

COMPARISON OF AIR PROPHY AND CONVENTIONAL POLISHING ON PLAQUE SCORES IN ORTHODONTIC PATIENTS. A RANDOMIZED CONTROLLED TRIAL

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Abstract

In the presence of orthodontic brackets, metallic bands, wire ligatures, and other appliances, there is an increased risk of plaque accumulation, which may result in periodontal damage and dental caries. One way of polishing teeth is through the prophylactic polishing paste method. The recent and more conservative approach is that of abrasive powder (e.g., sodium bicarbonate), which is used in prophy jet, which is less abrasive as compared to aluminum oxide particles. The objective of this randomized clinical trial is to compare prophylactic paste and air prophy polishing methods on plaque scores in orthodontic patients who will undergo fixed orthodontic therapy.

A total of 30 patients fulfilling the inclusion criteria were included in this split-mouth randomized controlled clinical trial. Included patient required placement of fixed orthodontic appliances, plaque index should be equal to or greater than 15, patient's age ranging from 12 -30 years. Excluded patients had missing permanent teeth except for 3rd molars, advanced periodontal diseases, systemic diseases, and

allergic to any of the paste content.

All the patients included in the study completed the study. Results showed no significant changes in post plaque score were found between the air prophy and rubber cup groups. A statistically significant change in pre and post-plaque score was found with both air prophy and rubber cup polishing methods.

There was no significant difference in reducing plaque score between air prophy or rubber cup polishing methods. Both methods can be safely used to decrease the plaque score in patients with fixed orthodontic appliances.

Keywords *Key words:* Oral health, fixed orthodontic treatment, plaque score, rubber cup polishing, air prophy jet

Introduction

Healthy oral environment is necessary for patients that undergo fixed orthodontic appliance treatment. Although long term effects of orthodontic treatment on periodontal tissues are debatable, but in presence of orthodontic brackets, metallic bands, wire ligatures and other appliances, there is increased risk of plaque accumulation, which

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may result in periodontal damage and dental caries.¹

To control plaque accumulation and biofilm formation in orthodontic patients, prophylaxis polishing is recommended at regular intervals. If oral environment is not properly isolated from plaque and biofilm, there is increased chance of bracket failure.² After tooth polishing, there is less chances of bracket failure as enamel surface gets smoother.³

One way of polishing teeth is through prophylactic polishing paste method. Factors that influence polishing consists of rubber cup's RPM (revolution per minute), coarseness of prophy paste, pressure maintained at rubber cup and duration of application.⁴ If it is used in excess, it may demineralize enamel structure, which on removal of stimulus gets remineralized in 3 months.⁵

Historically, the standard procedure for in-office dental prophylaxis has included the application of abrasive paste, rubber-cup, and brush for teeth polishing. Smoothing the tooth surface is a crucial aspect of periodontal therapy. Although the naked eye can detect a smooth surface on enamel and cementum after debridement, microscopic examination can reveal numerous surface irregularities. With proper training, air polishing is a secure and efficient method for achieving this goal. While air polishing is a viable alternative for eliminating dental plaque and tooth stains, there have been limited studies comparing its effectiveness in vivo. When it comes to eliminating supragingival plaque and reducing gingival inflammation, air prophy and rubber-

cup, conventional rubber cup brush with paste polishing are found to have similar levels of effectiveness.

Recent and more conservative approach is that of abrasive powder (e.g., sodium bicarbonate), that is used in prophy jet, which is less abrasive as compared to aluminum oxide particles,⁶ that is why it is more suitable for removal of plaque and stains.⁷ Tooth surface abrasion that is caused by prophy jet is so minimal that clinically it is hardly observed, yet there are chances of enamel demineralization.⁸ Oral prophylaxis procedures involve a critical polishing stage that helps to slow down the accumulation of plaque on the root surface. When compared to Sodium Bicarbonate Prophy Powder, Glycine Prophy Powder has been found to be a superior polishing powder due to its ability to produce a smoother root surface with less roughness.

Air-powder polishers are routinely used for cleaning the teeth but it is also handy for enamel prophylaxis and cleaning before brackets bond-up.¹ Gerbo et al found that usage of prophy jet have no adverse effects on bond strength.⁹ Kaur et al found that use of prophy jet removes plaque and pigments more efficiently than prophylactic paste method.¹⁰ Poormoradi et al found a significant decrease of plaque level in both prophy jet and rubber cup polishing method. In terms of efficacy both air powder polishing and rubber cup polishing are reported to be the same but considering time duration, removal of stains by air prophy takes less time.¹¹ Moreover, bracket debonding rate of different prophylactic methods is reported to be 3.5 - 25%.⁸

To our knowledge, air prophylaxis jet has not been evaluated with randomized clinical trial for oral hygiene (through plaque index) in fixed orthodontic patients in Pakistan. Therefore, the purpose of this randomized clinical trial is to compare prophylactic paste and air prophylaxis polishing method on plaque scores in orthodontic patients that will undergo fixed orthodontic therapy. If proven to be more efficient and effective, air prophylaxis jet may replace the conventional rubber cup prophylactic polishing method.

Materials & Methods

This study was approved by Institutional Review Board (IRB-2020-11-046) of Rehman College of dentistry. Written informed consent from the patients was taken after clarification of the purpose of the intervention and the associated risks and benefits. This was randomized controlled clinical trial. It had 2-arm split-design in which right side of each patient was randomized to either experimental group or control group.

The sample size was calculated using open epi with the following parameters:

Power of the study= 80%

α error = 0.05

Mean and standard deviation of Air prophylaxis method: 11.57 ± 4.39 .¹

Mean and standard deviation of Prophylactic paste method: 23.74 ± 8.17 .¹

The calculations yielded a required sample of 10 per group; however, a sample of 15 per group was taken to further increase the

power of the study. This led to a sample size of 30 patients.

The included patients had fixed orthodontic appliances and plaque score was no less than 15. Those patients with missing permanent teeth except for 3rd molars, advanced periodontal diseases, systemic diseases and allergic to any of the prophylactic paste content were excluded.

Orthodontic treatment was started in all subjects using fixed preadjusted edgewise appliance (0.022-in MBT prescription, Ortho Organizers, Inc. USA). Once included into the study, the dentition quadrants were randomized to each intervention using random table generated in Microsoft Excel. The random allocation sequence was concealed in opaque envelopes, which were opened at the time of procedure.

Patient was seated on a dental chair. Patient was given a disclosing agent tablet. After chewing it for some time, the patient spit it out so that remains of disclosing tablet was removed from tooth surfaces. A periodontal examination was performed to calculate plaque index for each patient using O'Leary's method by recording presence or absence of disclosing agent on four surfaces (buccal, lingual, mesial, and distal) of all teeth.¹² plaque score was then be calculated.

The procedure of plaque calculation and prophylaxis methods was explained to the patient. The dental chair was then retroclined to achieve optimal posture for the operator.

Rubber cup polishing method was carried out by a micromotor (EX-203, NSK)

with rubber cup attached (SD-310, StarDent Equipment Co, Ltd). Paste containing pumice and fluoride salts (stannous fluoride) were used. The procedure was started from the central incisors working posteriorly towards 2nd premolars in all quadrants.¹²

Air prophylaxis jet method was carried out through pressurized air containing powder (20-80µm, CHARMING OEM) and water using prophylaxis jet (Dental polisher, Shukang). Air prophylaxis jet was kept at 2-3 mm distance from enamel surface, with angle of 60-70° with long axis of tooth.¹²

The statistical analyses were performed using SPSS version 26.0. Means and standard deviation were calculated for quantitative variable i.e., age. Frequencies and percentages

were calculated for the qualitative variables such as gender and plaque levels. Comparisons between the effects of two interventions were performed through paired T test and Chi Square/Fischer exact test. A p value of 0.05 or less will be considered significant.

Results

The study included 30 patients with mean age of 25.2±3.7 years of which n=21 (70%) was male mean age of (25±3.5 years) and n=9 (30%) was female mean age of (26.7±3.9 years). Minimum age was 20 years and maximum age of 32 years. The frequencies and percentages of gender distribution are shown in (Table 1 and figure). The comparison of age between male and female is not significant p>0.05 (Table 1).

Variable	Condition	Total
Gender	Male	21
	Female	9
	Mean	SD
Age	25	3.5

Table 1: Gender and age distribution

According to **Table 2**, mean plaque index in air powder polishing method before intervention was significantly higher than mean plaque index after intervention, and this difference was statistically significant. The mean of this index in rubber cup polishing method after intervention was less than before

intervention (but not as air prophylaxis method). Furthermore, the mean (SD) comfort in rubber cup polishing and air powder polishing method was which was statistically significant (P<0.001).

The mean plaque score in patients with prophylaxis jet method after intervention is

29.1±8.1. The mean plaque score in patients with rubber cup method after intervention is 27.9±9. There is no statistically significant difference of plaque score after comparing both methods with each other (Table 2).

Moreover, the mean (SD) comfort in rubber cup polishing method and air prophy polishing method Was 51 % and 77% respectively.

Table 2: Effects of APP and RCP on plaque scores

Plaque index	Mean (SD) APP	RCP	Test results
Before intervention	39.6±8.8	39.4±9.9	P=0.202
After intervention	10.9±4.2	11.6±3.2	
Test results	P<0.001	P<0.001	

Discussion

The objective of our study was to compare two polishing methods for removal of plaque and to ensure oral and dental well-being of patients undergoing orthodontic treatment as well as to provide health education and offer necessary medical assistance. We found no statistically significant difference in RCP and APP method: P= 0.078. Plaque score in RCP group was 39.4±9.9 before polishing and 11.6±3.2 after polishing. Plaque score in APP group was 39.6±8.8 before polishing and 10.9±4.2 after polishing commencement.

Plaque reduction can be done by various methods including tooth brushing, interdental aids, chlorhexidine, oral probiotics, polymeric tooth coatings, nanoparticles, Argon laser curing, rubber cup polishing and air prophy polishing. Air prophy polishing uses specialized hand piece that generates a jet of pressurized air, water, and powder. Powder is main component of APP. Advantages include

efficient plaque removal, less operative fatigue, and time efficiency.¹³ Powder is an important component of air polishing system. Various powder preparation available are amino-acid glycine salt, glycine, calcium carbonate, aluminium Tri hydroxide, calcium sodium phosphor silicate, erythritol and sodium bicarbonate.¹⁴ Air prophy polishing using aluminium Tri hydroxide powder, which is less abrasive and water soluble, without permanent damage to the gingiva is effective on removing plaque. In our study, sodium bicarbonate powder was used. Sodium bicarbonate is non-toxic and water soluble that is why it is more suitable for intra oral use. The study conducted by Barnes et al, revealed that air prophy polishing exhibited significant efficacy in plaque removal. Notably, it surpassed the rubber cup polishing method by reducing treatment time and enhancing patient comfort. Furthermore, their findings indicated that employing the air prophy polishing system did not have any detrimental effects on resin

composites or the bonding of brackets, nor did it cause damage to wires or other orthodontic appliances. Ramaglia et al.'s research results indicated that, when compared to rubber cup polishing, the air prophy polishing system did not inflict any harm on dental appliances. Advantages of sodium bicarbonate are cheap to produce, alkaline nature of sodium bicarbonate and large individual particle size Rubber cup polishing was done with pumice.¹⁵ Plain, fine, flour pumice and water mixture were used to prepare paste. A reduction of 48% of plaque score was considered statistically significant, our panel of experts agreeing on 20 % of plaque reduction as clinically significant.¹⁶ O'Leary plaque index has several advantages over others PI. It can be used for oral hygiene education; quantifying plaque and it does not include 2nd molar which is difficult clean and analyse.¹⁷

There was no significant difference in plaque score between rubber cup polishing and air prophy polishing, i.e. (P= 0.202). Both methods significantly reduced plaque score. Based on our results, the average plaque scores in rubber cup polishing were more than in the air prophy polishing technique. In our study no statistically significant gender-based difference in RCP and APP method: P= 0.078.

In addition, the average patient satisfaction rate was greater with air prophy polishing than with rubber cup polishing. Excellent satisfaction for APP was 77% for APP and 55% for RCP. Patient satisfaction was more for APP method. That is contributed to less noise and time reduction.¹³

One of the important characteristics of this study is the maximum control of confounding factors by designing a clinical trial. Both treatments were performed simultaneously in each patient. Each method was done by a dentist on both sides of the mouth in the form of a cross-arch (split-mouth design), to make two groups alike and the pre-study data became homogeneous. The use of the disclosing tablet before the polishing allowed all plaques to be seen; this improved the polishing.

The outcome of our results is in line with the findings of Kaur et al., who observed a significant reduction in plaque scores with the use of both the air prophy jet and rubber cup polishing. In a different study conducted by Simon et al., focusing on individuals with chronic periodontitis. They noted that the application of glycerine and ultrasonic polishing resulted in a decrease in plaque scores. It's worth mentioning that in the ongoing study, the participants did not have periodontitis or gingival decay.

As per the conclusions drawn from this study, it is essential to include professional prophylaxis as part of the care provided to patients receiving orthodontic treatment. This precaution is necessary due to the heightened risk of dental caries and gingival diseases that can occur during orthodontic procedures. To evaluate this goal, the air prophy polishing method can be proposed as an efficient way requiring less time.

Assessment of gingival health and plaque levels using clinical indices does have some limitations. They are visual grading

systems that rely on operator assessment. An inherent weakness of clinical indices is that they rely on the examiner to consistently apply the index over time. They are however cheap, convenient, and widely accepted throughout the literature. For these reasons the most appropriate index was utilized in our RCT.

Conclusions

Air prophylaxis and rubber cup polishing both demonstrated significant effectiveness in reducing plaque scores. Notably, there was no statistically significant distinction between the plaque scores achieved with air prophylaxis (APP) and rubber cup polishing (RCP). Furthermore, patients expressed greater comfort and satisfaction when undergoing air prophylaxis jet polishing.

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