



## COMPARATIVE EVALUATION OF EFFICACY OF TREHALOSE POWDER OVER PROPHY PASTE AS A POLISHING AGENT- AN INVITRO FIELD EMISSION SCANNING ELECTRON MICROSCOPE STUDY.

### Periodontology

<b>Dr. Lanka Shiny Supriya*</b>	Postgraduate, Department of Periodontology, Government Dental College And Hospital, Cuddalore District, Chidambaram, Tamilnadu-608002*Corresponding Author
<b>Dr. Rajasekar Sundaram</b>	Professor and Head of the department, Department of Periodontology, Government Dental College And Hospital, Cuddalore District, Chidambaram,
<b>Dr. Lakshmi Sree Sankar</b>	Professor, Department of Periodontology, Government Dental College And Hospital, Cuddalore District, Chidambaram, Tamilnadu-608002.
<b>Dr. Selva Kumar Murugaiyan</b>	Postgraduate, Department of Periodontology, Government Dental College And Hospital, Cuddalore District, Chidambaram, Tamilnadu-608002

### ABSTRACT

**Background:** Plaque and calculus on the tooth and in the periodontal pockets are the most important local factors for the initiation and development of periodontitis. Polishing can be considered as the final step after scaling and root planing (SRP). Different techniques employed and materials used for polishing can cause tooth surface alterations and roughness. To reduce the surface roughness and to promote oral maintenance, various polishing materials are used. The aim of the study is to compare the efficacy of Trehalose powder with Propy paste as a polishing agent by evaluating the surface roughness of teeth exposed to SRP and polishing materials. **Materials and methods:** Periodontally diseased 30 extracted teeth were randomly divided into three groups. Each group was exposed to its set of criteria to analyze the aim of the study. The root surface roughness and its surface microtopography that resulted from the using an ultrasonic scaler, Gracey curette, prophy paste and trehalose were examined using Field Emission Scanning Electron Microscope (FESEM) photographs. **Results:** In the Group A in which SRP was performed, was found to have the highest mean roughness value with  $2.43 \pm 0.50$ ; which was followed by Group B, the value being  $2.10 \pm 0.65$ . The lowest surface roughness was observed in the samples where SRP along with trehalose polishing (Group C) was performed with  $1.70 \pm 0.56$ . **Conclusion:** Polishing and ultrasonic treatment have a comparable effect on the maintenance of teeth. Moreover, apart from its tremendous advantages, trehalose is cost-effective and compatible. This makes it distinctive to be chosen as a polishing material.

### KEYWORDS

FESEM photographs, prophy paste, scaling and root planing, surface roughness, trehalose.

### INTRODUCTION:

The success of periodontal therapy depends on the complete elimination of infective agents and minimising the inflammation in periodontal tissues. Accumulation of plaque and calculus on the tooth surface may lead to entry of micro-organisms into the gingiva<sup>1</sup>. Following the microbial insult, our immune system gets activated and produces a series of inflammatory reactions leading to periodontal diseases. Failure of complete removal of etiological agents might lead to gingival inflammation, further progressing into more aggressive forms of periodontitis<sup>2</sup>. Hence, scaling and root planing (SRP) are carried out during the initial or supportive periodontal therapy in order to remove plaque and calculus from tooth surfaces.

Polishing can be considered as the final step after scaling and root planing. Polishing could be selectively or widely performed. It improves the surface uniformity, provides a smooth surface finish, reduces bacterial adhesion, provides better surface cleansing and has higher aesthetic appeal<sup>3</sup>. Surface alterations and roughness can be caused by a variety of techniques, depending on time and material<sup>4</sup>. Different polishing materials can reduce surface alterations and roughness caused by scaling and one such newer material is Trehalose.

Trehalose consists of white orthorhombic crystals with a particle size of 30  $\mu\text{m}$ . It is more than 98% pure and thermostable. It is approximately 45% as sweet as sucrose and is significantly hygroscopic. It is usually used in medicines, cosmetic and food industries. Studies reported that Trehalose decreased oral dryness and pain caused by dental treatment while preserving cells from dryness-induced damage<sup>5</sup>. Moreover, it has proved to be both less cariogenic and anti-cariogenic, making it a possible sugar alternative<sup>6</sup>.

Along with appropriate materials, to reduce the surface roughness and to promote maintenance of oral hygiene, various polishing armamentarium are used such as bristle/prophy brush, rubber/prophy cup and vector system in combination. Hence, the present study aims to compare the efficacy of Trehalose powder with Propy paste as a polishing agent by evaluating the surface roughness of teeth exposed to SRP and polishing materials.

### MATERIALS AND METHODS:

**Study design, sample size estimation and eligibility criteria:** This in vitro Field Emission Scanning Electron Microscope (FESEM) study, was conducted to compare the efficacy of Trehalose powder over Propy paste as a polishing agent by evaluating the surface roughness of teeth exposed to SRP and polishing materials.

In this study, 30 periodontally diseased teeth were collected (Figure-1). The teeth included were washed in running tap water for about 20 seconds to eliminate blood and surface debris immediately after extraction and stored in a 2% glutaraldehyde solution till use. Inclusion criteria were anterior teeth with intact roots, absence of caries and no previous history of professional periodontal treatment. Whereas, resorbed, multirooted and fractured teeth were excluded.



**Figure-1:** Extracted teeth

**Mounting procedures:** The teeth included were mounted in acrylic resin (Figure-2). Each mounted tooth was numbered, from 1 to 30 and randomly divided into three groups by blinding a colleague.

Group A received : SRP alone (n=10);  
Group B received : SRP with prophy paste (n=10);  
Group C received: SRP with trehalose powder (n=10).

**Figure-2:** Mounting of specimens in acrylic resin

Instrumentation was carried out by using an ultrasonic scaler (Woodpecker® UDS-P LED Ultrasonic Scaler, Uttar Pradesh, India), G2 inserts, at medium power setting with copious irrigation. Root planing was carried out using curettes (Gracey curettes No. 1/2,3/4 HuFriedy Co., Chicago, IL, USA) by 3 to 5 strokes in apicoronal direction with a horizontal inclination of 0 between tips and roots. Group-B teeth were polished using prophylaxis paste (Pyrax® Prophylaxis Paste, Uttarakhand, India) and rubber cup (ADDLER® Dental Polishing Rubber Cups, Maharashtra, India). For Group-C, trehalose powder (Profoods® Trehalose Powder, Bhiwandi, India) mixed with distilled water was used along with the rubber cup in a feather touch motion for 10 seconds.

Field Emission Scanning Electron Microscope (FESEM) sample preparation: With a diamond tapered fissure bur (Mani® Diamond Burs TF-11 bur, Japan) fixed on air turbine hand piece (NSK® Pana Air FX PAF SU B2, Japan) along with copious irrigation, the specimens were cut into a dimension of 5×5 mm, excluding the incisal 2mm. The samples were dehydrated gradually in increasing concentrations of isopropyl alcohol: 50% for 2 hours, 75% for 8 hours, 90% for 12 hours and 100% for 48 hours and air-dried for 24 hours. Following which, specimens were sputter-coated with chromium and examined at magnifications of 200x and 500x (ZEISS® Sigma 300, Ho Chi Minh City, Vietnam).

### Roughness criteria:

The enamel surface roughness was scored under three groups based on FESEM photographs as proposed by Kontturi-Närhi et al.<sup>7</sup>.

The FESEM photographs were evaluated by three examiners, who were masked of the group allocation and interventions received. (FIGURE-3)



**FIGURE-3:** Scanning Electron Micrograph showing morphology of tooth surface changes as seen in all the three groups on carrying out respective procedures.

### STATISTICAL ANALYSIS:

The statistical analysis was carried using the SPSS® software (IBM Corp. Released 2012, V 21.0. Armonk, NY, USA). Dunn's post-hoc test following the Kruskal-Wallis test was carried out for comparison between the groups. The statistical significance level was set at  $p \leq 0.05$ , and the tests were two-tailed.

### RESULTS:

**Table 1:** Scores of enamel surface roughness of control -SRP (Group A), prophylaxis paste (Group B), and trehalose powder (Group C).

Group	Score	n=10(%)
Scaling and Root Planing	2	5 (50.0%)
	3	5 (50.0%)
Scaling and Root Planing+ Prophylaxis Paste	1	2 (20.0%)
	2	4 (40.0%)
	3	4 (40.0%)
Scaling and Root Planing+ trehalose powder	1	4 (40.0%)
	2	5 (50.0%)
	3	1 (10.0%)

All values are expressed as frequency with percentages (in parentheses)

Table 1 outlines that equal number of teeth in Group A had mild ( $n=5$ ) and severe ( $n=5$ ) abrasion when SRP alone was performed. Four teeth exhibited mild and severe abrasion each when SRP was carried out followed by polishing with prophylaxis paste. However, 50% of the teeth present in Group C showed mild surface roughness and 40% showed no surface roughness when SRP was carried out followed by polishing with Trehalose.

**Table 2:** Comparison of enamel surface roughness of control -SRP (Group A), prophylaxis paste (Group B), and trehalose powder (Group C)

Group	n	Mean $\pm$ SD	Statistical analysis		
			Mean Rank	Kruskal-Wallis H	p-value
Scaling and Root Planing	10	2.43 $\pm$ 0.50 $\alpha$	20.4	6.823	0.033*
SRP + Prophylaxis Paste	10	2.10 $\pm$ 0.65 $\alpha$	15.8		
SRP + Trehalose Powder	10	1.70 $\pm$ 0.56 $\beta$	10.3		

The same Greek symbol ( $\alpha$ ) indicates an insignificant difference between the group within the column. The statistical test used: Dunn's post hoc method following a significant Kruskal-Wallis test; level of significance:  $p \leq 0.05$  is considered statistically significant.

Table 2 summarizes the mean score of enamel surface roughness as witnessed in all three scenarios. The mean roughness value was highest in Group A with  $2.43 \pm 0.50$ ; followed by Group B, the value being  $2.10 \pm 0.65$ . The lowest surface roughness was observed in the samples of Group C with  $1.70 \pm 0.56$ . Thus, on pairwise comparison between the groups, it was observed that the use of Trehalose as a polishing agent was found to be superior than prophylaxis paste and SRP alone and statistically significant;  $p=0.033$ .

### DISCUSSION:

Although scalers and curettes remove supra and subgingival deposits effectively, many studies have proved that they failed to provide a smooth surface<sup>8,9</sup>. This increasingly leads to accumulation of plaque on the tooth surface, that favors colonization of pathogens which in turn aggravates periodontal diseases<sup>10,11</sup>. To overcome this, polishing the tooth surface is done to achieve smooth surface after instrumentation. However, there is a widespread debate regarding whether to polish or not. Studies have revealed that polishing eliminates plaque<sup>12,13</sup> and reduces accumulation of bacteria, achieving a smooth tooth surface<sup>14</sup>. However, with over polishing the superficial tooth structure wears off that leads to more accumulation of local deposits<sup>15</sup>. Hence, polishing should be done selectively only in cases where extrinsic stains are present.

In the present study, enamel surface roughness was lowest when SRP was done followed by polishing with Trehalose. A randomized clinical trial by Kruse<sup>16</sup> et al showed that air polishing with Trehalose was more comfortable for patients during periodontal supportive therapy. Weusmann J<sup>17</sup> et al concluded that trehalose air-polishing powders showed reduced inflammation and a better cellular response than other polishing agents. Also Endo Y and Tomofuji T<sup>18</sup> concluded that the topical administration of trehalose can reduce differentiation of osteoclast by inactivating the RANKL-induced pathway, in rat models.

FESEM was used to evaluate the tooth surface roughness. It generates topographical and fundamental information ranging from 10x to 3000,000x magnifications, with nearly infinite depth of focus. Compared to conventional SEM, FESEM delivers clear, electrostatically less distorted images with resolution of 11/2 nm which is three to six times better<sup>19</sup>.

The enamel surface roughness in our study was maximum when only SRP was performed. Comparatively, prophylaxis paste produced less abrasive effect on the teeth. This was similar to our in-vitro study which showed significantly very less surface roughness, rendering smoother surface instead of SRP alone.

### CONCLUSION:

This in-vitro study showed that polishing and ultrasonic treatment have a comparable effect on maintenance of teeth. Moreover, apart from its tremendous advantages, trehalose is very cost effective and compatible. This makes it distinctive to be chosen as a polishing material. Nevertheless, further studies should be conducted to clinically assess the long term efficacy of Trehalose.

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