Original Study

EFFECTIVENESS OF POLISHING AFTER SCALING AND ROOT PLANING – A PROFILOMETRIC ANALYSIS

Catherine J,[1]Boyapati L,[2] Sivaram G,[3]Sivakumar B [4]

1. Senior Lecturer, Department of Periodontology, Tagore Dental College & Hospital, Chennai, Tamil Nadu
2. Senior Lecturer, Department of Periodontology, Meghna Institute of Dental Sciences, Nizamabad, Telangana
3. Professor, Department of Periodontology, Ragas Dental College & Hospital, Chennai, Tamil Nadu
4. Professor, Department of Periodontology, Ragas Dental College & Hospital, Chennai, Tamil Nadu

ABSTRACT

Objective: This study was done to determine if polishing the exposed root surfaces would decrease the surface roughness after SRP.

Materials and Method: Twenty four single rooted teeth that were extracted due to periodontitis were selected. the surface roughness was determined using a contact profilometer before SRP, after SRP and after polishing.

Results: The study showed that SRP resulted in a rough surface that was significantly reduced after polishing which creates a less favorable environment for plaque accumulation.

Statistics: Intragroup analysis for change in surface roughness was done using t-test.Intergroup analysis to evaluate the effectiveness of polishing agent was done using Kruskal- wallis test.

Conclusions: Polishing of the exposed root surfaces should be done mandatorily after SRP to prevent plaque accumulation.

Key Words: Polishing after SRP, Profilometric analysis, Root surface roughness.

Introduction

In chronic periodontitis the cementum undergoes physical, chemical and ultrastructural changes which occur due to the effect inflammatory exudates and bacterial endotoxins on the cementum. Alterations in the cementum occur even before the junctional epithelium has migrated and it is accentuated when the cementum is exposed to the oral environment as in gingival recession.

The goal of scaling and root planning (SRP) is to remove the factors contributing to periodontitis such as plaque and calculus along with the diseased cementum within which bacterial endotoxins are embedded.[1] However SRP results in root surface irregularities that serve as a nidus for plaque accumulation which could result in recurrence of periodontitis.[2]

Although polishing of the tooth surface is routinely done after oral prophylaxis to obtain a smooth surface; polishing of the root surface is not regularly performed after root planing. This results in a rough root surface which in turn leads to plaque accumulation and periodontal breakdown.

The aim of this study was to assess the change in the root surface roughness after SRP and to evaluated if polishing the root surface after SRP would effectively reduce the surface irregularities and produce a smooth surface.

Materials and Methods

Collection and storage of samples

Twenty four single rooted teeth that were extracted due to moderate to severe periodontitis were collected and washed in running water for 30 seconds and stored in 0.9% NaCl throughout the study period.

Inclusion criteria

1) Single rooted teeth.
2) CAL of >5mm on the labial surface.
3) Grade II or grade III mobility.

Exclusion criteria

1) Presence of root caries.
2) Teeth with cervical abrasion.
3) Teeth with pulpal or periapical infection.
4) History of abscess in relation to the tooth indicated for extraction.
5) Patients with aggressive form of periodontitis.

Experimental groups

The collected samples were divided into 3 groups:
Group A, group B and group C with each group consisting of 8 teeth. [Figure 1]

Figure 1: Grouping of extracted teeth.

Working zone/ instrumentation zone determination

The buccal cemento enamel junction (CEJ) of all the teeth were detected using an explorer and marked. A line was drawn 4mm apical to the CEJ following the contour of the

root. This was taken as the instrumentation zone or the working zone. [Figure 2]

Figure 2: Determination of working zone.

Clinical procedure

Scaling was done on all the samples to remove calculus deposits on the root surface using a peizoelectric ultrasonic scaler with a vibrating frequency of 25KHz and a No: 10 scaler tip. Scaling was followed by root planing using a 1/2 Gracey curette. Each sample was subjected to 10 vertical strokes within the 4mm working area.[3] [Figure 3]

Figure 3: SRP done on the root surface.

Polishing was done using a slow speed hand piece at a speed of 2500 rpm and a standard webbed polishing cup. Polishing was done on each sample for 5 seconds.[4][Figure 4]

Figure 4: Polishing of the root surface.

Polishing material used in each study group

Group A: Silicon dioxide containing polishing material
Group B: Dicalcium phosphate containing polishing material
Group C: Silicate containing polishing material

Analysis of root surface roughness

The surface roughness within the instrumentation zone of the root was determined using a contact profilometer. [Figure 5]

Figure 5: Contact Profilimeter.

The surface roughness was determined at three time points during the study period:

T1: Before SRP
T2: After SRP
T3: After polishing.

Analysis of roughness parameters

The surface roughness was determined by the Ra value or the average roughness value.
Ra is defined as the mean between peaks and valleys of the surface profile. Ra is the average roughness of the surface analysed and is expressed in µm. [Figure 6]

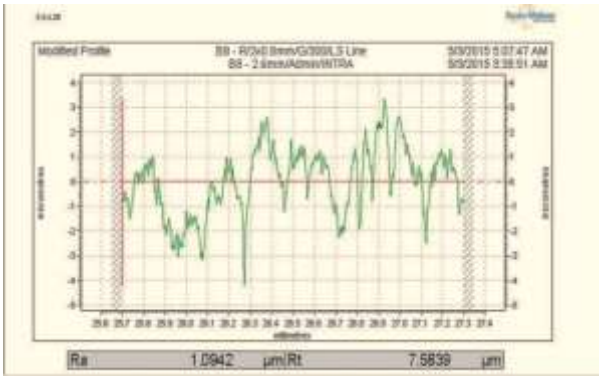

Figure 6: Graphical representation of surface roughness.

Statistical analysis

Intra group analysis comparing pre-instrumentation, post-instrumentation and post- polishing mean Ra values was done using t-test.

Inter group analysis of post-polishing Ra values to compare the efficacy of the three polishing agents used was done using Kruskal - Wallis test.

Results

The present study was done to evaluate the changes in the root surface roughness after SRP and to asses if polishing of root would result is a smooth root surface free of any irregularities.

Root surface roughness was assessed using a contact profilometer on 24 teeth that were extracted due to periodontitis. Surface roughness measurements were recorded at three different points during the study.

1) Before SRP (Pre-instrumentation)
2) After SRP (Post-instrumentation)
3) After polishing (Post polishing)

Mean Ra value before SRP

The mean Ra value before SRP was 2.2263 µm for group A; 2.1249 µm for group B and 2.3558 µm for Group C. [Table 1]

Mean Ra value after SRP

The mean Ra value after SRP was 1.9409 µm for group A ; 1.9254µm for group B and 2.1949 µm for Group C. [Table 1]

Mean Ra value after polishing

The mean Ra value after polishing was 0.4707µm , 0.3957µm and 0.7603µm for Group A ,Group B and Group C respectively. [Table 1]

Intra group analysis comparing pre-instrumentation and post- instrumentation mean Ra values

On statistical analysis there was no significant difference in the pre-instrumentation and post- instrumentation mean Ra values in all the three groups with a *p* value of 0.754 for Group A, 0.647 for Group B and 0.713 for Group C. [Table 2]

Intra group analysis comparing post -instrumentation and post - polishing mean Ra values

Statistically significant difference was seen between the post -instrumentation and post - polishing mean Ra values in all the three groups with *p* value of 0.007 for Group A, 0.000 for Group B and 0.001 for Group C. [Table 2]

Inter group analysis of post-polishing Ra values

On inter-group analysis to assess the efficacy of the polishing agents; there was no statistically significant difference in the post-polishing mean Ra value between the groups with a *p* value of 0.527. [Table 3]

Discussion

In the best case scenario, scaling and root planing should remove plaque, calculus and endotoxins embedded within the cementum resulting in a root surface smooth enough to prevent plaque accumulation.

The removal of diseased cementum is of prime importance because cementum bound endotoxin results in demineralization of the cementum upto 300µm along with the loss of collagen in the PDL attached to the cementum.[5] Although the cementum appears clinically normal there are microscopic irregularities which habour could harbour periopathogens which would result in periodontal breakdown in the future.

Although SRP cannot achieve 100% endotoxin removal ; the use of a both ultrasonic and hand instruments have been suggested to obtain a root surface that is relatively free of endotoxins.[6,7,8]

Ribeiro and Casarin *et al* [9] evaluated the root surface defects produced by curettes and ultrasonic instrumentation and showed that there was a direct influence on the topography on the root surface after instrumentation. Several sulci and valleys were formed after instrumentation, an increase in the roughness also is observed when seen by scanning electron microscopy (SEM).

Similar finding was reported by Wilkinson showed that there were depressions and irregularities on the cementum surface after root planing when seen under a scanning electron microscope.[10]

A number of in vitro [11-13] and in vivo [14] studies have reported varying degree of surface roughness induced by the use of ultrasonic and hand instruments on the root.

The present study was designed to assess the change in the root surface roughness after instrumentation and to evaluate the effectiveness of polishing on the root surface.

Results from this study show that there was only a slight but statistically insignificant decrease in the mean Ra value after SRP.This is due to the fact that SRP minimally

reduced the surface irregularities present on the root surface and resulted in a coarse finish. [Figure 7]

Figure 7: Diagramatic representation of change in surface roughness

Comparing the post-instrumentation and post- polishing mean Ra values all three groups showed statistically significant difference.(*p* value : Group A 0.007, Group B 0.000 and Group C 0.001) [Table 1].

Group	Pre-Instrumentation Vs Post-Instrumentation			Post-Instrumentation Vs Post-Polishing		
	Mean	SD	p Value	Mean	SD	p Value
A	0.2855	± 2.4	0.754	1.4702	± 1.9	0.007
B	0.1995	± 1.1	0.647	1.5295	± 0.6	0.000
C	0.1609	± 1.0	0.713	1.4346	± 0.7	0.001

Table 1: Statistical analysis for group A,B, and C.

Polishing the root surface resulted in a fine finish when compared to the coarse finish obtained after SRP. [Figure 7 and Figure 8]

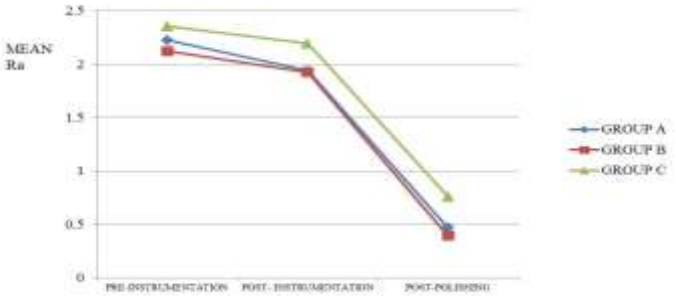

Figure 8: Graphical representation of change in surface roughness. (Based on values from Table 2)

According to Bollen *et al* Ra value of 0.2µm favors plaque accumulation. And from the data obtained from the study by Quirynen, plaque accumulation increases by 25 fold when the Ra value is 0.8µm.[15] Results from this study showed that polishing reduces the root surface roughness to a level at which plaque accumulation is not favored since the mean Ra value after polishing was 0.4707µm, 0.3957µm and 0.7603µm for Group A ,Group B and Group C respectively. [Table 2]

Groups	Pre-Instrumentation	Post-Instrumentation	Post-Polishing
A	2.2263	1.9409	0.4707
B	2.1249	1.9254	0.3957
C	2.3558	2.1949	0.7603

Table 2: Mean Ra Value in µm.

In this study different polishing agent were used for each group. Silicon dioxide, Dicalcium phosphate and silicate polishing agents were used for group A, B and C respectively.

For effective polishing, the abrasive particles must be harder than the surface material being polished. Mohs Hardness value serves as standard for measuring the hardness; the higher the value, the harder the material or the more abrasive the material.[16]

Mohs hardness value of cementum is 3-4 . The hardness value of all the three polishing agents used in the study was more than 4.

On intra-group analysis to assess the efficacy of different polishing agents; no statistically significant difference was seen in the post-polishing mean Ra value between the groups with a *p* vaue of 0.527. [Table 3]

Group	Mean	df	p Value
A	0.4707	2	0.527
B	0.3957		
C	0.7603		

Table 3: Statistical Inter-group analysis for polishing.

This shows that all three polishing agents were equally effective in producing a smooth root surface after SRP.

Limitations

Some of the limitations of the present clinical study which might have a significant impact on the results obtained include:

Polishing agents differ in their grit size or particle size which influence the extent of abrasion produced on the tooth surface by the polishing agent during the procedure. Based on the grit size polishing agents are assigned a Relative Dentine Abrasivity (RDA) value. Polishing agents with a higher RDA value have larger sized particles and greater abrasivity. The slight differences in the post-polishing mean Ra between groups could be due to the fact that the RDA value was not considered for the polishing agents used in this study.

Future directions

Structural alterations can occur when the root surface is polished since cementum is less mineralized than enamel and it abrades faster than enamel. Excessive pressure during polishing may result in inadvertent removal of cementum. A scanning electron microscopic study should be done to assess the changes in the cementum structure after polishing the root surfaces.

Conclusion

Geriatric patients often report with generalized gingival recession. This not only creates an esthetic problems when it affects the anterior teeth but also increases the anxiety about tooth loss due to progression of the destructive process in the periodontium. Other problems include dentinal hypersensitivity, root caries, abrasion and/or

cervical wear as a consequence of exposure of the root surface to the oral environment.

In an observational study in south Indian population , the prevelance of gingival recession was reported to increase with age and patients with the highest percentage of recession was between the age group of 45 years and 60 years.[17]

In geriatric patients where surgical periodontal therapy is contraindicated due to the patient's medical status or when the recession present is generalized where surgical therapy cannot be contemplated, the patients are subjected only to phase I periodontal therapy followed by regular maintenance programme. When SRP alone is done it creates an environment favorable for plaque accumulation and result in further periodontal breakdown. However polishing the exposed root surface after SRP would prevent plaque formation and increase the longevity of the tooth.

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Corresponding Author

Dr. Juala Catherine
A4, Prarthana Block Grove Apartments,
City Link Road, Adambakkam,
Chennai, Tamil Nadu, INDIA – 600088.
Email Id: - catherinej88@gmail.com