

## **Cover page**

**Official title of the study:** Comparison of Orthodontic Bracket Bond Failure Using Acid Etching With or Without Sandblasting Method for the Preparation of Enamel

**Document Date:**

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## **1. Introduction**

Fixed mechanotherapy is an integral aspect of orthodontic treatment that aims to achieve functional efficiency, structural balance, and aesthetic harmony. Bracket bonding is the most fundamental part of fixed orthodontic treatment. For effective orthodontic treatment that will enable precise tooth movement, efficient bonding of attachments to teeth is very important (Kumar, Kumar Jain and Prasanna Aravind, 2024). The optimal orthodontic treatment must attain the desired results within a reasonable timeframe and a manageable number of appointments. So there must be sufficient optimal orthodontic bond strength to secure the brackets for a favorable treatment duration (Alavi S and Ehteshami A, 2019).

However, bracket bond failure during orthodontic treatment is a frequent occurrence and can occur for a variety of reasons, some of which are undesirable and others of which may be intentional to realign the bracket in more ideal locations (Dirie et al., 2021). So effective enamel preparation is crucial for successful bonding of orthodontic brackets to minimize bond failure rates. In (Buonocore, 1955) first introduced phosphoric acid etching of enamel. When the enamel surface dissolves, it creates microporosities of enamel and provides micromechanical retention between material and enamel. A few years later, (Newman, 1965) promoted this method for preparing enamel prior to the bonding of orthodontic brackets. Since then, enamel etching has gained widespread global application for enamel preparation before orthodontic bracket bonding (Baumgartner et al., 2017).

So, the employment of supplementary mechanical procedures to further optimize enamel surface preparation has received interest in minimizing bracket failure rate to its lowest. When compared to acid etching alone, a research revealed that enamel treated with sandblasting and then acid etching exhibited increased surface roughness, a more consistent type-1 etching pattern, and better infiltration (Patcas et al., 2015). An intraoral sandblaster is a dental tool that uses a high-velocity stream of air and fine powder such as aluminum oxide to clean and prepare surfaces for operations. The particles' kinetic and mechanical energy is released when they collide with enamel, causing microscopic conditioning. By expanding the surface area, this process roughens the enamel surface and improves the mechanical interlocking effect

(Baumgartner et al., 2017). An in vitro and in vivo study suggests that sandblasting before acid etching yields higher bond strength values compared to acid etching alone and also decreases the clinical failure rate from 25% in the acid etching only group to 10% in the sandblasting before acid etching group(Dirie et al., 2021).

A systematic review in Bangladesh was conducted by (Hassan T. and Sattar, 2017) on bond strength performance of conventional acid etch-and-rinse and self-etch primer bonding systems in orthodontics. They highlighted that conventional phosphoric acid etching consistently resulted in higher shear bond strength compared to self-etch systems. So it is essential to evaluate the need for further comparative studies assessing whether additional surface roughening procedures, such as sandblasting prior to acid etching, offer a meaningful clinical benefit in reducing orthodontic bracket bond failure (Hassan T. and Sattar M.H., 2017).

To the best of my knowledge, there is lack of local study, that has been conducted on assessing the synergistic impact of combined acid etching and sandblasting techniques on enamel preparation for orthodontic bracket bonding. This study aims to compare the bracket bond failure rate using acid etching with or without sandblasting method for the preparation of enamel.

## **2. Rationale**

In orthodontic practice, bond failure of brackets is a common clinical challenge that prolongs treatment time, increases chairside work and affects patient satisfaction. So, the need for effective enamel preparation for adequate bond strength is crucial in orthodontic practice. Conventional acid etching has long been the standard method for bonding.

Repeated acid etching due to bracket bond failure may cause enamel damage, which may in turn affect the longevity of subsequent bonds, as it can disrupt the ability of adhesives and bonding agents to effectively bond to the enamel, leading to further bracket failures and a cycle of repeated etching. So, it is essential to emphasize adequate bond strength on initial bracket bonding.

As far best of my knowledge, there is lack of local data from Bangladesh that has been designed to compare the clinical failure rates of the orthodontic brackets following two enamel conditioning methods. This study will provide evidence-based guidance for orthodontic practitioners in Bangladesh regarding the most effective enamel preparation method for orthodontic bracket bonding. It will also contribute to global orthodontic literature by highlighting context specific factors like dietary abrasives and hygiene barriers that influence bonding success.

### **3. Research Question**

What are the differences in bracket bond failure rate between acid etching with or without sandblasting method for enamel preparation?

#### **Hypothesis**

**Null hypothesis:** There is no difference in the bracket bond failure rate between the two methods, acid etching with or without sandblasting for enamel preparation.

**Alternate hypothesis:** Acid etching with sandblasting method decreases the bracket bond failure rate than acid etching without sandblasting method.

## **4. Study objective**

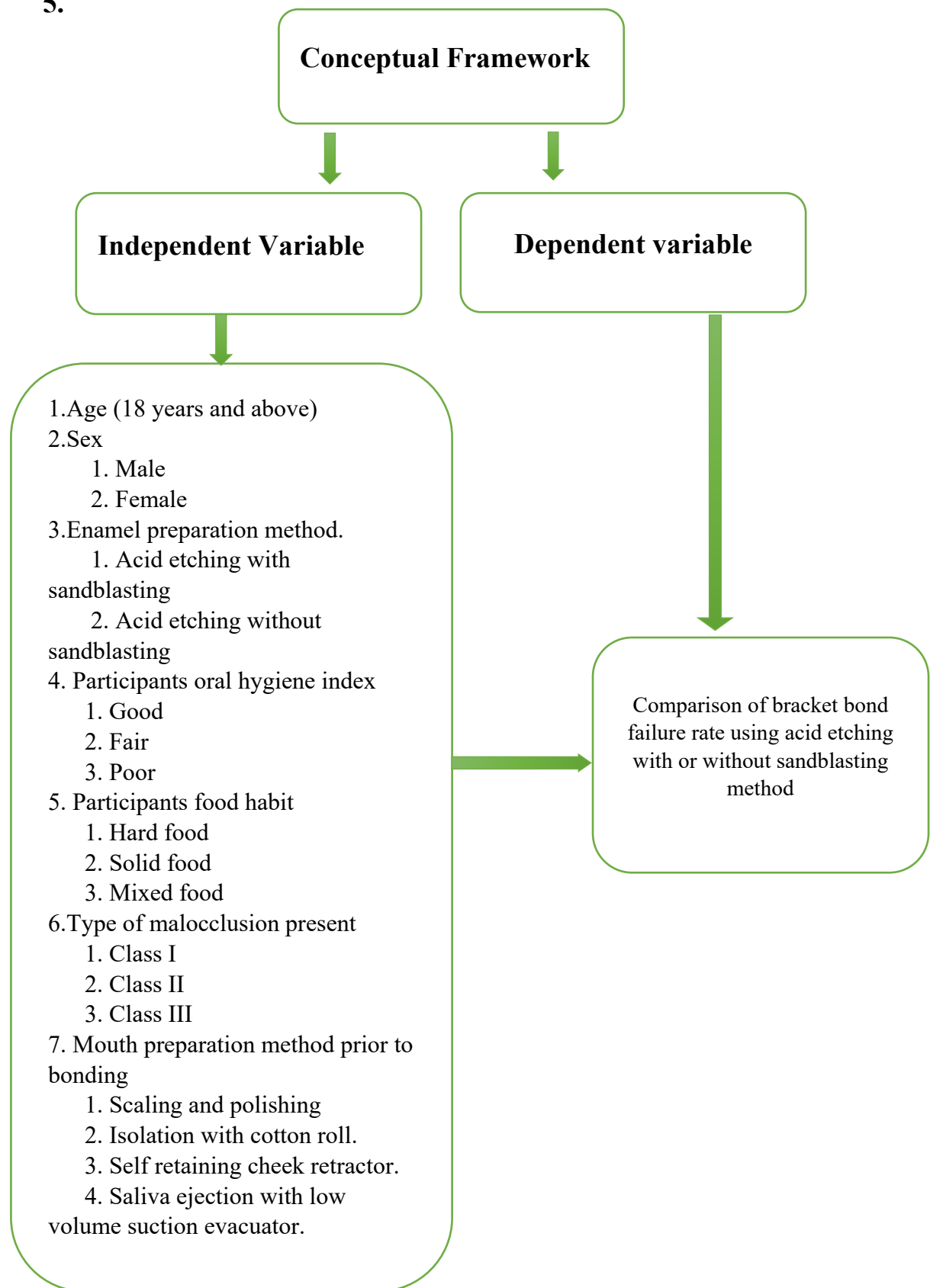
### **4.1 General objective**

To compare the bracket bond failure rate using acid etching with or without sandblasting method for the preparation of enamel.

### **4.2 Specific objective**

- To compare the bracket bond failure rate between the two enamel preparation methods in relation to the age & sex of the participants.
- To determine the clinical efficacy and longevity of bracket bonding when enamel is pretreated with acid etching alone compared to sandblasting followed by acid etching.
- To observe if the use of acid etching with sandblasting method yields a significant advantage in bond retention compared to the acid etching without sandblasting method.
- To determine the survival rate of orthodontic bracket following the two enamel preparation methods according to the oral hygiene index (Green & Vermillion, 1964), food habit and occlusion type of the participants.
- To observe any significant advantage in bond retention while acid etching with sandblasting is used for enamel preparation following the standard oral preparation method.

5.



## 6. Operational definitions

**Orthodontics:** It is a branch of dentistry concerned the alignment of the teeth and the correction of facial proportions (Proffit et al, 2019).

**Orthodontic bonding:** Orthodontic bonding is defined as the process of attaching brackets to enamel using adhesive materials, which is essential for creating a stable bracket-adhesive interface that effectively transfers forces from an activated arch wire to the tooth (Bhalajhi S.I., 2022).

**Orthodontic bracket:** Orthodontic brackets are small orthodontic attachments (metal or ceramic) secured to a tooth for fastening an arch wire. Each attachment is either soldered or welded to a previously placed band enclosing the tooth or is bonded directly on to the tooth. (Proffit et al, 2019).

**Bond failure:** Bond failure refers, to the occurrence of failure at the interface between an adhesive and adherends, which can manifest as adhesive failure, cohesive failure in the adhesive layer, or cohesive failure in the adherent. It is characterized by separation of surfaces involved in the bond (Jakavičė, Kubiliūtė and Smailienė, 2023).

**Acid etching:** Acid etching of enamel is a dental procedure that uses a mild acid, typically phosphoric acid, to roughen the surface of a tooth. This creates microscopic pore or microporosities, in the enamel that allow dental materials, such as resins, to penetrate or mechanically lock into the tooth surface, creating a much stronger and durable bond (Buonocore, 1955).

**Sandblasting:** Sandblasting in orthodontics refers to a surface treatment procedure in which fine abrasive particles—commonly aluminum oxide ( $\text{Al}_2\text{O}_3$ )—are propelled onto the enamel surface under controlled air pressure to create micro-roughness. This mechanical roughening enhances the surface area and improves micromechanical retention of orthodontic brackets when bonding (Bishara SE, 2005).

**Bond strength:** Bond strength refers to the amount of force required to detach an orthodontic bracket from the tooth surface, indicating the effectiveness of the adhesive and surface preparation method used. It reflects the quality of adhesion between the bracket base, bonding resin, and enamel surface. (Bakhadher et al., 2015)



**Enamel preparation:** Enamel preparation refers to the clinical or laboratory process of conditioning the enamel surface before bonding orthodontic brackets to enhance adhesive retention. This involves modifying the enamel surface through mechanical or chemical means to increase surface roughness and surface energy, thereby improving micromechanical interlocking between the adhesive and enamel (Bishara SE, 2005).

**Surface roughness:** Surface roughness refers to the microscopic irregularities or texture on the enamel surface created after mechanical or chemical conditioning procedures such as sandblasting or acid etching. These micro-roughened areas enhance the surface area available for bonding, improving micromechanical retention between the adhesive and the enamel (Bishara SE, 2005).

## 7. Literature review

Acid etching is the widely used standard protocol for orthodontic bracket bonding. As bracket Dislodgement due to bond failure is a common occurrence, the need for additional mechanotherapy to enhance bond strength and reduce bond failure is crucial.

Dirie et al. (2021) conducted an in vitro study and a randomized controlled trial to evaluate the bond strength and bracket failure rate of re-bonded brackets after enamel preparation using sandblasting with acid etching (SBE) versus acid etching alone (AE). On in vitro, the study found, higher bond strength using SBE than using AE only and on vivo, SBE shows 10% clinical failure whereas AE group shows 25% clinical bond failure. The study does not investigate the two methods on initial bonding, as effective bond strength on initial bonding decreases the need for re-bonding due to bond failure.

Durrani OK. (2024) conducted an eighteen-month randomized controlled trial comparing the efficacy of two bracket base treatments: sandblasting with acid etching versus acid etching alone. The study found no statistically significant difference in bracket failure rates between the acid-etched bases and those treated with sandblasting in conjunction with acid etching. Therefore, the conflict regarding the effectiveness of bracket base sandblasting versus enamel sandblasting in conjunction with the acid etching technique for the durability of brackets remains unresolved.

Al-Daher et al. (2024) conducted an in vitro study on enamel preparation using sodium hypochlorite with acid etching (NaOCL-AE), acid etching only (AE) and sandblasting with acid etching (SB-AE) to enhance the shear bond strength of metallic brackets in a third bonding. The study shows increased shear bond strength of metal brackets on NaOCL-AE group then AE and SB-AE group. As it is an in vitro study the clinical failure rate of brackets using this enamel preparation technique have not been tested to evaluate their stability in the mouth.

Baumgartner et al. (2017) did a systemic review and meta-analyses on the effect of enamel sandblasting on enhancing bond strength of orthodontic brackets. The study showed that there was no statistically significant increase in shear bond strength when

sandblasting was added to conventional acid etching protocol. Also emphasizes on the need for standardized, better-designed, laboratory and clinical studies.

Scribante A. et al. (2022) did a study on Enamel pretreatment with erythritol, glycine and sodium bicarbonate to evaluate the bonding efficacy and survival rates of orthodontic brackets in both in vivo and in vitro. The study found higher in vitro value of shear bond strength when enamel pretreated with erythritol. Also clinically erythritol is associated with a low failure rate of brackets. So different methods of enamel pretreatment should evaluate to identify a viable technique to reduce failure rates of orthodontic bracket.

(Hassan T. and Sattar M.H., 2017) conducted a systematic review evaluating the bond strength performance of conventional acid etch-and-rinse and self-etch primer bonding systems in orthodontics. The study mainly focused on shear bond strength (SBS), ARI scores, and enamel surface changes, while actual orthodontic bracket bond failure rates in clinical conditions were not directly analyzed. So it supports the need for further comparative studies assessing whether additional surface roughening procedures, such as sandblasting prior to acid etching, offer a meaningful clinical benefit in reducing orthodontic bracket bond failure.

The above-mentioned studies illustrate that enamel surface preparation, whether through acid etching alone or in combination with acid etching and sandblasting, is crucial for evaluating bracket bonding success. The majority of the research is in vitro and indicates that brackets bonded to sandblasted enamel surfaces may demonstrate enhanced shear bond strength and reduced failure rates. Since my study is designed as a clinical trial, it is expected to provide more clinically relevant evidence on bracket bond failure rates and also will critically determine the need for adjunctive use of sandblasting with conventional acid etching for optimal enamel preparation prior to bracket bonding.

## **8. Materials and methods**

**8.1 Study design:** It will be a randomized clinical trial.

**8.2 Place of study:** Department of Orthodontics, Bangladesh Medical University (BMU), Dhaka, Bangladesh.

**8.3 Study duration:** One year after getting approval from Institutional Review Board, Bangladesh Medical University.

**8.4 Study population:** Participants will be orthodontic patients requiring fixed orthodontic appliances according to treatment plan in the department of orthodontics BMU, Shahbag, Dhaka.

**8.5 Sampling and randomization technique:** 15 participants will be selected according to predefined inclusion criteria by simple random sampling method and each participant will provide written and informed consent before participation. After enrollment, intra-patient random allocation of enamel preparation method either the right or left side will be performed using a computer-generated random sequence (Office 365, version2024, Microsoft corporation, USA) with a 1:1 allocation ratio.

## 8.6 Sample size calculation:

Basis from previous study

Based on (Dirie et al., 2021a).

### Mean Values

1. Acid etching with sandblasting ( $\mu_1$ ) = 22.37
2. Acid etching without sandblasting ( $\mu_0$ ) = 17.31

### Standard Deviation

1. Acid etching with sandblasting ( $\sigma_1$ ) = 3.159
2. Acid etching without sandblasting ( $\sigma_0$ ) = 2.850

### Power

Power = 80%

u = 0.84

Level of Significance

$\alpha$  = 0.05

v = 1.96

### Sample Size Formula

$$n = (u + v)^2 (\sigma_1^2 + \sigma_0^2) / (\mu_1 - \mu_0)^2$$

$$n = (1.96 + 0.84)^2 \times (3.159^2 + 2.850^2) / (22.37 - 17.31)^2$$

$$n = 5.54 \approx 6$$

(Machin, D., Campbell, M.J., Tan, S.B., Tan, S.H. and Tan, S., 2009. *Sample size tables for clinical studies* (Vol. 3). Chichester: Wiley-Blackwell)

### Adjustments

Considering 80% response rate:

$$\text{Adjusted sample size} = 6 / 0.8 = 7.5 \approx 7$$

Adjustment for male : female ratio

$$7.5 \times 2 = 15 \text{ subjects per group}$$

### Final Sample Size

Therefore, a total of 15 subjects per group will be selected.

## **9. Criteria for sample selection**

### **9.1 Inclusion criteria**

1. Participants with good general health condition and oral hygiene status.
2. Age range of the patients will be 18 years and above.
3. Sex of the participants will be both male and female.
4. Patients with full permanent dentition present (excluding 3<sup>rd</sup> molar).
5. Patients with enamel integrity, absence of traumatic or carious lesion.
6. Participants who had no enamel pretreatment procedure performed with chemical agents.
7. Participants with no crossbite, scissor bite or occlusal interference (to prevent any potential early bond failure).

### **9.2 Exclusion criteria**

1. Patients who have congenital enamel defects,
2. Patients who are in need of orthognathic surgery.
3. Patients with craniofacial syndromes.
4. Patients who present with partially erupted teeth with hypoplasia.
5. Patients for whom a rapid expander or a fixed functional appliance will be planned.

## **10. Variables**

### **10.1 Independent variables**

1. Age of the participants will be 18 years and above.
2. Both male and female participants will be enrolled.
3. Enamel preparation method:
  1. Acid etching with sandblasting
  2. Acid etching without sandblasting
4. Participants oral hygiene index:
  1. Good
  2. Fair
  3. Poor
5. Participants food habit:
  1. Hard food
  2. Solid food
  3. Mixed food
6. Type of malocclusion present:
  1. Class I
  2. Class II division 1 and class II division 2
  3. Class III
7. Mouth preparation method prior to bonding:
  1. Scaling and polishing
  2. Isolation with cotton roll.
  3. Self retaining cheek retractor.
  4. Saliva ejection with low volume suction evacuator.

### **10.2 Dependent variable**

Comparison of bracket bond failure using acid etching with or without sandblasting method.

## **11. Study procedures**

**11.1 Sampling method:** The study population will be chosen according to the research objectives, and the study sample will select using exclusion and inclusion criteria. A sampling frame will be prepared with those who give consent. Then 15 participants will be selected according to predefined inclusion criteria by simple random sampling method, and each participant will provide written and informed consent before participation. After enrollment, intra-patient random allocation of enamel preparation method either the right or left side will be performed using a computer-generated random sequence (Office 365, version 2024, Microsoft Corporation, USA) with a 1:1 allocation ratio.

### **11.2 Materials and instruments requirements**

#### **Armamentarium and instruments required**

1. Dental Sandblaster machine.
2. Alluminum oxide particle.
3. 37% orthophosphoric acid gel.
4. 0.22 Roth metal bracket.
5. Primer.
6. Adhesive composite.
7. Curing light.
8. Self-retaining cheek retractor.
9. Data collection sheet.
10. Informed written consent form in Bangla and English.
11. Laptop.



### **11.3. Data collection procedures**

The selected participants thorough oral prophylaxis will be conducted utilizing a rubber cup, pumice, and water slurry. The teeth will thereafter be isolated using self-retaining cheek retractors, cotton rolls, and a low-volume, oil-free suction evacuator. Then the fixed mechanotherapy will start using 0.22 Roth metal bracket (Meta metal bracket, GNI co., Ltd) following standard orthodontic bonding protocol. Each participant will have sandblasting of enamel prior to acid etching on one side, whereas the contralateral side will receive acid etching only(Kumar, Kumar Jain and Prasanna Aravind, 2024)

Sandblasting procedure: Sandblasting will be done using micro Jato sandblaster (Bio-art dental equipment ltd, Brazil) and 50 $\mu$ m aluminum oxide particles. The sandblaster will connect to air turbine supplied with controllable pressure and timer. Sandblaster will automatically stop when preadjusted time is reached. The labial surface of enamel will be sandblasted for 5seconds at 60psi with a 10mm of nozzle tooth surface distance at an angle of 45°(Al-Daher et al., 2024). Figure 1 adapted from (Kim et al., 2007) showing enamel preparation with sandblasting for orthodontic bracket bonding. After sandblasting the teeth will be etched with 37% orthophosphoric acid for 30seconds and rinsed with water for 30seconds and air dried for 30seconds till having chalky white appearance(Dirie et al., 2021).Figure 2 Adapted from (OM P Kharbanda Orthodontics, 3<sup>rd</sup> edition showing acid etching of enamel for orthodontic bracket bonding) showing acid etching of enamel with etching gel application, cleaning & drying of enamel and frosty white appearance of enamel (Kharbanda, 2019)



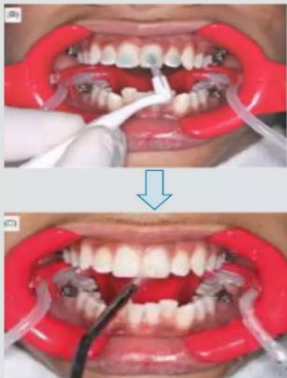
Figure 1 (Adapted from Kim et al., 2007)

## ACID ETCHING

◦ FROSTY WHITE



A



Om P. Kharbanda Orthodontics: Diagnosis and Management of Malocclusion and Dentofacial Deformities, 3<sup>rd</sup> edition

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Figure 2: (Adapted from OM P Kharbanda Orthodontics, 3<sup>rd</sup> edition.)

The contralateral side will receive acid etching without sandblasting method following the same acid etching technique. The entire bonding procedure for each participant will be performed by the operator in a single appointment. Following the completion of bonding a 0.012 SS arch wire will be placed on both upper and lower jaw.

All participants will get both verbal and written instructions on maintaining adequate oral hygiene and food restrictions shortly following the treatment. Patients will subsequently recall for observation at 3 weeks interval for a total duration of four months. The operator needs to carefully evaluate and record the number of bracket bond dislodgements at each session. All data will be collected in data collection sheet.

#### **11.4 Data management plan**

Following data collection, it will be examined for errors and incompleteness. Using SPSS for Windows version 30.0, IBM, New York, USA, a database will be created. One by one, the data will be entered into the database until the collection process is complete. Descriptive statistics will be used to further examine the data for the presence of any missing or unusual values. A data file will be created, and all information will be double-checked in both hard copy and soft copy. If necessary, contact to patients will be made. Data will be prepared for final data analysis once all issues has been taken into account.

#### **11.5 Data analysis plan**

Normality test will be carried out. On the basis of normality of data parametric or non-parametric test will be done. The P value is  $<0.05$  will be considered as statistically significant. All the statistical analyses will be performed using SPSS (version 30.0, IBM, New York, USA).

#### **11.6 Study quality control methods**

1. Pretesting of the data collection sheet will be carried out.
2. Every step of the study will be carried out under direct supervision of the guide.
3. All data will be entered and analyzed by an expert.

### **11.7 Ethical considerations**

This clinical trial will be commenced after approval from Institutional Review Board (IRB) of Bangladesh Medical University (BMU) and will adhere to the ethical standards established in the Declaration of Helsinki (2013). All participants will receive comprehensive information regarding the study's aims, methods, potential benefits, and associated risks prior to inclusion. Informed written consent will be acquired from each participant. Confidentiality and privacy will be preserved by utilizing unique identifying codes instead of personal identifiers. Clinical data will be securely archived and utilized exclusively for research reasons. The participants fixed mechanotherapy will be started according to his or her individual malocclusion type. Participants will recall every 3 week interval as a regular follow up period. Interventions will be done on a regularly scheduled visit time. So the patient doesn't need to make any further effort to take part in our research. Precautions will be taken so that the risk of bodily, psychological, and social harm will remain minimal. In an easily understood local language, the study subjects will be informed about the purpose, goals, methodology, risks, and advantages of the study. The study name, study type, patient benefit and risk, confidentiality, and the patient's right to withdraw from the research without interfering with treatment will be included in the written consent. Patients of the Orthodontic Department will give their consent in front of a witness who will also sign the consent form. By avoiding data fabrication, falsification, or selective reporting, the study will uphold scientific integrity. The study's findings will be openly disseminated while participant anonymity is maintained. There is no possibility that the participants would lose any of their important working time because they will not be asked to give extra time for this study. There will be no drugs, placebos, organs, tissues, bodily fluids, fetuses, or abortions to use in this study.

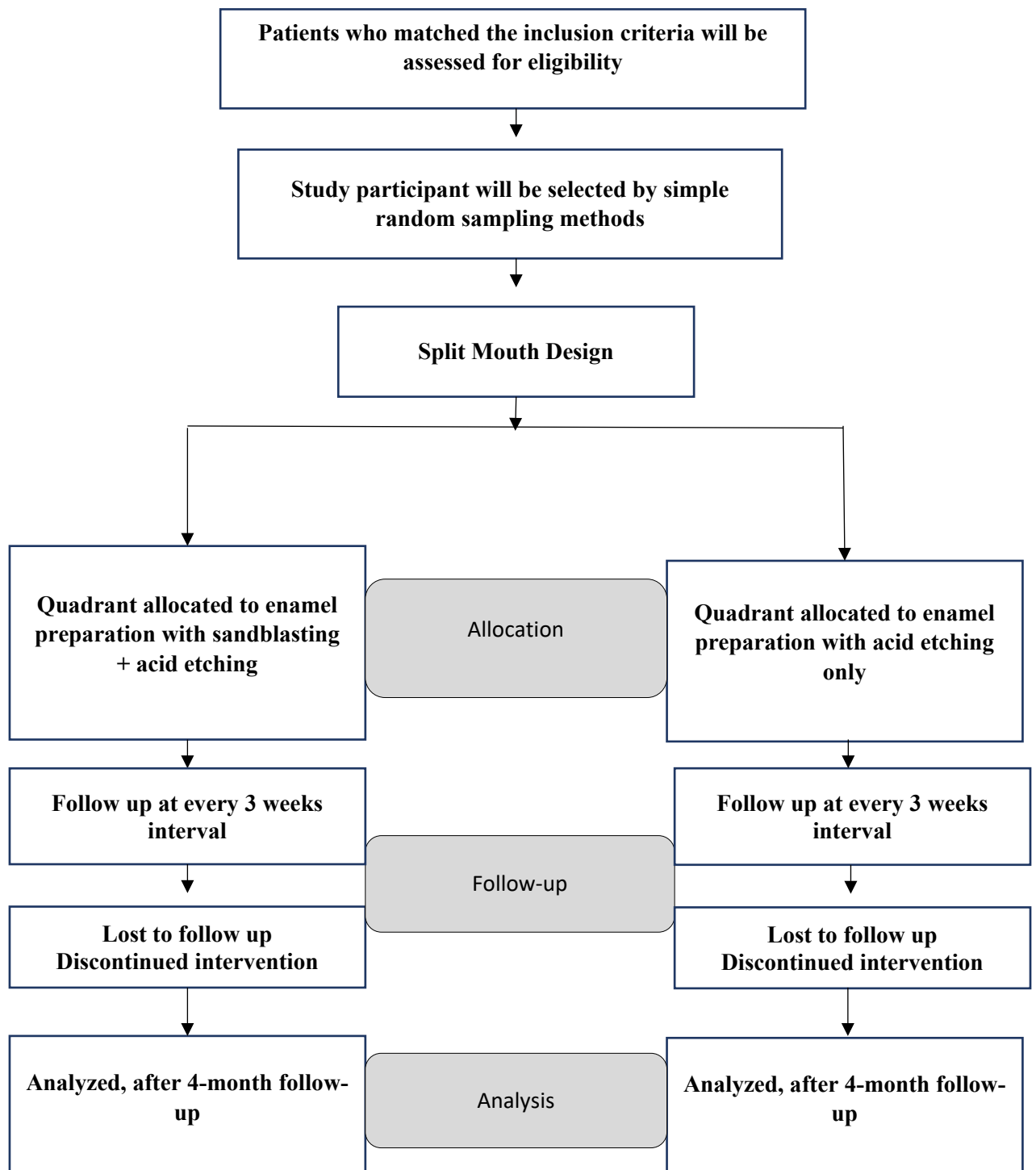
### **11.8 Expected outcome**

Acid etching with sandblasting for enamel preparation may decrease bracket bond failure rate compared to acid etching method alone.

### **11.9 Utilization of outcomes**

The study will help orthodontists identify the more effective enamel preparation technique that minimizes bracket bond failure. This evidence-based approach can lead to improved clinical outcomes, reduced treatment time, and fewer emergency visits due to bracket failure.

## 12. Flowchart of the Study



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## **Appendix-I**

### **Participants Informed Written Consent Form**

**Title: “Comparison of orthodontic bracket bond failure using acid etching with or without sandblasting method for the preparation of enamel”**

**Investigator's name: Dr. Kamrun Nahar Nazia**

MS Resident, Phase-B

Department of Orthodontics

**Institution: Bangladesh Medical University**

I am going to give you information and invite you to be part of this research. Please read this form carefully and ask any question you may have before agreeing to be in the study. You must be 18 years or older to participate in the study.

#### **Purpose of research**

The purpose of the study is to compare the orthodontic bracket bond failure rate using acid etching with or without sandblasting method for the preparation of enamel. By evaluating the effective enamel preparation method the need for bracket rebonding due to bond failure will reduce which will help to attain the desired results within a reasonable timeframe and a manageable number of appointments.

#### **Procedure**

1. Acid etching will be done on one side .
2. Acid etching with sandblasting will be done on the other side.

#### **Duration**

No additional time will be required from the participants for this study, so there will be no chance of loss of their valuable working time.

#### **Side Effects and Risks**

Ethical approval by Institutional Review Board of BMU will be taken prior to commencement of the study. You will be undergoing proper diagnosis and treatment plan in the Department of Orthodontics according to hospital protocol. Your records will be kept strictly confidential. Utmost care will be implemented to prevent any

physical, psychological, personal risks and or hazards to you. Any information revealing your identity as a participant will not be published.

### **Benefits**

You may have benefited from increased bond strength of orthodontic brackets and a reduced number of bracket bond failures. This research will be beneficial for the advancement in the field of Orthodontics and will help to improve the treatment quality for future patients.

### **Confidentiality**

With this research, something out of the ordinary is being done in your community. We will not be sharing the identity of those participating in the research. The information that we collect from this research project will be kept confidential. Information about you that will be collected during the research will be put away and will be accessible only to the researchers involved. Any information about you will have a number on it instead of your name.

### **Sharing the Results**

Before publication of any information regarding the contents of this research, the participants will be informed and their permission will be asked. Confidential information will not be shared.

### **Right to refuse or withdraw**

You do not have to take part in this research if you do not wish to do so. You may also stop participating in the research at any time you choose. It is your choice and all of your rights will still be respected.

### **Questions**

If you have question you may ask them now or later, even after the study has started. If you wish to ask questions later, you may contact the principal investigator.

### **Consent agreement**

I hereby acknowledge that I have completely understood the nature of the study and the benefits of the results of this study in orthodontic practice and I gave my consent willingly to participate in this study.

Witness's signature

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Signature of investigator

1 \_\_\_\_\_

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Participant's signature

Date:

2 \_\_\_\_\_

## Appendix-II

### Data collection sheet

**Title of the study: “Comparison of orthodontic bracket bond failure using acid etching with or without sandblasting method for the preparation of enamel”**

Principle investigator: Dr. Kamrun Nahar Nazia

Patient's Name: Address:

Patient's ID No:

Date:

Nationality:

#### **A. General Information:**

1. Age of the participant (in years):

2. Sex:

1. Male

2. Female

3. Malocclusion type:

1. Class I

2. Class II Division 1

3. Class II Division 2

4. Class III

4. Oral Hygiene Status:

1. Good

2. Fair

3. Poor

5. Food habit usually habituated to:

1. Soft diet

2. Mixed diet

3. Hard diet

6. Acid etching technique and region of the mouth involved

Quadrant Assigned (Split-mouth):

1. Right Side – Acid Etching + Sandblasting
2. Left Side – Acid Etching Only

7. Follow-up Assessment:

1. Follow-up Time:

2. Presence of Bond Failure:

1. Yes
2. No

3. Tooth involved:

8. If Bond Failure Occurs:

1. Side:

1. Right
2. Left

2. Location:

1. Acid Etching + Sandblasting side
2. Acid Etching Only side

2. Investigator Notes

.....

Signature of Investigator:

## Appendix – IV

### GANTT CHART

Sl. No	Tasks	2025			2026								
		1 <sup>st</sup> Month Oct, 2025	2 <sup>nd</sup> Month Nov, 2025	3 <sup>rd</sup> Month Dec, 2025	4 <sup>th</sup> Month Jan, 2026	5 <sup>th</sup> Month Feb, 2026	6 <sup>th</sup> Month Mar, 2026	7 <sup>th</sup> Month April, 2026	8 <sup>th</sup> Month May, 2026	9 <sup>th</sup> Month June, 2026	10 <sup>th</sup> Month July, 2026	11 <sup>th</sup> Month Aug, 2026	12 <sup>th</sup> Month Sept, 2026
1	Title selection												
2	Research Methodology plan												
3	Protocol writing												
4	IRB submission												
5	Literature Review												
6	Data collection												
7	Data analysis												
8	Thesis writing												
9	Thesis submission												