

Comparative evaluation of gingival trauma by Prophy-Jet and rubber-cup polishing techniques using aluminium trihydroxide

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Abstract

Objective: The aim of the present study was to compare the gingival trauma with Prophy-Jet and rubber-cup polishing techniques using aluminium trihydroxide as polishing agent. **Materials and Methods:** 15 subjects suffering from gingivitis were enrolled in a randomized controlled split mouth experimental investigation. After scaling, Prophy-Jet and rubber-cup polishing techniques were applied on either side of the mouth using aluminium trihydroxide as polishing agent and the gingival trauma was assessed immediately after, 7 days and 21 days posttreatment using trauma index (TI). **Results:** Statistically significant difference was observed in the mean TI scores of gingiva immediately after polishing with the two techniques, with the mean score of 0.25 ± 0.12 after rubber-cup and 0.40 ± 0.11 after prophy-jet polishing technique. **Conclusion:** Within the limitations of the study, it can be concluded that inspite of higher gingival trauma immediately after air polishing using aluminium trihydroxide agent, there was no lasting difference in gingival trauma between rubber-cup and air-polishing techniques at 7 and 21 days posttreatment.

Key words: Air polishing, aluminum trihydroxide, rubber-cup polishing, trauma

INTRODUCTION

Supragingival, subgingival plaque and stain removal is crucial for the maintenance of periodontal health.^[1] Various longitudinal studies have shown the efficacy of the standard treatment approach consisting of a combination of systematic scaling and root planning,^[2] patient's daily meticulous oral hygiene and regular maintenance visit to remove newly formed subgingival deposits.^[2,3] However during maintenance therapy, regular mechanical scraping of the tooth surfaces by the patient, supplemented by professional plaque and stain removal will lead to cumulative damage in the form of tooth substance loss and surface roughness.^[4] This roughness favors constant plaque accumulation, especially on the proximal and cervical sites, and enhances the chances of recurrence of gingival inflammation. Hence, tooth polishing, a process of

smoothing the rough surfaces and removing stains, has been advocated as an adjunct to mechanical plaque removal for the effective maintenance of disease-free periodontium.

For over half a century, the most common method of polishing was using rubber-cup and paste technique. The polishing paste consisted of flour of pumice, glycerine, color additive and in addition, sodium fluoride or stannous fluoride was added for desensitizing effect.^[5-7] Lately, commercially available injection abrasive water jets, also known as air polishing devices have emerged as an alternative to hand curetment and rubber-cup polishing.^[8,9] These devices use an abrasive powder introduced into a stream of compressed air to clean or polish a surface by removing deposits with higher efficiency or by smoothening its texture.^[10,11]

Sodium bicarbonate was the first air polishing powder used with Prophy-Jet technique.^[10] However, due to

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Quick Response Code:



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DOI:

10.4103/0975-962X.163041

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its high abrasiveness and restricted use in sodium intolerant patients, newer agents such as calcium carbonate, glycine, calcium phosphor silicate and bioactive hydroxyapatite are continuously being explored.^[12,13]

Recently aluminum trihydroxide has been introduced in the market as an alternative to the conventional agents. The mean particle size of the aluminum trihydroxide crystal is 80–325 μm with Moh's hardness of 2.5–3.5 and crystal shape is rounded.^[10]

During polishing, these agents are known to inevitably affect the gingival epithelium surrounding the tooth. Hence, some amount of gingival trauma occurs inadvertently during the procedure. But whether the degree of gingival trauma depends on the technique of polishing is still under investigation.^[14,15] So, the aim of this study was to compare the gingival trauma with the two polishing techniques viz., Prophy-Jet and rubber-cup polishing techniques utilizing the novel aluminum trihydroxide polishing agent.

MATERIALS AND METHODS

Subject selection

Fifteen patients suffering from gingivitis, from the Department of Periodontology and Oral Implantology, National Dental College and Hospital, Derabassi (Punjab) were screened and selected according to the following inclusion and exclusion criteria.

Inclusion criteria

- Patients having slight to moderate generalized gingivitis
- Patients with probing depth of ≤ 4 mm
- Patients with > 18 years of age
- Having a minimum of 20 teeth.

Exclusion criteria

- Patients using orthodontic and prosthetic appliances
- Pregnant patients
- Smokers or who used any form of tobacco product
- History of allergy to abrasives
- History of any uncontrolled systemic disease
- Edentulous patients.

Study design

A randomized, controlled split-mouth experimental design was used to compare the effect of Prophy-Jet and rubber-cup and paste techniques on gingiva using aluminum trihydroxide polishing agent [Figures 1 and 2].



Figure 1: Air-prophy unit and micromotor with rubber cup

One week prior to the beginning of the study, the patients were subjected to atraumatic supragingival calculus removal. Any stain, if observed was left intact. The patients were instructed to discontinue the use of mouthwash until the study was to be over and to practice routine oral hygiene. Prophy-Jet and rubber-cup polishing techniques with aluminum trihydroxide were randomly allocated (using a coin toss method) to either side of the mouth. The effects on gingiva were scored by a single examiner, immediately after, 7 days and 21 days posttreatment on the facial and lingual side of each quadrant using trauma index (TI) reported by Weaks *et al.*^[16]

Scoring criteria

- No abrasion, no bleeding, no color change
- No noticeable epithelial abrasion, slight bleeding, slight color change
- Some epithelial abrasion, considerable bleeding, marked color change and
- Marked abrasion exposing underlying tissue, profuse bleeding, and considerable color change.^[16]

The papillae between the maxillary and mandibular central incisors were not scored so as to prevent cross-contamination between the two techniques. The gingiva around the third molars was also not scored.

Methods

- For air polishing, a slow speed handpiece and prophy angle was used with aluminum trihydroxide polishing powder. The tip of the Prophy-Jet was kept 4–5 mm from the tooth surface and the spray was centered on the middle third of the tooth. A constant circular motion was used, and care was taken not to direct the spray into the sulci. The spray was directed at an 80° angle toward the gingiva, in a slightly distal direction, for cleaning

molars and premolars, and at a 60° angle toward the gingiva for cleaning cuspids and incisors. All teeth were polished, whether stain and plaque were present or not, as is routinely done during standard prophylaxis procedures

- For rubber-cup and paste technique, the paste used was a plain, fine, aluminum trihydroxide and water mixture, which was filled in the cup and was also spread over the teeth in the area to be polished. Finger rest was established and the cup was placed in contact with tooth. The stroke was from the gingival third toward the incisal third of the tooth. Using the slowest speed, the revolving cup was applied lightly to the tooth surface for 1–2 s with a patting, wiping motion and an overlapping stroke.^[16,17]

In the absence of stain and plaque a minimum of two back and forth sweeps of each facial and lingual tooth surface was made with either the Prophy-Jet or rubber-cup.

Statistical analysis

All statistical analysis has been carried out using the Statistical Package for the Social Sciences, version 15 software package (IBM SPSS Data Collection). Mean and standard deviations were calculated for the variables to be compared. Nonparametric analysis for changes in the gingival trauma was assessed using the *t*-test.

RESULTS

The mean TI scores immediately after the rubber-cup polishing technique was 0.25 ± 0.12 and after Prophy-Jet polishing technique was 0.40 ± 0.11 [Table 1] which showed a statistically significant difference in trauma between the two techniques.



Figure 2: Aluminum trihydroxide polishing agent

A statistically significant reduction in the mean TI scores was observed at 7 and 21 days post-treatment [Table 2] after both the techniques with the mean TI score of 0.01 ± 0.02 with rubber-cup and 0.02 ± 0.05 with Prophy-Jet technique at 21st day of evaluation. However the relative trauma scores of either of the technique were not significantly different at 7 and 21 days.

The mean change in the TI scores of the two techniques is depicted in Table 2 and the comparison of the mean change is summarized in Table 3. It indicates a significantly more decrease in TI scores after air polishing technique with the mean reduction maximum between immediately after and 21 days interval.

DISCUSSION

Recently, there has been many comparisons made between the use of air polishing treatments versus rubber-cup prophy treatments by Vande Velde

Table 1: Intergroup comparison of mean TI scores with the two techniques at different intervals

	Mean±SD		P
	Rubber-cup polishing	Prophy-Jet polishing	
Immediately after	0.25±0.12	0.40±0.11	0.001
After 7 days	0.06±0.06	0.12±0.12	0.079
After 21 days	0.01±0.02	0.02±0.05	0.411

TI: Trauma index; SD: Standard deviation

Table 2: Intragroup mean change of TI scores between different intervals after polishing with two techniques

	Mean change±SD		
	Immediately after and 7 days	7 days and 21 days	Immediately after and 21 days
Rubber-cup polishing	0.19±0.09	0.04±0.05	0.23±0.11
P	<0.001	0.005	<0.001
Prophy-Jet polishing	0.28±0.12	0.10±0.12	0.37±0.11
P	<0.001	0.007	<0.001

TI: Trauma index; SD: Standard deviation

Table 3: The intergroup comparison of mean change in TI scores between different intervals after polishing with two techniques

	Mean change±SD		P
	Rubber-cup polishing	Prophy-Jet polishing	
Immediately after and 7 days	0.19±0.10	0.28±0.12	0.046
Immediately after and 21 days	0.23±0.11	0.37±0.11	0.002
7 days and 21 days	0.04±0.05	0.10±0.12	0.124

TI: Trauma index; SD: Standard deviation

et al., Adriaens *et al.*, and De Boever *et al.*^[18] Our ongoing pursuit is to evaluate and compare gingival trauma after Prophy-Jet and rubber-cup polishing techniques using aluminum trihydroxide polishing agent.

Aluminum trihydroxide was the first air polishing agent developed as an alternative to specially processed sodium bicarbonate for patients who are sodium intolerant.^[19] In terms of hardness, it's rated 4 on the Mohs scale. It is safe for enamel and is indicated as a polishing agent on heavily stained enamel surfaces.^[19]

For the assessment of gingival trauma, TI given by Weaks *et al.*, has been utilized in the study. It has got good sensitivity and reliability and is one of the most common index used to quantify gingival trauma in terms of presence or absence of gingival color change, bleeding and abrasions.^[15,16]

The results of the study revealed that there was a statistically significant difference in the gingival trauma immediately after rubber-cup and air polishing. While there was evidence of more trauma immediately after use of the Prophy-Jet technique as compared to rubber-cup technique, none of the techniques caused active hemorrhage or gingival erosions after treatment. At 7 and 21 days, no statistically significant difference in gingival trauma was seen with both the techniques. This can be attributed to the quick healing response of gingival leading to the complete epithelization of the wound at 7th day.^[19-22]

Similar finding have been earlier reported by Weaks *et al.*,^[16] Baer^[15] Mishkin *et al.*,^[20] and Kontturi-Närhi *et al.*,^[21] who showed an increased gingival bleeding and trauma immediately after air polishing which could no longer be detectable and clinically insignificant at 7 and 21 days of evaluation.

In our study, one of the 15 subjects complained of peeling of the inner aspect of the lower lip after polishing, which again was not evident by 7th day of evaluation. It could be due to insufficient rinsing of the mouth during the procedures that allowed the abrasives to pool and cause irritation to the soft tissue in that area.^[19]

As reported in the results, no major gingival damage occurred during polishing. Although some initial soft tissue impact was observed but postoperative follow-up at 7 and 21 days showed that the relative trauma scores of either air polishing or rubber-cup treatment were not significantly different. Air polishing

offers many advantages to clinicians and their patients and it has been reported that its less time consuming and effective in heavily stained surfaces (e.g., smoking and chlorhexidine stain), thus minimizing the operator and patient fatigue.^[23-27] It will be exciting to see the results of additional research to see, if there is a point where speed and efficacy of air polishing treatment can override clinically insignificant soft tissue impact and provide superior treatment outcomes.

CONCLUSION

Our findings suggested that in spite of higher gingival trauma immediately after air polishing using aluminum trihydroxide, there was no lasting difference in gingival trauma between rubber-cup and air polishing techniques in subjects suffering from gingivitis. Gingival bleeding and color change are temporary soft tissue effects of polishing and are not clinically significant at 7 and 21 days posttreatment. It is likely that there will be many new developments that will enhance the use and efficacy of air polishing in the very near future.

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How to cite this article: Kaur G, Grover V, Malhotra R, Kapoor A. Comparative evaluation of gingival trauma by Prophy-Jet and rubber-cup polishing techniques using aluminium trihydroxide. Indian J Dent 2015;6:130-4.

Source of Support: Nil. **Conflict of Interest:** None declared.