Evaluation of Surface Roughness of Teeth Post Brushing Simulation with Different Commercially Available Ultrasoft Toothbrush

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Abstract

Introduction

Form, function and aesthetics is the primary goal of dentistry. Brushing plays an important role in maintaining the form , function and aesthetics. Choosing the right toothbrush plays an important role in maintaining dental hygiene.

aterials and Methods

Eight central incisors non carious teeth were selected and decoronated. The coronal portion was mounted in a silicone mould of standard dimension.Three commercially available ultra soft toothbrushes were chosen .The base line roughness was evaluated using a profilometer. The pre and post roughness mean was calculated.

Result

The study concluded that there is no significant difference in the roughness post brushing.

Discussion

Different commercially available ultra soft toothbrushes have different bristle diameter which determines the stiffness or texture of the toothbrush.

Conclusion

There was no significant difference between post and pre roughness caused by the three toothbrushes, yet one tooth brush causes comparatively less surface roughness than the other two toothbrushes.

Keywords

Brushing, toothbrushes, surface roughness, abrasion

1. INTRODUCTION

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Oral health is an important factor to maintain a quality life. Different oral diseases prevail that can be irreversible, progressive and chronic. These diseases can be prevented when detected at an early stage. Different oral hygiene measures have been followed across the world. Using toothbrushes and toothpaste to maintain oral hygiene is the most common method (1) . Form,function and aesthetics forms the primary goal of dentistry. Brushing plays an important role in maintaining the form, function and aesthetics. Tooth brushing helps in preventing oral diseases and removing the oral bacteria that causes oral diseases.

A toothbrush is a principle instrument that helps in maintaining proper hygiene and oral care.Based on the different bristle diameters the tooth brushes have been categorized as soft (0.2mm), medium (0.3mm) and hard (0.4mm). Choosing the right toothbrush plays an important role in maintaining oral hygiene (2) . Apart from choosing the right toothbrush, proper usage of the toothbrush should also be taken into consideration, as improper brushing may lead to the soft and hard tissues of the teeth (3). This may lead to conditions such like abrasion .Abrasion is the process in which the enamel erodes due to the force applied on teeth ,improper brushing can also be caused for abrasion (4). Toothbrushes with different functions have been developed for oral health management.The factors that influence the surface roughness of teeth are the brushing methods , frequency ,duration of brushing ,bristle diameter,shape, force of brushing direction of brushing ,number of bristles per tuft and its management (5)

A tooth brush should be able to clean the teeth efficiently and reach all the areas of the mouth. Since different brands of commercially available brushes have different bristle quality.

Choosing the right bristles is important as the bristles come in contact with the gums and teeth. The bristles of the tooth brush play an important role in maintaining plaque control.

The ultra soft toothbrushes have conical shape arrangement of bristles that was found to be effective on the teeth surface,post surgeries (6). The ultra soft toothbrushes have better contact area thereby resulting in better cleaning of the tooth surface. The ultrasoft tooth caused less abrasion than the other toothbrushes .The tapered bristles provide easy brushing. The slim filament helps in densely arranged and soft elastic bristles. The hard bristles when compared to the smooth bristles caused more gingival recession.The previous studies have shown that the ultra soft toothbrushes caused less abrasion and reduced the sensitivity of the teeth .Ultrasoft brushes have been also used by patients who have inflammation or pain in the mouth.

The flexibility of the bristles is an important factor in determining the surface roughness.Durable smoothness of the teeth contribute to the aesthetic appearance,an ideal tooth brush maintains this smoothness. The surface roughness of the teeth has prime importance in plaque control.This surface roughness is said to be maintained by the ultra soft toothbrushes more efficiently thereby minimizing the damage to the tooth surface. Our team has extensive knowledge and research experience that has translate into high quality publications (7–16))((17–26)

Thus this study planned to evaluate the surface roughness of teeth post brushing simulation with different commercially available ultra soft toothbrushes.The objective of this study was to

measure the surface roughness of the teeth sample pre and post brushing and to compare the change in roughness caused by different commercially available ultra soft toothbrushes.

2. MATERIALS AND METHODS

Selection of teeth
Eight central incisors were selected and decoronated .The coronal portion was mounted on a silicone mould with standard dimensions.

Selection of Toothbrushes
Commercially available ultra soft toothbrushes were purchased from the local market for the study. The toothbrushes were fixed tightly with the help of screws in the automated brushing machines.

Roughness Evaluation
The baseline roughness was evaluated using a Stylus Profilometer. The Profilometer is a device that is used to measure the surface roughness changes .It produces a trace using the digital and analogue hardware and software . The Roughness average (Ra),The Roughness peak(Rz),The Root mean Square Roughness (Rq) were obtained for the mounted tooth specimens .

Duration and Frequency of Brushing
The tooth samples were mounted in the SD MECHATRONIK BRUSHING SIMULATOR
Which consists of 20,000 cycles (Linear x-5000,clockwise -5000 and anticlockwise -5000)
After which the pre and post roughness mean were calculated and the change in the roughness was compared.

Procedure
The profilometric analysis was done for the mounted tooth samples before tooth brushing and the mean surface roughness was calculated . The tooth samples were fixed in the base and the ultra soft toothbrushes were screwed tightly in the brushing simulator (Figure 1 :Eight central incisors non carious were chosen for the study).The simulator allows unidirectional movement. Brushing was carried out for a fixed duration of time in a perpendicular direction with uniform force After the brushing process was completed the post roughness average was calculated for each tooth sample (Figure 2 : The pre roughness of the tooth sample was calculated). The differences in the readings obtained were compared through computation (Figure 3: Roughness average calculated using the stylus profilometer, Figure 4 : SD MECHATRONIK BRUSHING SIMULATOR used for brushing the teeth samples).

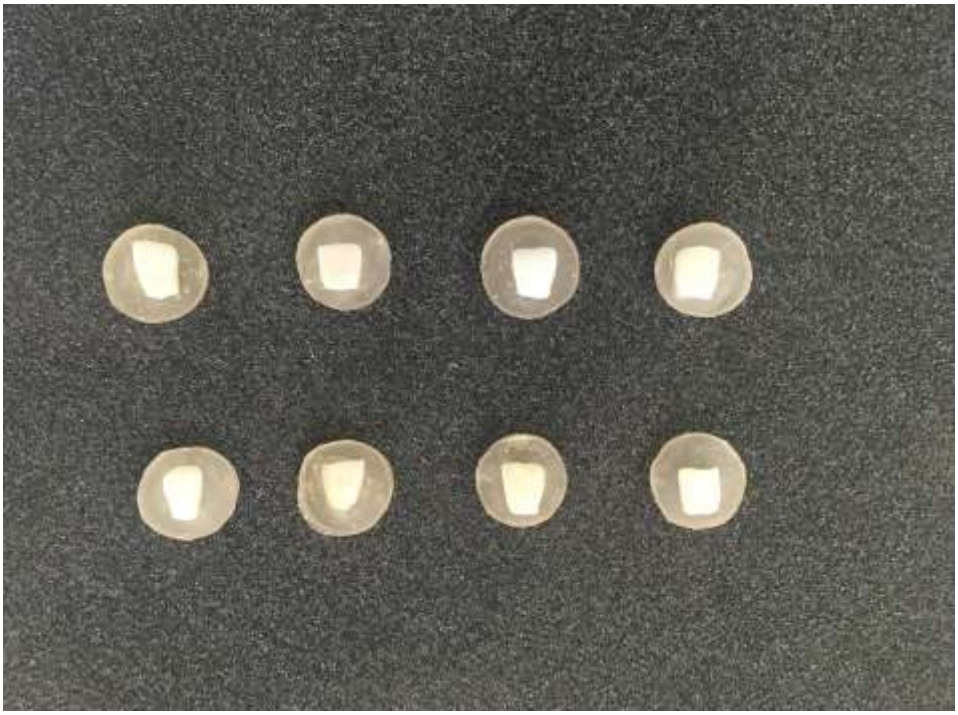

Figure 1: Eight central incisors non carious were chosen for the study.

Figure 2: The pre roughness of the tooth sample was calculated .

Figure 3: Roughness average calculated using the stylus profilometer .

Figure 4: Sd Mechatronik Brushing Simulator Used For Brushing The Teeth Samples.

3. RESULTS AND DISCUSSION

One way ANOVA and TUKEY POST HOC was used for the statistical analysis,which inferred that there was no significant difference between roughness post brushing. Though all the brushes were ultrasoft, one brush was found to cause less surface roughness.

The figure 5 shows the Ra,Rq,Rz values and the mean values calculated for the tooth brushes.

Ra-is the roughness average

Rq-is the root mean square roughness

Rz- is the roughness peak

It was inferred that there is no significant difference in the roughness (the significant value p<_ 0.05) .In this study the brushing was performed by an simulator device which delivered uniform force ,which helped to give more accurate results to reveal the accurate role of toothbrushes.The frequency of brushing was kept constant which helped to deliver a uniform force.

Figure 6 shows the comparison between the roughness caused by different toothbrushes.

The different commercially available ultra soft toothbrushes have different bristle diameters,which determines the stiffness or the texture of the toothbrush. The factors that may affect the surface of the teeth are the type of toothpaste and the type of brush used and the brushing force. The tuft ,flat trimmed and polished bristles help in better cleaning of the tooth surface. Our team has extensive knowledge and research experience that has translate into high quality publications ((27), (28), (29), (30), (31), (32,33), (34), (35), (36), (37)).

Various types of toothbrushes are commercially available but the quality of the brushes vary. Tooth brushing is an important factor of maintaining oral hygiene .Various factors like the brushing force ,duration,technique and the filament stiffness play an important role in toothbrushing. The bristles and the diameter of the bristles are a major factor that determines the toothbrush texture and surface .The flexibility and the contact area of the bristle help to retain more amount of toothpaste which helps in better cleaning of the tooth . The tooth

brush should be able to clean with least side effects .Since the diameter of the ultra soft toothbrushes is less than 0.2mm it is found that they cause lesser tooth damage and the efficacy of reducing the surface roughness was found to be more .In recent years the ultra soft toothbrushes have been manufactured keeping in mind the sensitivity of the surgical sites and discomfort caused.

The brushes tend to lose their elasticity over use so the use of brushes should be confined to shorter durations and should be changed over a period of time for better results .The quality of the bristles and the diameter helped to reduce the soft tissue injuries (Figure 7: The above graph indicates the roughness peak pre and post brushing**).** Previous studies have shown that the hard bristles caused more tissue injury than the ultra soft bristles , this was determined by various factors like the tooth brush material ,texture and the diameter.

If the extent of surface roughness of the teeth is ignored it may lead to various disease and complications one such consequence is tooth abrasion .In the present study the use of the

a profilometer is considered as a good tool for the measure of the surface roughness. The toothbrushes used in the study were found to differ in size ,shape and texture. In the present study it was found that there was no significant difference in roughness caused by the toothbrushes,yet this surface roughness should not be ignored as it may lead to various oral health problems.

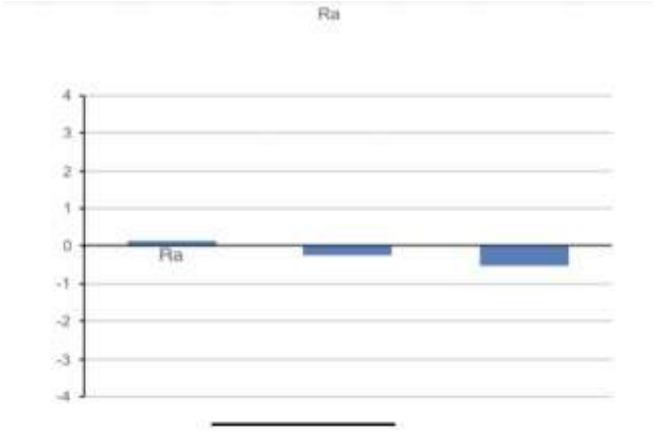

Figure 5: The above graph represents the roughness average of the ultra soft toothbrushes

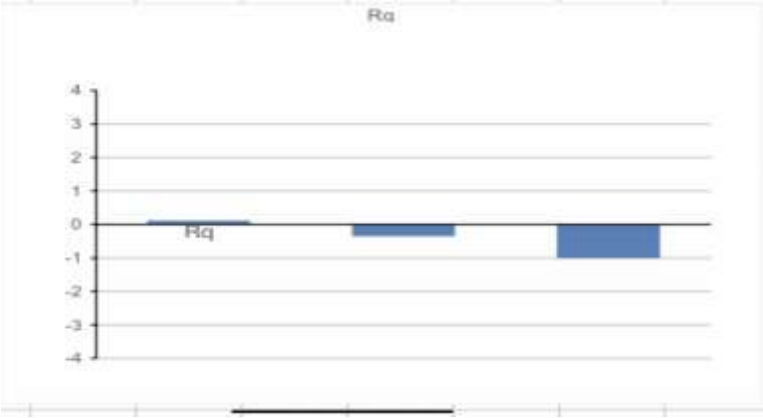

Figure 6 : The above graph shows the root mean square roughness pre and post brushing

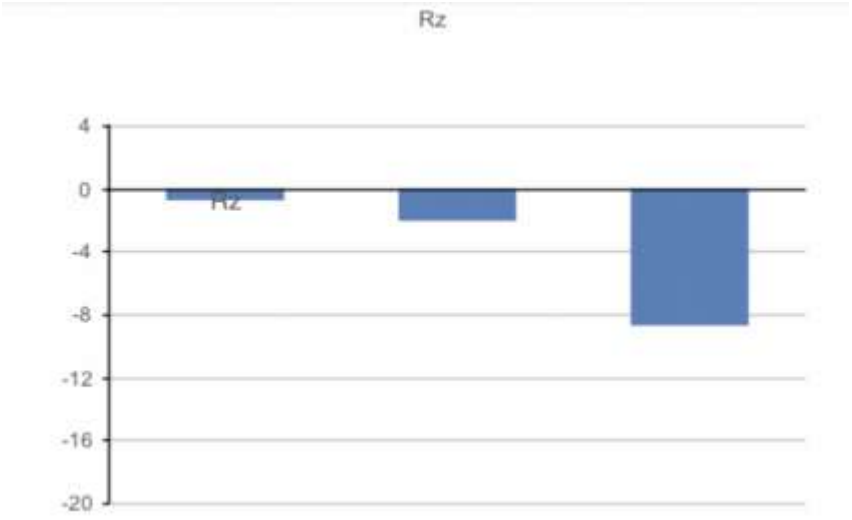

Figure 7: The above graph indicates the roughness peak pre and post brushing

4. CONCLUSION

The study concluded that there is no significant difference between the post and pre roughness caused by the three toothbrushes, yet one tooth brush comparatively causes less surface roughness than the other two toothbrushes.

Future Scope

The present study should be used to develop a better quality of ultrasoft toothbrush after proper clinical study.

Conflict of Interest:

The authors hereby declare that there is no conflict of interest in this study.

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Author Contribution:

A) Varshashree - contributed in designing the study, execution of the project, statistical analysis, manuscript drafting.

B) Dr. Jayalakshmi - contributed in designing the study, execution of the project, statistical analysis, manuscript drafting.

C) Dr.V.Vishnupriya - contributed in study design, guiding the research work, manuscript correction.

D) Dr. Gayathri R - study design, statistical analysis, manuscript proofreading and correction.

E) Dr. Kavitha S - study design, statistical analysis, manuscript proofreading and correction.

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