COMPARATIVE EVALUATION OF THREE DIFFERENT POLISHING METHODS ON ENAMEL SURFACE ROUGHNESS: AN IN-VITRO STUDY

Dr. Deep Gagan Gupta[1], Dr. Harveen Singh[2], Dr. Gaurav Kansal[3], Dr. Bhagwan Dass Puri[4], Dr. Sayed Tahir Bukhari[5], Dr. Mehtab Singh Kamal[6], Dr. Aasiya Gul[7], Dr. Arushi Goyal[8]

Article History: **Received:** 05.03.2023 **Revised:** 20.04.2023 **Accepted:** 05.05.2023

Abstract

AIM: To compare and evaluate the effect of three different polishing methods in reducing the tooth surface roughness after scaling and root planing.
Materials & methods: 60 freshly extracted incisors were included in the present study. Only those specimens were obtained which were extracted because of periodontal reasons. After randomization, three study groups were formed with 20 specimens in each group as follows: Group 1: Polishing was done with rubber cups and prophylactic paste, Group 2: Polishing was done with air polisher and Group 3: Polishing was done with stain buster burs.
Results: On comparing the before polishing and after polishing values among group 1 specimens, statistically significant results were obtained. On comparing the before polishing and after polishing values among group 2 specimens, statistically non-significant results were obtained except for Rt values. On comparing the before polishing and after polishing values among group 3 specimens, statistically significant results were obtained. After polishing, whilecomparing the Ra, Rq, Rz, Rmax and Rt values in between group 1 andgroup 2 & in between group 2 and group 3, significant results were obtained. However; while comparing in between group 3 and group 1, statistically non- significant results were obtained. Hence; while analysing and comparing the results statistically, the efficacy of the three study groups was found in following order: GROUP 1 = GROUP 3 > GROUP 2.
Conclusion: Repeated polishing has iatrogenic effects depending on increasing the life time of the teeth. Careful selection of patients on whom polishing will be applied will reduce the complications and adverse effects. In the presentstudy, we tried to create a scientific guide for the clinical application of polishing processes. According to the results, stain buster burs seem to be an alternative to traditional polishing materials because they provide smooth surfaces like prophylaxis paste and ease of application like air-polishing techniques.

Keywords: Polishing; Scaling; Stain buster burs.

[1]PG student, Department of Periodontology, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab.
[2]Professor and HOD, Department of Periodontology, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab.
[3]Professor, Department of Periodontology, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab.
[4]PG student, Department of Periodontology, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab.
[5]PG student, Department of Periodontology, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab.
[6]PG student, Department of Periodontology, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab.
[7]Sr. Lecturer, Department of Periodontology, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab.
[8]Sr. Lecturer, Department of Periodontology, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab.

***Corresponding Authors:**
Dr Deep Gagan Gupta, PG student, Department of Periodontology, Genesis institute of dental sciences and Research, Ferozepur, Punjab.

Email:- guptadental07@gmail.com

DOI: 10.31838/ecb/2023.12.s3.599

1. Introduction

The external tooth coloration, plaque, calculus and bacterial components are removed during the scaling and root planing (SRP). The teeth surface should be smoothened with minimal damage. SRP procedure plays an important role in maintaining periodontal health and preventing recurrence of the disease.For this purpose, hand instruments were commonly used in the past. Nowadays, sonic and ultrasonic devices are often used in addition to hand instruments in periodontal treatment.[1]

Although enamel and cementum show a smooth surface clinically after debridement with the naked eye, they present with several surface irregularities that can be detected microscopically. Several studies have observed that subgingival instrumentation leads to surface roughness, resulting in a significant effect on subgingival colonization of microorganisms. A smooth enamel or cementum is less likely to accumulate plaque which can only be achieved by performing polishing after scaling and root Planing.[2]

Roughness of the residual root surface as a result of instrumentation is another important consideration in periodontal therapy. A wide variety of prophylactic materials and techniques are being employed in the dental office for the removal of stain and calculus. Unfortunately, little research has been done concerning the effect of these materials upon the enamel and dentin surfaces. It is quite possible that certain types of materials and techniques now being employed are detrimental to the tooth surface. Such deleterious effects could occur not only from excessive abrasion and resulting tooth loss but also from production of a rough, dull surface which might accumulate stain and debris more rapidly. If possible, one would desire a prophylactic agent in which the material will have adequate cleansing power, yet leave a surface which is, or can be, easily polished. A polished surface will be better aesthetically and will remain cleaner for a long period of time.[3]

In spite of numerous techniques and materials being available for getting rid of the plaque and extrinsic stains, none has qualified as a gold standard treatment modality till date. Routine home dental polishing done with powered toothbrush and whitening paste, although effective, still lacks efficiency in inaccessible areas, thus necessitating a more efficient professional polishing other than conventional rubber-cup polishing.[4] Use of traditional polishing methods, i.e. a rubber-cup with prophylaxis paste, has been shown to remove the fluoride-rich outer layer of the enamel and cause significant loss of cementum and dentin over time. With the growing body of evidence to support alternative tooth polishing methods, air polishing part has shown more promising results not only for supragingival polishing but also for effective subgingival plaque removal.[5] Various studies conducted so far involve a range of manual polishers such as porte polisher, polishing strips, and engine-driven polishing devices such as rubber cups, brushes attached to prophy angles, and air-powder polishers along with polishing pastes/powder; and their effects on the hard as well asthe soft tissues of the oral cavity.[5] Stain buster burs are evaluated as the new material for polishing. These burs are made of glass fiber reinforced resins that are enriched by zircon. They are designed for removing the colored layers, stains and cement from enamel surface.[6] A large amount of information is available about finishing and polishing of the restorative materials on the tooth surface, but less attention has been given on polishing of the enamel and cementum surface, which perhaps is the most vital part of periodontal therapy. Thus, the objective

of this study was to evaluate the effect of three different polishing methods in reducing the tooth surface roughness occurring after ultrasonic scaling.

2. Material and methods

The present study was conducted in the department of Periodontology of Genesis Institute of Dental Sciences and Research, Ferozepur with the aim of comparing and evaluating the effect of three different polishing methods in reducing the tooth surface roughness after scaling and root planing.

Methodology

In this study, 60 incisors extracted for periodontal reasons were used. **(Figure 1, 2)** After the extraction, teeth were washed under running water for 1 minute, it was maintained in distilled water. All teeth were scaled using the ultrasonic device (woodpecker ultrasonic scaler) in contact with the lateral surface of teeth, in facio-lingual direction and with light pressure. **(Figure 3)** The scaling was stopped when the test area seemed smooth and clean by visual inspection. Following the completion of scaling process, teeth were randomly divided into 3 groups of 20 teeth each.

Group 1: Each tooth was polished by using dental prophylaxis paste (Protec) and rotary rubber cup (Addler) for 5 seconds using micromotor and contra angled handpiece at the speed of 7000 rpm. **(Figure 4 & 5)**

Group 2: Each tooth was polished by using air flow air polisher (Dentmark). Cleaning powder (Clinpro) mint flavour sodium hydrogen carbonate was used in air polisher device for 5 seconds. Each tooth was held at right angle while using the device and it was 1-1.5 cm away in average. **(Figure 6 & 7)**

Group 3: Each tooth was polished by using stainbuster bur (Two stripe and Trihawk) for 5 seconds. It is used with the help of micromotor and contraangle latch type hand piece (NSK) at 6000 rpm with slight pressure and with irrigation water spray. **(Figure 8 & 9)**

Root surfaces of teeth were removed by cutting from cement-enamel junction, as the measurement of roughness was only be limited to the enamel surface. 20 teeth were fixed in self-cure acrylic in each group so that the measurements could be performed quickly and accurately.

Teeth were evaluated in terms of surface roughness by profilometer (Mitutoyo). **(Figure 10)** It is SJ-210, is portable, handheld surface roughness tester with a 2.4 inch, colour, backlit Led screen that displays in vertical and horizontal orientation. It is also called surface tester, surface roughness tester, roughness gage or surface finish gage. It is a device has an ingress protection (ip)-53 rating for water and dust resistance.

This profilometer works on the principle that Stylus of profilometer use a probeto detect the surface, physically moving a probe along the surface in order to acquire the surface height. This is done mechanically with a feedback loopthat monitors the force from the sample pushing up against the probe as it scans along the surface.

The unit has a stylus alarm that indicates when cumulative measurement distance exceeds the present limit. Profilometer measurements included Ra, Rq, Rz, Rmax and Rt values and surface graphics.

These values are:

Ra: Arithmetic average value of all absolute distance of roughness profile.

Rq: Root mean square roughness is the square root of the sum of the squaresof the individual heights and depth from the mean line.

Rz: Average maximum peak to vally of five consecutive sampling length within the measuring length.

Rmax: Maximum roughness depth.

Rt: Roughness depth.

All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis using SPSS software. Student t test was used for evaluation of level of significance. P-value of less than 0.05 was taken as significant.

Figure 1: Study Material

Figure 2: Extracted teeth before scaling

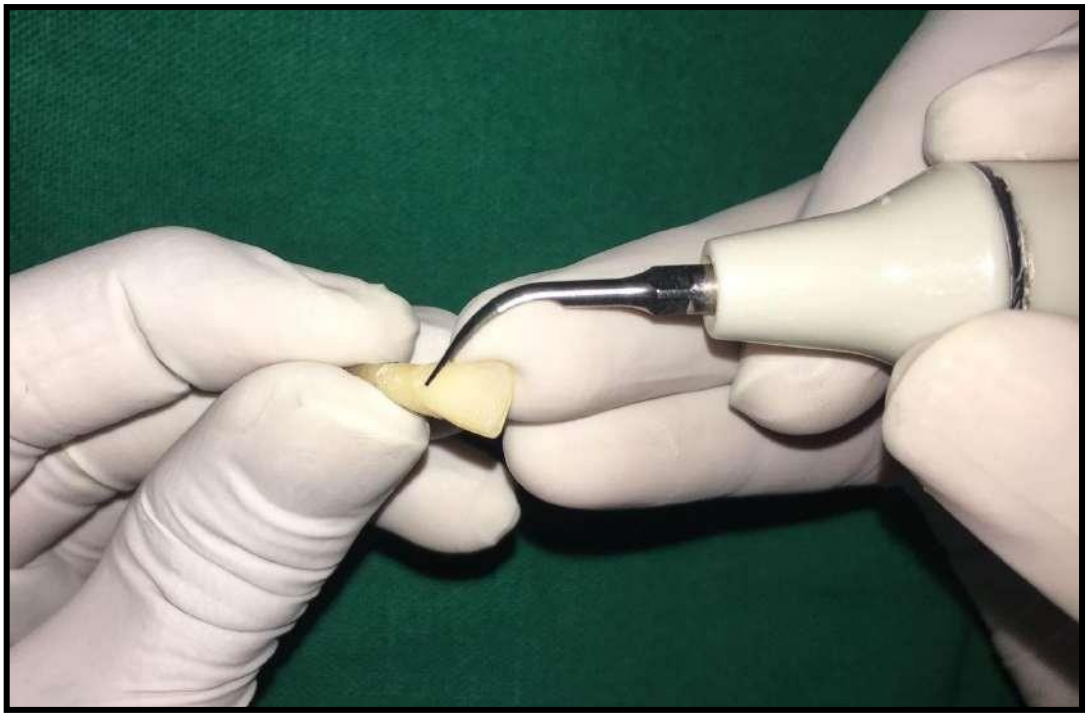

Figure 3: Sample after scaling

Figure 4: After scaling incisor samples

Figure 5: Group 1 Polishing done with rubber cups and prophy paste

Figure 6: After scaling incisor samples

Figure 7: Group 2 polishing done with air polisher

Figure 8: After scaling incisor samples

Figure 9: Group 3 polishing done with stain buster burs

Figure 10: Samples fixed in self-cure acrylic

Figure 11: Profilometer

3. Results

The present study was conducted in the department of Periodontology of Genesis institute of dental sciences and research with the aim of comparing and evaluating the effect of three different polishing methods in reducing the tooth surface roughness after scaling and root Planing. 60 freshly extracted incisors were included in the present study. Only those specimens were obtained which were extracted because of periodontal reasons. After randomization, three study groups were formed with 20 specimens in each group as follows:

Group 1: Polishing was done with rubber cups and prophylactic paste,

Group 2: Polishing was done with air polisher and

Group 3: Polishing was done with stainbuster burs.

In Group 1 (Table 1)

Mean Ra value before polishing was 0.778 ± 0.84 and after polishing was 0.559 ± 0.08 with p-value of 0.000* which is statistically highly significant.

Mean Rq value before polishing was 1.174 ± 0.101 and after polishing was 0.748 ± 0.09 with p-value of 0.000* which is statistically highly significant.

Mean Rz value before polishing was 4.561 ± 0.296 and after polishing was 0.559 ± 0.08 with p-value of 0.000* which is statistically highly significant.

Mean Rmax value before polishing was 7.965 ± 0.321 and after polishing was 3.891 ± 0.416 with p-value of 0.000* which is statistically highly significant. Mean Rt value before polishing was 8.232 ± 0.252 and after polishing was 4.438 ± 0.476 with p-value of 0.000* which is statistically highly significant.

In Group 2 (Table 2)

Mean Ra value before polishing was 0.738 ± 0.105 and after polishing was 0.759 ± 0.083 with p-value of 0.422 which is statistically non-significant.

Mean Rq value before polishing was 1.106 ± 0.125 and after polishing was

1.217 ± 0.164 with p-value of 0.682 which is statistically non-significant.
Mean Rz value before polishing was 3.423 ± 0.276 and after polishing was 3.587 ± 0.265 with p-value of 0.771 which is statistically non-significant.
Mean Rmax value before polishing was 5.065 ± 0.277 and after polishing was 5.638 ± 0.657 with p-value of 0.621 which is statistically non-significant.
Mean Rt value before polishing was 5.526 ± 0.535 and after polishing was 6.376 ± 0.499 with p-value of 0.000* which is statistically highly significant.

In Group 3 (Table 3)
Mean Ra value before polishing was 0.693 ± 0.08 and after polishing was 0.571 ± 0.074 with p-value of 0.000* which is statistically highly significant.
Mean Rq value before polishing was 1.084 ± 0.148 and after polishing was 0.757 ± 0.142 with p-value of 0.000* which is statistically highly significant. Mean Rz value before polishing was 3.384 ± 0.429 and after polishing was 2.264 ± 0.355 with p-value of 0.000* which is statistically highly significant.
Mean Rmax value before polishing was 6.431 ± 0.414 and after polishing was 3.642 ± 0.460 with p-value of 0.000* which is statistically highly significant. Mean Rt value before polishing was 7.217 ± 0.376 and after polishing was 4.092 ± 0.375 with p-value of 0.000* which is statistically highly significant.

On Comparison between Groups
In intergroup comparison, the value of Ra between group 1 and group 2 is statistically highly significant with a p-value of 0.01*. The value of Ra betweengroup 2 and group 3 is statistically highly significant with a p-value of 0.00*. The value of Ra between group 1 and group 3 is statistically non-significant with a p-value of 0.75. **(Table 4)** In intergroup comparison, the value of Rq between group 1 and group 2 is statistically highly significant with a p-value of 0.01*. The value of Rq between group 2 and group 3 is statistically highly significant with a p-value of 0.00*. The value of Rq between group 1 and group 3 is statistically non-significant with a p-value of 0.335. **(Table 5)** In intergroup comparison, the value of Rz between group 1 and group 2 is statistically highly significant with a p-value of 0.00*. The value of Rz between group 2 and group 3 is statistically highly significant with a p-value of 0.00*. The value of Rz between group 1 and group 3 is statistically non-significant with a p-value of 0.428. **(Table 6)** In intergroup comparison, the value of Rmax between group 1 and group 2 is statistically highly significant with a p-value of 0.01*. The value of Rmaxbetween group 2 and group 3 is statistically highly significant with a p-value of 0.01*. The value of Rmax between group 1 and group 3 is statistically non- significant with a p-value of 0.335. **(Table 7)** In intergroup comparison, the value of Rt between group 1 and group 2 is statistically highly significant with a p-value of 0.00*. The value of Rt between group 2 and group 3 is statistically highly significant with a p-value of 0.00*. The value of Rt between group 1 and group 3 is statistically non-significant with a p-value of 0.799. **(Table 8)**

Table 1: Value of mean surface roughness in Group 1

Variable	Mean ± SD	p- value
Ra before	0.778 ± 0.84	0.00*
Ra after	0.559 ± 0.08	

Rq before	1.174 ± 0.101	0.00*
Rq after	0.748 ± 0.09	
Rz before	4.561 ± 0269	0.00*
Rz after	2.721 ± 0.252	
Rmax before	7.965 ± 0.321	0.00*
Rmax after	3.891 ± 0.416	
Rt before	8.232 ± 0.252	0.00*
Rt after	4.438 ± 0.476	

* P-vaule < 0.05 = Significant

Table 2: Value of mean surface roughness in Group 2

Variable	**Mean ± SD**	**p- value**
Ra before	0.738 ± 0.105	0.422
Ra after	0.759 ± 0.083	
Rq before	1.106 ± 0.125	0.682
Rq after	1.217 ± 0.164	
Rz before	3.423 ± 0.276	0.771
Rz after	3.587 ± 0.265	
Rmax before	5.065 ± 0.277	0.621
Rmax after	5.638 ± 0.657	
Rt before	5.526 ± 0.535	0.00*
Rt after	6.376 ± 0.499	

Table 3: Value of mean surface roughness in Group 3

Variable	**Mean ± SD**	**p- value**
Ra before	0.693 ± 0.08	0.01*
Ra after	0.571 ± 0.074	
Rq before	1.084 ± 0.148	0.00*

Rq after	0.757 ± 0.142	
Rz before	3.384 ± 0.429	0.00*
Rz after	2.264 ± 0.355	
Rmax before	6.431 ± 0.414	0.00*
Rmax after	3.642 ± 0.460	
Rt before	7.217 ± 0.376	0.00*
Rt after	4.092 ± 0.375	

Table 4: Comparison of Ra values (µm) after polishing

Groups	**p- value**
Group 1 Vs Group 2	0.01*
Group 2 Vs Group 3	0.00*
Group 1 Vs Group 3	0.75

Table 5: Comparison of Rq values (µm) after polishing

Groups	**p- value**
Group 1 Vs Group 2	0.01*
Group 2 Vs Group 3	0.00*
Group 1 Vs Group 3	0.335

Table 6: Comparison of Rz values (µm) after polishing

Groups	**p- value**
Group 1 Vs Group 2	0.00*
Group 2 Vs Group 3	0.00*
Group 1 Vs Group 3	0.428

Table 7: Comparison of Rmax values (µm) after polishing

Groups	**p- value**
Group 1 Vs Group 2	0.01*
Group 2 Vs Group 3	0.01*
Group 1 Vs Group 3	0.335

Table 8: Comparison of Rt values (µm) after polishing

Groups	**p- value**
Group 1 Vs Group 2	0.00*
Group 2 Vs Group 3	0.00*
Group 1 Vs Group 3	0.799

4. Discussion

Polishing is defined as "the implementation of making the tooth surface smooth and lustrous". As it smoothens the enamel surface of the tooth, it is the most crucial step in the treatment of periodontal disorders. To attain total periodontal health is the main goal of periodontal therapy. Scaling and root planing can eliminate local etiological elements like plaque and calculus, resulting in an uncontaminated tooth surface that enables oral hygiene maintenance throughout the initial or supportive periodontal therapy. This is essential for resolving gingival inflammation.[1]

In the present study, it was studied that prophylaxis paste and air-flow powder were provided to be completely the same properties in order to be able to eliminate the effects of abrasive powder used in air-polishing techniques on the amount of abrasion. Therefore, the same paste and powder products having the same contents and produced by the same manufacturer were usedfor testing. In this way, it was evaluated if the application of the products having the same abrasive properties with the rotary instruments and aerator devices affected on surface roughness. According to the statistical analysis of data, it was determined that reduction observed in roughness values of prophylaxis paste group has been significant.

Although using a rubber cup and paste to polish is the most common technique, new air-powder polishing equipment are progressively replacing it. Although its actual effectiveness in smoothing the enamel surfaces is still up for debate, it is thought to be able to reach the places that a rotating device cannot. An air polisher enhances the surface roughness and debris on enamel surfaces, according to earlier research by **Bailey and Phillips et al 1950,[8] Kontturi-Närhi et al. 1950,[9] and Sahrmann et al in 2014**.[10]

George and Brinkmann et al in 1998 have previously demonstrated that increasing

pressure causes more abrasion and roughness, which causes tooth surface loss.[11] According to **Francis and Barnes in 2008**, the pressure utilised when using a rotary (bristle brush and rubber cup) polisher is roughly 20 psi, but the air polisher is frequently used with an air setting of 80 psi. Hence, care should be used when using an air-polishing gear.

Another material tested in our study is stain buster burs. Studies on the effectof burs on hard tooth tissues and especially surface roughness are not sufficient on the literature. For comparing the effects of bur on surface roughness, it was preferred air-polishing method that was known to leave rough surfaces and the prophylaxis paste that was the most commonly usedin clinics While comparing the materials, polishing application was made only in the enamel surface in each group, thus it was provided that different degrees of abrasion observed on cement and dentin did not affect the result of the study, and the roughness was evaluated only on the enamel surface. Although some loss of tooth structure was observed in the reports on air- powder instruments, there were also studies showing that the surface became surprisingly smooth.[7]

In our study, while it was observed a smooth appearance on half of the toothin group applied air-flow and polishing in average, the surface roughness increased in the other half, in line with the other studies showing the harmful effects of air-polishing systems.[12,13]

Although polishing applications were only limited to the enamel surface in our study, this result emerged showed that air-polishing could lead to the oppositeresults with the philosophy of polishing application, even though it was appliedon the enamel surface. In our study, it was discovered statistically significant decrease in the group which we applied prophylaxis paste. This result is inline with the studies recommending the polishing application following scaling and root Planing processes.

In a prior work, **Tuzcel et al**. assessed the impact of three distinct polishing Techniques on the surface roughness that results from sonic scaling. Using a sonic instrument, dental calculus from 60 extracted teeth that had been preserved in distilled water was removed. Following a profilometer measurement of surface roughness, samples were split into three groups. Thesamples in the first group were polished using a rotating rubber cup and prophylaxis paste, the samples in the second group were polished using air flow, and the samples in the third group were polished using a stain buster bur.At each step, the surface roughness measurements were acquired using a profilometer. Surface roughness was significantly reduced in the groups that employed prophylaxis paste and stain buster bur, and the reduction was consistent across these groups. Surface roughness in the group that used air flow did not significantly decrease. Because it offers smooth surfaces like prophylaxis paste and is as simple to use as air-polishing techniques, stain buster bur may be a good substitute for conventional polishing materials.[14]

However, our study supports the argument that application by the rotaryrubber is more effective option in reducing the surface roughness independently of the grain size, because prophylaxis paste that was used in paste application done by rotary rubber cup and the powder that was used in air-flow instrument were manufactured by the same manufacturer and theyhad the same grain size.[15] In our study, stain buster, the new material intended to be evaluated by comparing the efficacy was also reduced the surface roughness in a statistically significant way. There was no sufficient study related to this material. Our results were in concordance with the results obtained by Tuzcel et al who also reported similar findings.[14]

5. Conclusion

Repeated polishing has iatrogenic effects depending on increasing the life time of the teeth. Careful selection of patients on whom polishing will be applied will reduce the complications and adverse effects. In the present study, we tried to create a scientific guide for the clinical application of polishing processes. According to the results, stain buster burs seem to be an alternative to traditional polishing materials because they provide smooth surfaces like prophylaxis paste and ease of application like air-polishing techniques.

6. References

1. Yildirim, T. T., Oztekin, F., Keklik, E., & Tozum, M. D., 2021, 'Surface roughness of enamel and root surface after scaling, root Planing and polishing procedures: An in-vitro study'. Journal of oral biology and craniofacial research, vol.11, no.2, pp. 287–290
2. Catherine, J, Boyapati, L, Sivaram, G, Sivakumar, B 2017, 'Effectiveness of polishing after scaling and root Planing — A profilometric analysis', Annals of Dental Speciality, vol. 5, no.1, pp. 9 -13
3. Sinjari, B, Addazio, G, Bozzi, M, Santilli, M, Traini, T, Murmura, G, Caputi, S 2019, 'SEM analysis of enamel abrasion after air polishing treatment with erythritol, glycine and sodium bicarbonate', Department of medical oral and biotechnological sciences', university G.d, Annunzio of Chieti- Italy, vol. 9, no. 9, pp. 1-8.
4. Patil SS, Rakhewar PS, Limaye PS, Chaudhari NP.l, 2015, 'A comparative evaluation of plaque-removing efficacy of air polishing and rubber-cup, bristle brush with paste polishing on oral hygiene status: A clinical study'. Journal Int Soc Prev Community Dent, vol. 5, pp. 457–62
5. Ghassemi A, Hooper W, Vorwerk L, Domke T, DeSciscio P, Nathoo S, 2012, 'Effectiveness of a new dentifrice with baking soda and peroxide in removing extrinsic stain and whitening teeth'. The Journal of Clinical Dentistry, vol 23, no.3, pp. 86-91.
6. Karacaoglu F, Tuzcel NY, Akkaya M, 2016, 'A Comperative Evaluation of3 Different Polishing Methods on Tooth Surface Roughness'. J BiomedicalSci, vol.6, no.1
7. Berkstein S, Reiff RL, McKinney JF, Killoy WJ, 1987, 'Supragingival root surface removal during maintenance procedures utilizing an airpowder abrasive system or hand scaling'. Journal Periodontol, Vol.58, pp. 327-329.
8. Bailey LR, Phillips RW, 1950, 'Effect of certain abrasive materials on toothenamel'. Journal Dent Res, vol. 29, pp :740–8
9. Kontturi-Närhi V, Markkanen S, Markkanen H, 1990, 'Effects of airpolishing on dental plaque removal and hard tissues as evaluated by scanning electron microscopy'. Journal of periodontology, vol. 61, no. 6, pp. 334-8
10. Sahrmann P, Ronay V, Schmidlin PR, Attin T, Paqué F, 2014, 'Three-dimensional defect evaluation of air polishing on extracted human roots'. JPeriodontol. Vol. 85, pp. 107–14
11. George P, Brinkmann J, 1998, 'The influence of air polishing on tooth enamel. An in vitro study'. Journal Orofac Orthop, vol 59, pp: 1–16.
12. Atkinson DR, Cobb CM, Killoy WJ, 1984, 'The effect of an air-powder abrasive system on in vitro root surfaces'. Journal Periodontol, Vol. 55,pp. 13-18.
13. Agger, M, Bindslev, P and Hovgaard, O, 2001, 'Abrasiveness of an air powder polishing system on root surfaces in vitro', Quintessence International, vol. 32, no. 5, pp. 407-411.
14. Tuzcel NY, Akkaya M. A,

Karacaoglu F, 2016, 'Comperative Evaluation of 3 Different Polishing Methods on Tooth Surface Roughness'. J BiomedicalSci. 6:1

15. Zampa ST, Green E, 1976, 'Effect of polishing agents on the root roughness'. Journal Periodontol, vol. 43, pp. 125-126