	Air-polishing devices

Introduction

Air abrasion was first used in dental community in 1945; it was used in non-mechanical cavity preparation by Dr. Robert B Black **(Black and Christi, 1945).**

Sodium bicarbonate has been commonly used in air-polishing devices since the 1980s **(Black R., 1945)**.

Aluminum oxide with a particle size of 50 µm, has found to be the most desirable for use in sandblasting and results in excellent bond strength **(Ferrari et al., 1987)**. It has been used to roughen the surface of all metals (including stainless steel), and as a result, increase the surface area for both chemical and mechanical bonding **(McConnell, 1993)**.

Sandblasting technique has been used in orthodontics for treating the fitting surfaces of bands and brackets to enhance bond strength **(Millett et al., 1993)** and for the Removal of cement from failed brackets prior to recementation **(Regan et al., 1993)**.

When sandblasting techniques using a high-speed stream of aluminum oxide particles propelled by compressed air , that sandblasting increased the bond strength and the survival time of the new brackets **(Sonis, 1996; Millet et al., 1993; MacColl et al., 1998)** .

Evaluation sandblasting as a method of enamel preparation prior to bracket bonding **(Reisner et al., 1997)**. Sandblasting produce a less well defined pattern on the enamel with irregular grooving of the enamel surface five seconds sandblasting was chosen because this would mimic what would be acceptable in the clinical situation **(Sargison, 1999)**.

There are many advantages and disadvantages I will discuss later.

AIMS OF THE STUDY

- To review the history of air abrasion.
- Devices used for air abrasion.
- Uses of air abrasion in orthodontics.

Chapter One: Review of Literature

1.1 Origin of sandblasting

Sandblasting has a longer history than you might expect. The absolute furthest it can be traced back is 1870, when Benjamin Tilghman invented a machine for paint and rust removal. Then, Thomas Pangborn took Tilghman's initial idea and ran with it, adding compressed air in 1904. Another substantial innovation took place in 1918, when the first enclosure was built. This enclosure contained a clear screen for sandblasters to surround the worksite and prevent dust from hitting workers' faces **(McCahill Painting company ,2021)**.

Figure 1 : Sandblasting dust control **(GRT engineering technology company, 2022)**

1.2 Definition

1.2.1 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 **(Chan-Te Huang et al., 2019)**.

1.2.2 Sandblasting

The technique which the required surface is impacted with hard particles at high velocities, thereby eroding the substrate and producing a roughened surface with expected higher wettability **(Chintapalli et al., 2014; Johnson King et al., 2016)**.

1.3 Air abrasion in dentistry

Air-abrasion has been used for several different applications within the field of restorative dentistry including removal of external stains and calculus, minimal cavity preparations, crown preparations and fissure sealant/preventive resin restoration placement **(Epstein S, 1951; Black R B, 1945; Black R B, 1955; Epstein S, 1951; Burbach G, 1993; Goldstein R E and Parkins F M, 1994).**

1.3.1 Prophylaxis

Several types of particles exist exclusively for cleaning purposes, such as sodium bicarbonate, glycine, calcium sodium phosphosilicate, calcium carbonate, and aluminum trihydroxide, These particles may all be used for the plaque removal prior to orthodontic bonding **(Barnes et al., 2014)**.

Orthodontic treatment provides functional and aesthetic improvement to the teeth, but favours the formation of plaque, especially around the brackets **(S.G. Iafigliola et al., 2018)**. As a complement and maintenance of the patient's oral health, prophylactic methods are used by the professional during the course of treatment **(S.G. Iafigliola et al., 2018)**. Among these methods, prophylaxis with sodium bicarbonate jet is widely used, as the technique requires less physical effort, requires a short clinical period for execution and does not generate heat, when compared to prophylaxis with a rubber cup or Robinson brush and paste prophylactic **(M. Camporesi et al., 2016)**.

Figure 2 : Intraoral view of prophylaxis by air-powder polishing at an angle of 90° relative to the bracket surface in the maxilla (A) and mandible (B) **(Cleansing orthodontic brackets with air-powder polishing: effects on frictional force and degree of debris., 2016)**

1.3.2 Conservative

Air abrasion for restoration preparation removes tooth structure using a stream of aluminium oxide particles generated from compressed air **(Vivek S Hegde and Roheet A Khatavkar, 2010)**.

Air abrasion has the advantage of decreased noise and vibration as compared to conventional rotary instruments **(Roeder LB et al., 1995)**.

The bonding of enamel and dentin surfaces prepared with air abrasion is much better than that with conventional carbide burs or acid etching **(Laurell K et al., 1993; Berry EA and Ward M., 1995)**.

All restorative surfaces were sandblasted before bonding using 50 micron aluminum oxide from a distance of 10 mm at a pressure of 2.5 bars for 4 s, and then rinsed and dried **(Özcan et al, 2007; Kanzow et al., 2019)** .

1.4 Devices used for air abrasion

1.4.1 Airdent machines

The first units to be commercially manufactured were the Airdent machine (figure 3).

Figure 3 : Airdent machine, **(Bernard Becker Medical Library, Washington University in St. Louis, 1950)**

1.4.2 Air-Flow Masters,EMS

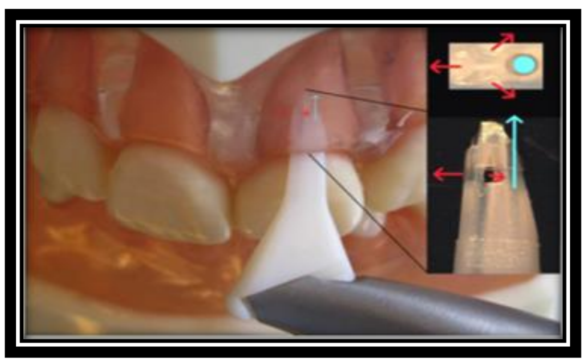

Figure 4 : Mode of application for subgingival air polishing debridement with the specially designed nozzle **(Subgingival debridement of periodontal pockets by air polishing in comparison with ultrasonic instrumentation during maintenance therapy., 2011)**

Test treatment comprised pocket/root debridement with the use of a low abrasive amino acid glycine powder (Air-Flows Perio Powder, EMS, Nyon, Switzerland) applied by the use of Perio-Flows hand-piece connected to an airflow unit (Air-Flow Masters,EMS) **(Wennstro¨m JL, Dahle´n G and Ramberg p., 2011)**.

1.4.3 Dental air polisher

Air polishers are relatively new devices that have provided dentistry with an alternative method for cleansing the tooth surface. It is found to be the most effective method for surface cleansing before bracket placement **(Laurence et al., 1992)**. This instrument operates by delivering a controlled stream of fine sodium bicarbonate particles onto the tooth surface through a water spray and compressed air **(Laurence, 1993)**, (Figure 5).

Figure 5 : Types of air-abrasion devices. Standalone (A) and attached (B) airabrasion units **(EMS catalog, 2020)**

1.4.4 Aquacare

Comfortable and quick procedures are provided by using a fine stream of fluid combined with a tiny volume of powder directed at the teeth to be treated. Unlike conventional rotary cutting instruments, the AquaCare handpiece is not in direct contact with the tooth structure, removing only the minimum of sound tooth material and eliminating the risk of chipping and stress fractures, AquaCare Sodium Bicarbonate provides an Air Polishing prophylaxis treatment that is highly effective in cleaning and stain removal.

Figure 6 : A) AquaCare | Black Edition ,B) single

Standard Tip Suitable for all powders and both handpieces, used mainly for hygiene and clean , iTip Designed for interproximal and diastema use, though routinely used in many other applications and Plus Tip Ideal for larger particle size and wider coverage (figure 7).

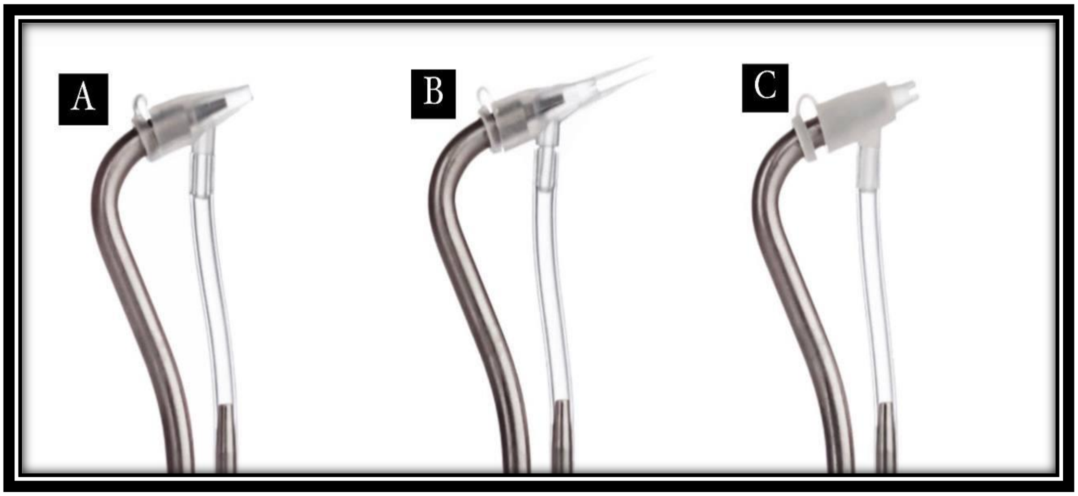

Figure 7 : A) Standard Tip ,B) iTip ,C) Plus Tip

1.4.5 Twin-pen dental sandblaster

Figure 8 :Twin-pen dental sandblaster

This dental laboratory equipment unit is used to polish the surface of porcelain crowns indentistry, strong sandblasting power.

1.4.6 Intraoral microetcher

Is an approved intraoral sandblasting machine **(Buyukyilmaz T and Zachrisson BU, 1998)**.

Figure 9 : Resin remnant removal after orthodontic bracket debonding with chair-side intraoral sandblasting. Standard high-volume suction tip is inserted close to side hole of Sand-Trap; tip of microetcher fits into small hole **(Seong-Sik Kim et al., 2007)**.

1.5 Optional accessories for the air abrasion system

In addition to the different grades of the powder particles and the various tip diameter sizes and tip angulations for the air abrasion handpiece, there a few more accessories which will provide the clinician a better working environment:

1_ Air abrasion resistant intraoral mirror: When indirect vision is used. In an effort to conserve mirrors, the dentists will have a tendency to migrate towards direct vision, These mirrors come gold-plated for ease of identification by the staff.

2_ Sand trap: These are soft plastic spheres that slip onto office suction and have a top opening through which the air abrasive system tip is introduced. This device traps the abrasive particles within the sphere from where they can be evacuated through the suction. This prevents the abrasive particles from entering the patient's oral cavity in the (figure 10).

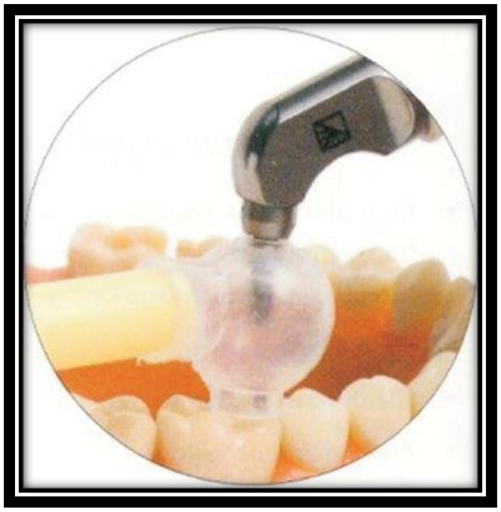

Figure 10 : Sandtrap placed on mandibular molar demonstrating ease of debris evacuation **(Roheet Khatavkar, 2010)**

3_ Power plus booster: Used to increase the air pressure to allow for faster cutting thus reducing the patient chair-time.

4_ Disposable air abrasion handpiece: The Airbrator (North Bay/Bioscience, LLC) is a single-use air abrasion handpiece that connects to your existing air-line. It is a direct alternative to traditional, expensive, self-contained air abrasion units.

5_ Super high volume evacuation systems: Like the RapidVac or Union Medical Evacuation System is the ideal companion for all air abrasive systems. Delivering super high volume suction, these devices completely eliminate the chances of contamination of the dental operatory with abrasive particles.

6_ MicroVibe: It also improves the flow of pit and fissure for effective restoration of cavities prepared using the air abrasives.

1.6 Uses of air abrasion in orthodontics

With the increased demands for adult orthodontic treatment and growing popularity of esthetic dentistry, clinicians are often faced with the problem of bonding orthodontic brackets to different types of restorations as well as to the enamel **(Trakyali G et al., 2009)**.

Numerous options to improve bracket bonding to such substrates have been suggested, generally combinations of mechanical (e.g., surface roughening by air-particle abrasion, bur grinding, or hydrofluoric acid etching (HF) and chemical (e.g., primer application) conditioning methods **(Özcan M et al., 2004)**.

1. Removing of soft deposits and extrinsic stains from all visible areas of tooth **(Graumann et al., 2013)**.

2. Cleaning of detached orthodontic attachments before rebonding, as no significant differences in bond strength were identified between brackets recycled by this technique and new brackets **(Quick et al., 2005)**.

3. Cleaning cavity preparations prior to bonding by removing plaque, light calculus, undermined enamel, poorly bonded resins or liners, and temporary fillings **(Huang et al., 2019)**.

4. Pretreatment of non-enamel surfaces prior to bonding of orthodontic attachments **(Eliades and Brantley, 2017)**.

5. Removal of superficial enamel defects and minimal preparation for small class I and class V cavities, preventive resin sealant restorations and for surface preparation of abfractions and abrasions **(White and Eakle,2000; Banerjee and Watson, 2002; Huang et al., 2019)**.

6. Removal of existing amalgam, composite and glass ionomer restorations for replacement **(Hegde and Khatavkar, 2010)**.

7. Minimally invasive preparation of labial surface of anterior teeth to be restored with composite, without creating obvious preparation margins **(Banerjee and Watson, 2002)**.

8. An adjunct to acid etching technique **(Banerjee and Watson, 2002;Eliades and Brantley, 2017)**.

9. Increasing the retentive area inside molar bands **(Millett et al., 1995)**.

10. Creating micromechanical retention for bonded retainers **(Graber et al., 2017)** (Figure 11).

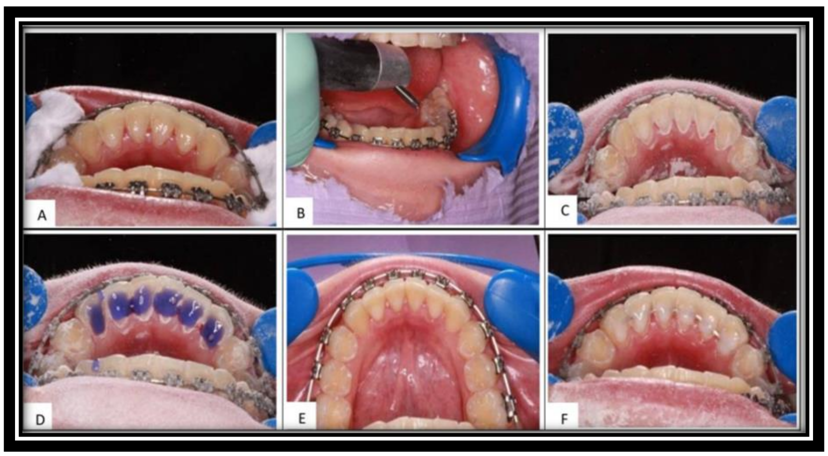

Figure 11: Use of air abrasion in improving orthodontic retainer adhesion. Initial aspect(A), air abrasion in action (B), after air abrasion (C), application of etchant (D), application of primer (E), after retainer bonding (F) **(Leon et al., 2016)**.

The most simple and effective surface conditioning method for orthodontic bracket bonding to glazed zirconia was a silane application to the cleaned surface in the clinic **(Ji-Young Kwak et al., 2016)**.

1.7 Preparation of enamel with sandblast

The buccal enamel surface is evenly sandblasted in the area, where the bracket is to be bonded and using 50 µm aluminum oxide particles at 80 Psi for 3 seconds at a distance of 10 mm from the tooth surface. The tooth was finally rinsed with distilled water for 30 seconds and dried with oil free compressed air for 30 seconds **(Clark et al., 2003)**.

There is inability to effectively etch fluorosed enamel with 37% phosphoric acid, which results in a decreased amount of enamel irregularity and thus prevents effective bonding **(Miller RA. , 1995)**.

Use the combination of sandblasting followed by acid etching produces higher bond strengths on fluorosed enamel surfaces than acid etching alone, irrespective of the adhesive system **(S Suma et al., 2012)**.

Differently from buccal orthodontics, in which direct rebonding is the preferred option, in lingual orthodontics rebonding sometimes should be indirect, indirect rebonding raises the risk of inaccurate repositioning and takes longer than direct rebonding **(Scholz RP et al., 1982; Wiechmann D., 2000)**.

The use of aluminum oxide sandblasting combined with (PH) phosphoric acid etching or self-etching primers to increase the bond strength of orthodontic brackets remains controversial. Although some studies found an increase in bond strength **(Halpern RM et al., 2010; Cal-Neto JP et al., 2011; Mati M et al., 2012)** others did not **(Brauchli L et al., 2010; Türköz Ç and Ulusoy Ç, 2012)**.

1.8 Conditioning of restorative surfaces

Air abrasion recommended of non-enamel surfaces prior to bonding of orthodontic attachments as it significantly increases the SBS **(Eliades and Brantley, 2017; Huang et al., 2019)**. Basically, effectiveness of sandblasting was found to be evident on amalgam **(Zachrisson et al., 1995; Skilton et al., 2006)**, composite **(Bouschlicher et al., 1997; Farzanegan and Tanbakuchi, 2014)**, and ceramic **(Zachrisson et al., 1996; Andreasen and Stieg, 1988)**. In terms of the resultant shear bond strength **(Machado et al., 2007; Portugal et al., 2008; Zaheer et al., 2018)**.

1.8.1 Amalgam

Although sandblasting is quite possibly the most effective means of mechanical surface treatment on amalgam **(Machado et al., 2007; Portugal et al., 2008; Zaheer et al., 2018)** , it minimizes or potentially eliminates the superficial oxide layer. Thus, sandblasting may have a negative impact on the effectiveness of these promoters **(Germec et al., 2008)**.

1.8.2 Porcelain

May be preferable to use sandblasting with 50 μm aluminum oxide to remove glaze instead of using burs or stones since only small amount of surface is removed and the procedure is more even and less damaging **(Zachrisson et al., 1996)**.

Then Observed a significantly higher SBS on sandblasted feldspathic porcelain after Scotchbond application than in the conventional bonding group **(Hellak et al.,2016)**.

1.8.3 Composite

The majority of sandblasted composite samples had score 4 in both conventional bonding system and Scotchbond groups **(Hellak et al., 2016)**.

While the cohesive fracture had a percentage of 40% when sandblasted composite was bonded **(Tayebi et al., 2017)**.

1.8.4 Gold alloy

Until recently, effective orthodontic bonding to crown and bridge restoration fabricated from gold and other metals were considered to be difficult. Conventional acid etching is ineffective in the preparation of gold surfaces for mechanical retention of orthodontic attachments **(BÜyÜkyilmaz et al., 1995)**.

Improved adhesion to gold alloy and other metal surfaces has been made possible by development of new technology, such as intraoral sandblasting , It may be feasible to bond orthodontic brackets successfully to artificial tooth surfaces of gold alloys **(Büyükyilmaz et al., 1995)**.

1.8.5 Temporary Crowns

A weak bond of the brackets to provisional materials will lead to a high failure rate, with adverse consequences on the cost and efficiency of orthodontic therapy and on patient comfort **(Al Jabbari Y. S et al., 2014; Pinho M et al., 2017)**. This concern has been addressed by several methods, including Mechanical preparation includes sandblasting and surface grinding with carbide burs or diamond burs **(Hammad S. M.and El Banna M. S., 2013)**.

Under thermocycling conditions, sandblasted provisional crowns would increase the bond strength of orthodontic brackets **(Suliman Y Shahin et al., 2021)**.

1.9 Sandblasting of bracket base to increase mechanical retention

One easy method for roughening surface of the metal with aluminium oxide by air abrasion ,When aluminium oxide treatment was performed on the alloy, microscopically cleaned and roughened surfaces were observed which allowed efficient wetting by resin and stronger composite-alloy bond **(Schneider et al., 1992)**.

Using Aluminum Oxide 50 µm, jetting for 3 seconds and at a 10 mm, sandblasting appeared not to cause any damage to the bracket base. In addition, if there is a microscopic damage to bracket base caused by sandblasting it is found to be not affecting the bond strength **(SharmaSayal et al., 2003)**.

Sandblasting Did not significantly increase the shear bond strength or the amount of adhesive remnant on the enamel surface after debonding of indirectly bonded lingual brackets **(Julissa Janet Robles-Ruíz et al., 2014)**.

Similar share bond strength at the resin/bracket interface can be expected after bracket sandblasting with 25µm, 50µm, and 110µm Al2O3 particle size. Independently of the particle size used, the sandblasted brackets showed greater shear bond strength than brackets without sandblasting **(AbadBocangel Salcedo-Alcaychahua and Aron Aliaga-Del Castillo, 2020)**.

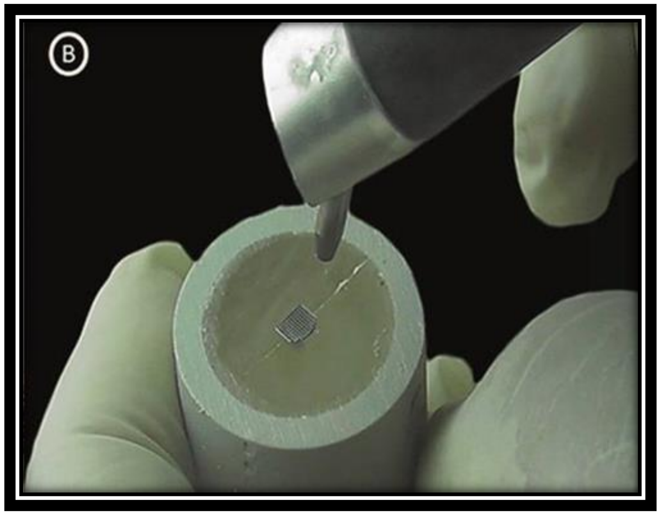

Figure 12 : Sandblasting with Al2O3 on debonded sample inside the sandblastin box **(J Orofac Sci ,2020)**

1.10 Sandbasting of Recycle Orthodontic Brackets

One possible alternative to the replacement with new bracket is to recycle the old or debonded bracket and rebond on tooth surface. The major advantage of recycling is the economic saving, which could be as high as 90 percent, due to the fact that a single bracket can be reused up to five times **(Matasa C. G. Pros and cons, 1989)** . Commonly used recycling methods include roughening of debonded attachment with greenstone, direct flaming, sandblasting, use of chemical solvents, ultrasonic cleaning etc. **(Postlethwaite K. M., 1992)**.

Sandblasting was the most effective in removing composite without a significant change in bond strength compared with new attachments. It is better than flaming or roughening with a greenstone **(Andrew et al., 2005).**

Recycling with sandblasting gives clinically acceptable shear bond strength **(Chetan G. B. M. R. Y., 2011; Bahnasi F. et al., 2013; Montero M. M. H., 2015)**.

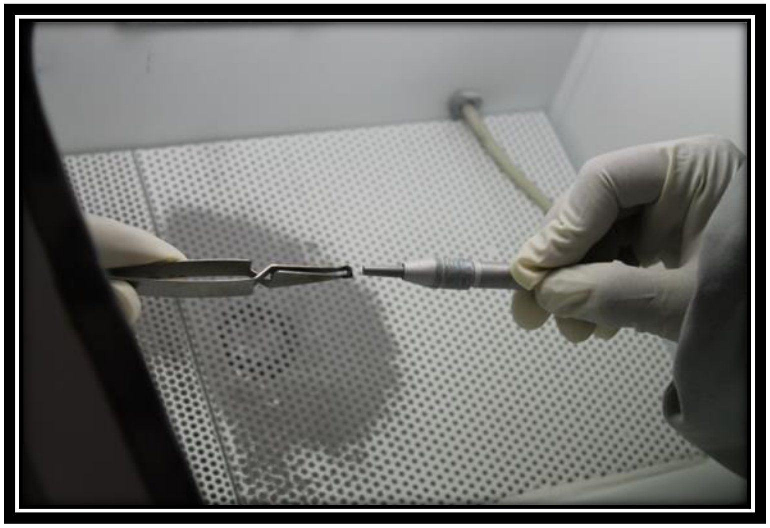

Figure 13 : Sandblasting of bracket **(Vasumathi Thiruvengadam et al ,2021)**

Based on the analysis of the data obtained in this study **(Purna Prasad Khanal et al., 2021)** the following conclusions are made:

1_ Shear bond strength of the new brackets was significantly higher than that of the recycled brackets.

2- Flaming with sandblasting as a method of recycling brackets provided adequate shear bond strength for clinical use. Hence, sandblasting should be considered as a viable, time-saving, and convenient method of chairside recycling.

1.11 Sandblasting of orthodontic bands

Various cements have been used over the past 20 years to aid band retention, but more recently attention has been focused on glass ionomer cements **(Fricker and McLachlan, 1985; Norris et al., 1986; Durning, 1989)**. The using of sandblasting to improve retention of those bands that required recementation with black copper and glass ionomer cements **(Seeholzer and Dasch, 1988)**.

Sandblasting produced almost a three-fold increase in the median survival time of orthodontic bands in the ball mill experiment **(D. T. Millett et al., 2016)**.

1.12 Sandblasting selected area of retainer wires

Failure in the bonding of the fixed retainer can depend on several factors, such as shape, surface characteristics and structure of the wire, the composite used for attachment, the wet or dry conditions of bonding area, the experience of the applier **(P.T. Dickinson et al., 1980; D.C. Smith et al., 1983)** and the width of the bonding surface area **(R. Maijer et al., 1981)**. All retainer wires showed clinically acceptable mean SBS values, sandblasting of the wires showed no difference in the bond strength of lingual retainers and the coaxial wire showed greater SBS in both the sandblasted and non-sandblasted groups **(panelPrathima Anita, Vignesh Kailasam, 2021)**. A significant increase of the SBS could be achieved by enamel sandblasting. In general, sandblasting not only increases the roughness of teeth, but also guarantees for a clean surface free from plaque and debris requiring only little efforts of time and material **(Claudia Reicheneder et al., 2014)**.

1.13 Sandblasting of orthodontic miniscrews

The stability of orthodontic miniscrews depends on mechanical locking of the threads rather than osseointegration **(Ohmae M et al., 2001)**. Several methods have been tried by the researchers to treat the surfaces of orthodontic miniscrews like different techniques of sandblasting **(Yadav S et al., 2015)**.

1.14 Remineralizing of white spot lesion by air abrasion

Different protocols have been described to remineralize enamel white spot lesions including bioactive glass (BAG) 45S5 **(Gjorgievska ES et al., 2013; Milly H et al., 2014)**. Air-abrasion with PAA-BAG powder was used to pre-condition the lesion surface as opposed to cutting it, in order to promote remineralization using different topical therapies including mixtures of bioactive glass 45S5 **(Milly H et al., 2014)**.

This pre-treatment enhanced the remineralization of white spot lesion treated with BAG 45S5 slurry assessed by the increased mineral content, improved mechanical properties and the ultrastructural changes and therefore maybe recommended clinically to promote the mineral uptake during remineralization therapy **(Hussam Milly et al., 2015)**.

1.15 Orthodontic adhesive remnant removal by air abrasion

Several factors may predispose to or directly induce enamel damage during, or after, fixed orthodontic treatment. The post clean-up procedure after removal of attachments is regarded as the most significant cause of enamel damage **(Knösel M et al., 2010; Pont HB et al., 2010)**. Therefore, various methods have been proposed for clean-up of residual orthodontic adhesives from the enamel surface. A number of studies have shown that conventional methods of adhesive removal, including scalers and dental burs, may lead to visible surface roughness with gouges ranging from 10–20 µm deep and loss of up to 100 µm thickness of enamel **(Dumore T and Fried D, 2000)**. Thus, maintaining the integrity of the enamel surface during the removal of residual adhesive is a key consideration during the removal of orthodontic appliances. In recent years, air-abrasion has shown promise as a method for removing residual adhesives **(Banerjee A et al., 2008)**. Banerjee and his coworkers, in an in vitro air-abrasion study, reported that the bioactive glass powder 45S5 produced less enamel damage compared with alumina air-abrasion and tungsten carbide burs **(Banerjee A et al., 2008)**.

A novel bioactive glass (QMAT3) with a lower hardness than 45S5(Sylc™) and enamel has been developed. Its bioactivity was proved by early apatite formation compared with a proprietary agent. QMAT3 was capable of selective removal of residual orthodontic adhesive without inducing enamel damage. therefore, shows promise as a viable alternative to adhesive removal with a TC bur **(Ayam A. Taha et al., 2018)**.

Chapter two: Discussion

Another major concern regarding the powder particles has also been averted due to the use of isolation in the form of rubber dam and high volume evacuation devices. Air abrasion also has the advantage of decreased noise and vibration as compared to conventional rotary instruments **(Roeder LB and Berry EA, 1995)**.

Today's air-polishing devices (APDs) can cover a wide range of indications—from tooth cleaning to cavity pretreatment before restorative therapy and preconditioning before orthodontic bracket application or periodontitis therapy **(Flemmig T.F et al.,2007; Frankenberger R. et al., 2007)**.

The devices are in widespread use, particularly in the field of prophylaxis and others can do both sandblasting , air prophylaxis and treatment by certain types of particles other devices only sandblasting for example aquacare, if we need in our work only sandblasting we can use only sandblaster , microetcher or small devices produce only sandblast , if we need other properties obtain by other types of particles use the device which have many options.

In orthodontics, the device which can be used for tooth surface or orthodontic parts or for excisting restorations , so it is preferable to use the device wide range of options which can used intraorally and for prophylaxis .

The advantages of air abrasion over the use of manual or rotating instruments **(Kontturi-Närhi V., 1989; Kontturi-Närhi V. et al., 1990)**, such as often reduced time requirements **(Kontturi-Närhi V., et al., 1990; Berkstein S. et al., 1987; Gerbo L.R., Barnes C.M. and Leinfelder K.F, 1993; Wennström J.L., Dahlén G. and Ramberg P., 2011)** and the more effective removal of discoloration **(Petersilka G.J.,et al., 2003; Berry E.A. et al., 1999; Kajihara H. et al., 2004)**. Undesirable side effects of air abrasion that include emphysema in the soft tissue, abrasive effects on root cement and exposed dentin **(Pelka M. et al., 2010; Hägi T.T. et al., 2013; Sahrmann P., et al., 2014)**, gingival irritation **(Kozlovsky A. et al., 2005)**, and possible recessions on exposed tooth necks **(Kontturi-Närhi V., Markkanen S. and Markkanen H., 1990; Agger M.S., Hörsted-Bindslev P. and Hovgaard O., 2001)**, Not very wide spread like dental handpiece and turbine ,so the use of air abrasion is limited and not all dentists like it.

Chapter three: Conclusions and suggestions

3.1 conclusion

Studies have shown that the bonding of enamel and dentin surfaces prepared with air abrasion is much better than that with conventional carbide burs or acid etching

1_ Air abrasion can do almost everything a drill can do and creates a much more comfortable experience. Where drills remove decay and some healthy parts of the tooth, air abrasion targets just the decay, leaving more healthy parts of the tooth in place than the drill does .

2_ Abrasive blasting with silica sand containing crystalline silica can cause serious and fatal respiratory disease. Death from silicosis in workers exposed to silica dust due to sandblasting operations suggests that overexposure and unsafe working conditions are prevalent because of a lack of dust suppression solutions .

3_ When we think to buy an air abrasion device we need it to be useful for all uses and can operate with all types of powder particles.

4_ In some parts of orthodontics air abrasion is very useful , could not be replaced by turbine like bracket cleaning or conditioning tooth surface but one day air abrasion might be enough .

3.2 Suggestions

1. To do a research to find if air abrasion useful and used by Iraqi orthodontist.
2. To do research about impact on orthodontic appliances parts (brackets, wires).
3. To do a research compare between type of particles uses in different application.

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