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Research Article

Evaluation of Remaining Cementum Thickness Following the Use of Hand and Ultrasonic Curettes of Periodontally Diseased Root Surface - An in-vitro Study

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I N F O

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A B S T R A C T

Background: Scaling and root planing are the most predictable treatment outcomes for periodontal disease. However root planing with hand curettes removes excess of cementum as compared to ultrasonic curettes. Hence the purpose of this study was to evaluate the effectiveness of remaining cementum thickness following the use of ultrasonic and hand curettes.

Aim: To evaluate the remaining cemental thickness following the use of hand and ultrasonic curettes on periodontally diseased root surface using a stereomicroscope.

Materials and Methods: Thirty single rooted teeth were extracted due to advanced periodontitis and were randomly divided into two groups: Group 1 (SRP with hand curettes) and Group 2 (SRP with ultrasonic curettes). The proximal surfaces of the teeth (mesial and distal) were subjected to root planning. one surface served as a test site where instrumentation was done and no instrumentation was done on the other surface (control site). Following instrumentation, midroot region of instrumented specimen was cross-sectioned and prepared for stereomicroscopic study. The data gathered from stereomicroscopic study was subjected to statistical analysis by Mann Whitney test.

Results: The results of our study showed that in both the groups, the mean cemental thickness in scaled group was significantly lower than unscaled group. Clinically, teeth treated with the ultrasonic scaler showed less tooth substance removal than hand curettes but the difference between the two groups were statistically non-significant.
Conclusion: Both the therapies i.e. SRP with hand curettes and ultrasonic curettes seemed to be effective in the removal of diseased cementum.

Keywords: Cementum Loss, Curettage, Hand Curette, Stereomicroscopic Analysis, Ultrasonic Curette

Introduction

Periodontal disease is characterized by chronic inflammatory process caused by the specific microorganisms, which trigger the host response, thereby causing progressive destruction of alveolar bone and apical migration of connective tissue and epithelial attachment over time.[1] These pathogenic microorganisms secrete endotoxins that are absorbed by hard tissue and destroy the collagen fibres embedded in the cementum, creating environment favourable to the penetration of bacteria. Viable bacteria have been found in the roots of 87% of periodontally diseased teeth.[2] Penetration and growth of bacteria leads to fragmentation and breakdown of the cementum surfaces and results in areas of necrotic cementum, separated from the tooth by mass of bacteria. Root planning is considered to be gold standard to produce a smooth, non-calculus surface and to remove diseased cementum. This can be accomplished by Hand instruments (Gracey curettes) and ultrasonic instruments.[3] Studies have reported beneficial results from mechanical therapy in terms of both clinical and microbiological aspects.[4]

Both these procedures are accompanied by tooth substance removal. During scaling and root planning procedures morphological changes occur in the cementum accompanied by decrease in cementum thickness. These alterations in the cementum affect the connective tissue attachment during the healing and regenerative procedures. It has been reported that the removal of extensive amount of cementum is not necessary to get the endotoxins free roots and hence should be avoided.[5]

Moreover, for periodontal regeneration it is necessary that cementum should be left on tooth roots after instrumentation. Cementum removal leads to removal of important cementum attachment proteins such as osteopontin, fibronectin and vitronectin that are important for periodontal regeneration.[6] All these factors outline the importance of cementum and its minimal removal for successful outcome of treatment.

Since long, the hand instruments were first choice of clinicians and was believed that these instruments produced a smooth root surface. However, they were more time consuming were more time consuming and were unable to reach deeper root surface where pockets are more than 4 mm.[3] To overcome this ultrasonic tip were thus designed for gross scaling and removal of supragingival calculus and stains. These instruments are simple to use; however, it is often difficult to achieve a smooth and calculus free root surface.[7] It has been now well documented that all the hand and power-driven instruments cause some gouging and removal of tooth substance. An ideal therapeutic modality would be the one in which biocompatible root planed surface is obtained with minimal removal of cementum.

Therefore, the present study aimed to evaluate the thickness of remaining cementum following the use of hand and ultrasonic curettes on periodontally diseased root surfaces of extracted teeth.

Materials and Methods

This study was conducted at Himachal institute of Dental Sciences, Paonta Sahib (H.P) under the permission of the ethical committee. Informed consent was taken from all the patients whose extracted teeth were used for the study. This study was carried for one and half years. In this study 30 single rooted teeth affected with advanced periodontitis were extracted by using forceps. Care was taken during extraction not to inflict damage to the root surface to be studied. Following extraction, the soft deposits from the root surfaces were removed gently and washed with distilled water and then stored in normal saline till further procedures. Later on, teeth were divided into two groups: - Group 1(15 teeth)(Scaling and root planning with hand curettes) and Group 2(15 teeth)(Scaling and root planning with ultrasonic curettes), via randomization method (flip of a coin).

The proximal surfaces of the teeth (mesial and distal) were subjected to root planning. One of the surfaces was instrumented and served as test site whereas the other surface where no instrumentation was done was taken as control site. For Group 1: The test site mesial or distal surface on the selected teeth, were subjected to overlapping strokes with Gracey curettes No. 1-2 and 3-4 (Hu-Friedy Chicago, IL, USA). For Group 2: The test site was subjected to ultrasonic curettes for root planning.

Following instrumentation, midroot region of instrumented specimen was cross-sectioned by using carbide disc. Control sites on the specimen were marked (-) that is (no instrumentation), so as to differentiate it from the instrumented sites and were viewed under stereomicroscope at 40x. For both the groups, three measurements were taken from the Test sites and Control sites, marked as L1, L2 and L3 and their mean was taken. This value was taken as final cementum thickness value. The data from the stereomicroscopic examination was compiled and subjected to statistical analysis which was performed using Mann-Whitney U test and Shapiro-Wik test.

Results

In 'Group-1' (Hand curettes), comparison between the scaled and unscaled sites showed that there was a statistically significant difference between the two sites (p=0.001). The mean cemental thickness in scaled group was significantly lower than unscaled group.

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Table 1.Mean cementum thickness in Hand curette group

Group 1	Method	No. of specimens	Mean thickness (in µm)	Std. deviation	P-value	Significance
	Scaled	15	55.58	15.01576	0.001	Significant
	Unscaled	15	93.08	42.61523		

Table 2.Mean cementum thickness in ultrasonic curette group

Group 2	Method	No. of specimens	Mean thickness (in µm)	Std. deviation	p-value	Significance
	Scaled	15	92.9754	29.94669	0.002	Significant
	Unscaled	15	175.0985	82.84813		

Table 3.Intergroup comparison between both the groups

Group	No of specimens	Change in mean cemental thickness (in µm)	Std. deviation	p-value	Significance
(Group 1) Scaled hand curettes	15	37.5035	42.69337	0.310	Non-significant
(Group 2) Scaled ultrasonic curettes	15	82.1231	79.48552		

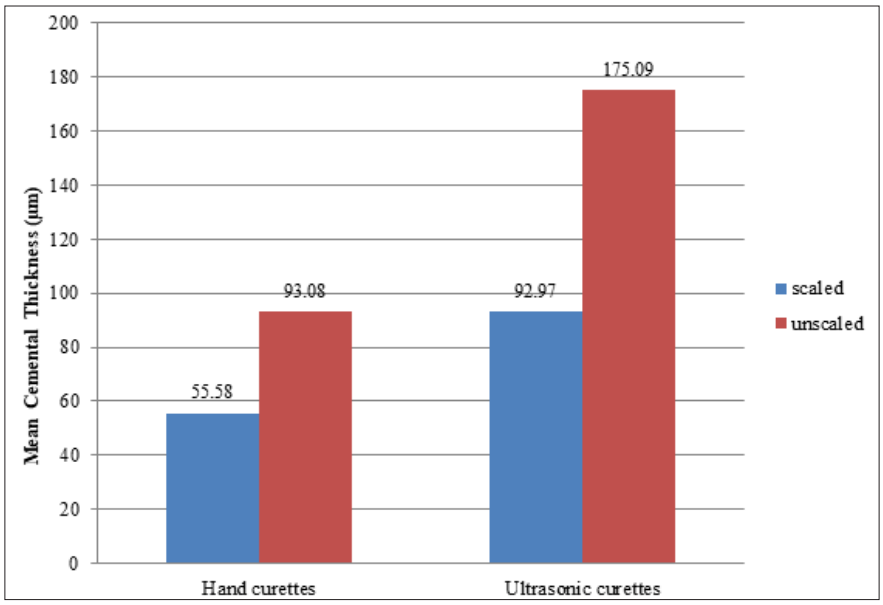

Figure 1.Mean cemental thickness of scaled and unscaled surfaces

Figure 2.Stereomicroscopic photograph of control specimen

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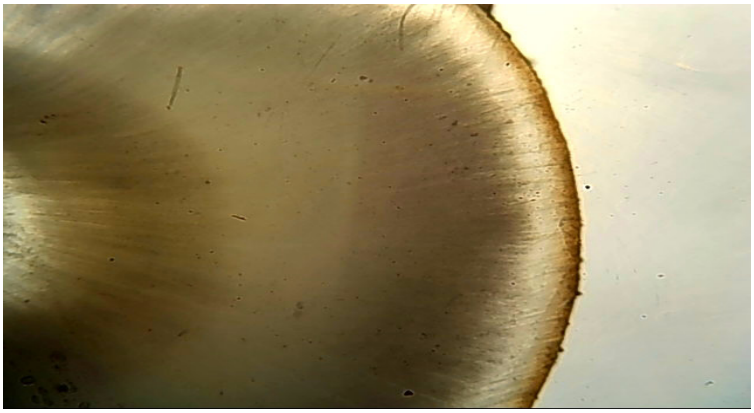

Figure 3.Stereomicroscopic photograph of ultrasonic curetted specimen

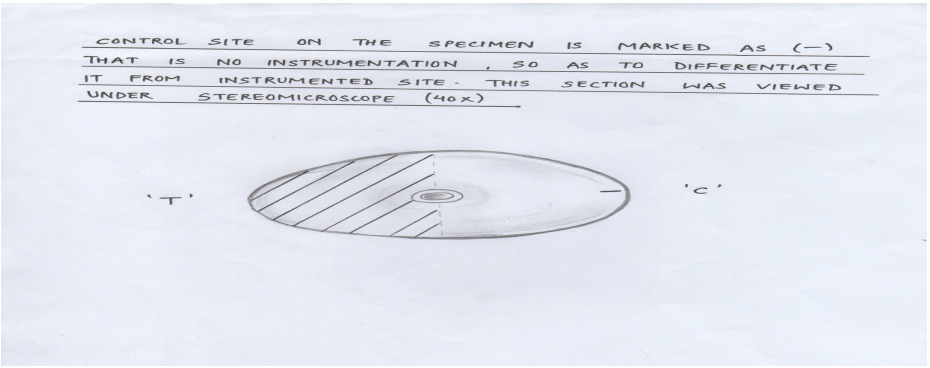

Figure 4.Cross-section of the specimen marked as (-), that is no instrumentation (C) and to differentiate it from instrumented site (T)

In 'Group-2' (ultrasonic curettes), comparison between the scaled and unscaled sites showed that there was a statistically significant difference between the two sites (p=0.002). The mean cemental thickness in scaled group was significantly lower than unscaled group.

Although the difference between the two groups, in terms of cemental thickness after scaling and root planning were statistically non-significant, but apparently the teeth treated with the ultrasonic curette showed less tooth substance removal than hand curettes.

Discussion

Periodontal therapy alters or eliminates the microbial ecology and contributing risk factors for periodontitis, thereby arresting the progression of disease and preserving the dental health, comfort and function with appropriate aesthetics and prevents the recurrence of periodontitis.[8]

The objective of periodontal instrumentation was to remove plaque, calculus, endotoxins and contaminated cementum by vigorous scaling of the root surface.[9] Current therapeutic approaches include gentle treatment of the root surfaces along with the removal of diseased cementum and preparation of new attachment i.e. the treated root surface is biologically compatible with host periodontal tissues. This is based on the observations that endotoxins do not penetrate the exposed root cementum, but form a loosely attached superficial layer on its surface.[10]

Scaling and root planning of the tooth surface is an important part of periodontal therapy. A variety of periodontal instruments are available to clinicians for mechanical root preparation, like hand curettes, sonic and ultrasonic scalers.

For proper periodontal regeneration and for cell attachment to occur, an appropriate root surface is required. Pathologically exposed root surfaces have undergone substantial alterations and thus may not serve as an appropriate substrate for cell attachment and fiber formation.[11] Dental calculus, a secondary etiological factor for periodontitis is clearly attached to the tooth surface through surface irregularities and by the forces acting between interlocking crystals.[12] Consequently, it is impossible to remove calculus completely without simultaneously removing some tooth substance.

Therefore, to reach a healthy disease-free area the depth of the root surface removal is unknown.[13] The most recent recommendation for achieving a clean and smooth surface is by removing a little tooth structure as possible.[14] For regeneration, it is necessary that the tooth root have 'disease free cementum' left on them after instrumentation as cementum is a better substrate for regeneration.[15]

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Considering the above findings an effort was made to conduct the study, for evaluation of residual thickness of cementum, following root planning under stereomicroscope. In the present in-vitro study 30 single rooted human teeth, with grade III mobility due to chronic or advanced periodontitis were extracted from the patients with intact root surfaces.

Teeth of patients with systemic disease were excluded as systemic factors modify periodontitis through their effects on the normal immune and inflammatory mechanisms and may increase its progression. Teeth affected by caries were not included in the study as it could adversely affect the root surface topography.[16] Minimal instrumentation during extraction was considered to avoid chipping off the root structure.[17] Teeth having periapical infection or non-vital teeth were not included as in chronic periapical inflammation, cementum formation may be substantial, giving rise to local hypercementosis. This may cause problems during extraction.[18]

Following extraction, the teeth were washed with distilled water and stored in normal saline. These specimens were randomly divided into two groups. The method of randomization was flipping of a coin. Group-1 specimens were subjected to scaling and root planning with hand curettes and Group-2 specimens were subjected to scaling and root planning with ultrasonic curettes.

Only proximal root surfaces were planed (mesial and distal), with one site serving as control where no instrumentation was done and other as test site[19] and subsequently sampled because facial and lingual surfaces are marred by the extraction forceps during tooth extraction.[20] The instrumentation of fifteen teeth included overlapping strokes with Gracey curettes No. 1-2 and 3-4 (Hu-Friedy Chicago, IL, USA) because of the design of the curette which allows it to be more easily adapted to the subgingival contours thereby providing the best adaptation to the complex root anatomy. Similarly, instrumentation of other fifteen was done by ultrasonic curette. Root planning was done until a smooth root surface was obtained which was then evaluated with the explorer.[10]

Following the root planning, teeth were sectioned at mid root region by a carbide disc for stereomicroscopic Analysis.[21]

After sectioning, the samples were decalcified for light microscope, in 10% Formic acid for 7 days as it ensures complete removal of calcium, causes minimal damage to cells, tissues and decalcifies at reasonable speed so that good quality sections can be prepared that will preserve all the essential microscopic elements.[22] The samples were thoroughly washed after decalcification process, and were kept in saline. Afterwards cross sections of specimens were made in mesiodistal plane (at mid root region) using carbide disc and were viewed under stereomicroscope at 40x. The results obtained are as follows:

The teeth were viewed under stereomicroscope with a magnificent of 40x. The residual cementum was assessed on proximal surfaces (mesial and distal), with one site serving as control where no instrumentation was done and other as test site using linear measurement scale with calibrations in mm that was placed on the eyepiece lens of the stereomicroscope.[3]

The mean cementum thickness (for Group-1 i.e. SRP with hand curettes), in our study was found to be, 93.08 µm (at control site) and 55.58 µm (at test site). The reason for this difference could be attributed to the fact that, the Gracey curettes and other manual instruments remove several layers of root substance and are intimately dependent on the applied force, angle and sharpness of the curette tip.[9] Also, it was concluded that ultrasonic devices were superior in preserving cementum, whereas hand curettes were the most effective instruments in removing cementum.[23]

Statistical comparison of mean cemental thickness of scaled and unscaled specimens after using Hand Curettes was found to be statistically significant (p=0.001).

The mean cementum thickness (for Group-2 i.e. SRP with ultrasonic curettes), in our study was found to be, 175.0985 µm (at control site) and 92.9754 µm (at test site). whereas statistical comparison of mean cemental thickness of scaled and unscaled specimens after using Ultrasonic Curettes was found to be statistically significant (p=0.002). This could be because of the design of the tip of the ultrasonic curettes as well as their adaptability to the root surface. Dahiya P et al.[24] also found that the newer, thinner tip of the ultrasonic instrument, caused less damage to the root surface.

The mean cemental thickness after scaling with Hand Curettes and Ultrasonic Curettes for Group-1 and Group-2 was found to be 37.5035 and 82.1231 respectively. The reason behind this may be due to, the mechanism of action of ultrasonic device was different, involving not only the mechanical effect of the vibrating tip but also a cavitation effect.[25] Also scaling with hand curettes remove more of the tooth substance than ultrasonic curette.[23]

Statistical comparison of mean cemental thickness after scaling with Hand curettes and Ultrasonic curettes was found to be statistically non-significant (p=0.310). This can be explained by the fact that both the groups were subjected to periodontal therapy of similar degree or because of small sample size and wide range of Standard deviation during sampling. It was also observed that the, root surfaces treated either by hand curettes or ultrasonic scalers were showing non-significant differences. These results indicate the beneficial effectiveness of both techniques in root treatment and planning.[26]

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In our study, areas with loss of tooth substance was evident where cementum had been completely removed, although most of the cementum was still present in other areas. Instrumentation of cementum is essential part of periodontal therapy both for surgical and non-surgical phases. Since cementum consists of growth factors and proteins which help in chemotactic migration, adhesion, proliferation and differentiation of various periodontal cells. Therefore, it is possible that cementum components have the potential to participate in the regulation of homeostasis and regeneration of these tissues. Thereby the preservation of cementum may facilitate the formation of fibrous connective tissue attachment.

However, the choice of hand or ultrasonic instrument for root debridement is totally dependent upon the clinician's acumen and also recent study has shown that, the pathologic changes of cementum in periodontally involved teeth are found only in superficial layers, so curettage of deeper layers should be avoided to achieve a calculus free biocompatible root surfaces.

Conclusion

It may be concluded that although the difference between the two groups, in terms of cemental thickness after scaling and root planning were statistically non-significant, but apparently the teeth treated with the ultrasonic curette showed less tooth substance removal than hand curettes. We may conclude that both hand curettes and ultrasonic curettes led to similar thickness of cementum post instrumentation but a large sample size could have been more conclusive in driving more valid interference from the study.

Conflict of Interest: None

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