Effect of three different polishing methods in reducing the tooth surface roughness occurring after ultrasonic scaling

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Abstract

Background: Polishing is defined as "the implementation of making the tooth surface smooth and lustrous". It is the most important part of periodontal therapy as it smoothens both enamel and the cementum surface of the tooth.

Material and 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 stainbuster burs.

Results: On comparing the before polishing and after polishing values among group 1 specimens, significant results were obtained. On comparing the before polishing and after polishing values among group 2 specimens, non-significant results were obtained except for Rt values. On comparing the before polishing and after polishing values among group 3 specimens, significant results were obtained. After polishing, while comparing the Ra, Rq, Rz, Rmax and Rt values in between group 1 versus group 2 and in between group 2 versus group 3, significant results were obtained. However; while comparing in between group 3 versus group 1, 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: According to the results, stainbuster burs are seen as 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, Stainbuster burs

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.

The 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 technics 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 technics 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 longer.[2]

Polishing is defined as "the implementation of making the tooth surface smooth and lustrous". It is the most important part of periodontal therapy as it smoothens both enamel and the cementum surface of the tooth. Main objective of periodontal therapy is to achieve complete periodontal health. Long term objective of periodontal treatment is maintaining the periodontal health. Elimination of local etiological factors like plaque and calculus to resolve gingival inflammation is vital and it can be achieved by scaling and root planning, resulting in an uncontaminated tooth surface permitting oral hygiene maintenance during the initial or supportive periodontal therapy.[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]

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.

Material and methods

The present study was conducted in the aim of comparing and evaluating the effect of three different polishing methods in reducing the tooth surface roughness after scaling and root planning.

ARMAMENTARIUM

- 60 extracted incisors.
- Ultrasonic scaler.
- Contra-angle hand piece with micro motor.
- Rubber cups with polishing paste.
- Air polisher with sodium bicarbonate, aluminium trihydroxide & calcium sodium phosphosilicate.
- Stain buster burs.
- Profilometer.

STUDY METHOD

In this study, 60 incisors extracted for periodontal reasons were used.

After the extraction, tooth were washed under running water for 1 minute, it was maintained in distilled water.

All teeth were scaled by using the ultrasonic device in contact with the lateral surface of teeth, in facio-lingual direction and with light pressure.
The scaling was stopped when the test area seemed smooth and clean by visual inspection. Following the completion of scaling process, teeth was randomly divided into 3 groups so that 20 teeth are in each group.
Group 1: polishing was done with rubber cups and prophy paste.
Group 2: polishing was done with air polisher.
Group 3: polishing was done with stainbuster burs.
Root surfaces of teeth was 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.
Profilometer measurements included Ra, Rq, Rz, Rmax and Rt values and surface graphics.
These values are:
Ra: Arithmetic average of Ra values in roughness profile.
Rq: Geometric average of the deviations occurring in roughness profile.
Rz: Average height of peak-to-valley.
Rmax: Maximum roughness depth.
Rt: Roughness depth.
In first group (G1), each tooth was polished by using prophylaxis paste and rotary rubber cup for 5 seconds. Clinician didn't applied extra force, it was solely provide the contact by own weight of the device. Second group (G2) was polished by using air-flow for 5 seconds. While using, the device was held at right angles to the applied tooth surface and 1-1.5 cm away in average. In third group (G3), teeth were polished by using stainbuster bur for 5 seconds. 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.

Results

60 freshly extracted incisors were included in the present study. Only those specimens were obtained which were extracted because of perinodal 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.

Table 1: Comparison of Ra values (µm) before and after polishing among specimens of Group 1

Variable	Mean	SD	p- value
Ra before	0.712	0.65	0.000*
Ra after	0.513	0.06	

*p-value< 0.05= Statistically Significant

Table 2: Comparison of Rq values (µm) before and after polishing among specimens of Group 1

Variable	Mean	SD	p- value
Rq before	2.125	0.203	0.000*
Rq after	0.641	0.05	

*p-value< 0.05= Statistically Significant

Table 3: Comparison of Rz values (µm) before and after polishing among specimens of Group 1

Variable	Mean	SD	p- value
Rz before	5.647	0.329	0.000*
Rz after	3.216	0.313	

*p-value< 0.05= Statistically Significant

Discussion

The first stage of periodontal treatment involves the removal of bacterial deposits and calculus from the root surface. The treatment includes the protection of healthy tissues, where a biologically acceptable root surface can be obtained. The main purpose of polishing is to remove plaque, biofilm and stains on the enamel and root surfaces to provide the smoothest surface possible. One of the aims of periodontal treatment is to reduce the accumulation of bacteria and plaque by minimizing the roughness of enamel and root surfaces. Creating a smooth surface after mechanical debridement facilitates the reattachment of gingival fibrous tissues. In addition to physiological tissue healing, surface features are also important for tissue regeneration.[6] 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.[7]

Although similar results were obtained between hand devices and sonic/ultrasonic devices in terms of the effectiveness and clinical results, hand tools have been known to leave partially smoother surfaces, when surface roughness, adverse effects and contraindications were evaluated. Teeth were washed under running water for 1 minute in order to be able to acquire accurate measurements following the scaling procedure, even though hand devices were not preferred and ultrasonic equipment, which smear layer development were known to be less frequently, were employed.

In order to reduce the surface roughness after scaling process, various techniques and materials are used. For these materials, removal times of colorations vary by grain size of the used material and/or the applied force. In our study, periodontal prophylaxis paste and air-flow applications routinely used in clinical practice for polishing was compared to stainbuster suggested as a new polishing material. It has been demonstrated in numerous experiments that air-polishing tools may be used to regular enamel surfaces quickly and effectively. Yet, it typically does not result in surface change and material loss that may be seen clinically. In contrast, if administered directly to the root surface or dentin, spray may result in a large amount of material loss. As much as the probe distance and the application surface, application time, powder application, and water application all affect how much tissue is lost as a result of the method. The application was carried out by the same researcher from 1 to 1,5 cm by coming up at a straight angle to the tooth surface, even though we used an air powder instrument in our investigation.

Similar to the polishing application, the rotating rubber cup polishing was carried out by the same researcher utilising only the weight of the rotary instrument and no additional pressure. One of the most popular methods for polishing is prophylactic paste applied with a rotating rubber cup/brush. Depending on the paste's composition and size, it might be abrasive. Yet, because there is no industry-wide standard for paste abrasiveness, fine-grained paste may be more abrasive than thick-grained paste. To be able to entirely exclude the impacts of abrasive

powder used in air-polishing techniques on the quantity of abrasion, prophylaxis paste and air-flow powder were provided with the exact same qualities in our investigation.
The one of the most commonly used polishing method is prophylaxis paste used with rotary rubber cup/brush. The abrasive properties of paste vary by content and size of paste. However, fine-grained paste can be more abrasive than a thickgrained paste, because there is no standard in abrasiveness of paste among manufacturers.
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 used for 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.
As a result, testing was conducted using identical paste and powder products made by the same manufacturer and containing the same ingredients. This allowed it to be determined whether using items with similar abrasive qualities with rotary instruments and aerator devices had an impact on surface roughness. The statistical analysis of the data revealed a considerable reduction in the roughness scores for the prophylaxis paste group.
In our study, while it was observed a smooth appearance on half of the tooth in 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.[8] Although polishing applications were only limited to the enamel surface in our study, this result emerged showed that air-polishing could lead to the opposite results with the philosophy of polishing application, even though it was applied on the enamel surface. In our study, it was discovered statistically significant decrease in the group which we applied prophylaxis paste. This result is in line with the studies recommending the polishing application following scaling and root planning processes.
George and Brinkmann et al[9] in 1998 have previously demonstrated that increasing pressure causes more abrasion and roughness, which causes tooth surface loss. 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.
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 (**Berkstein S et al 1984**).[10]
In a prior work, **Tuzcel et al**.[11] 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. The samples 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 stainbuster 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 stainbuster 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, stainbuster bur may be a good substitute for conventional polishing materials.
However, our study supports the argument that application by the rotary rubber 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 they had the same grain size (**Zampa ST et al 1976).**[12]

Conclusion

Repeated polishing has iatrogenic effects occurring 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, stainbuster burs are seen as an alternative to traditional polishing materials because they provide smooth surfaces like prophylaxis paste and ease of application like air-polishing techniques.

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