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Effects of Chlorhexidine (0.2%) as Irrigant During Ultrasonic Debridement: A Clinical Study

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Abstract: The objective of this study was to evaluate the effects of chlorhexidine (0.2%) used in ultrasonic debridement compared with conventional debridement followed by chlorhexidine as oral rinse and conventional ultrasonic debridement alone. Thirty patients with moderate periodontitis who had at least 6 lower anterior teeth with pocket depth of 4 mm or more were selected and randomly divided into three groups including: Group A, ultrasonic debridement with subgingival delivery of chlorhexidine; Group B, ultrasonic debridement with distilled water and oral rinse of chlorhexidine two times a day for six weeks; Group C, conventional ultrasonic debridement alone as control. After 6 weeks, plaque index of Group B decreased significantly more comparing to Group A. No significant difference was noted between gingival indexes of the 3 Groups (A, B, C). The gingival bleeding index of group B decreased more than that of group A. There was no significant difference in probing pocket depth of examined groups. Attachment gain was observed in all examined patients but no significant difference was found between them. A marked reduction occurred in the number of pockets equal or greater than 4 mm, although no statistically significant difference was observed in the reduction in proportion of these pockets between groups following the treatments. Using chlorhexidine 0.2%, as irrigant during debridement with ultrasonic scaler has no clinical advantage to conventional ultrasonic debridement with water. Also it is concluded that use of chlorhexidine 0.2% as mouthwash with mechanical plaque control and ultrasonic debridement significantly reduces dental plaque and improves healing.

Key words: Chlorhexidine, antimicrobial therapy, mouthwash, chemical plaque control, subgingival irrigation, ultrasonic scaling, periodontal disease/therapy

INTRODUCTION

Bacterial plaque is the major causative factor of inflammatory gingival and periodontal disease; therefore, the principal objective of periodontal therapy is to eliminate this microbial flora. Elimination of the subgingival microflora may be achieved mechanically either by hand or ultrasonic instrumentation^[1].

Mechanical methods of plaque removal can be supplemented by antimicrobial agents. One such particular agent, chlorhexidine gluconate, has been used as an appropriate chemotherapeutic agent at concentrations of 0.2 and 0.12% in Europe^[1] and the US^[2], respectively. Since these mouth rinses were effective in reducing the supragingival flora, chlorhexidine offered a therapeutic advantage for a local delivery system. Chlorhexidine is a bactericidal agent^[3] with a long chain molecule and a positive charge. It is attracted to the negatively charged surface of the biologic membrane of bacterial cells, disrupts the cytoplasm and bacterial death occurs^[4].

Ultrasonic scaling appear to be as effective as hand instrumentation in reducing probing depths and bleeding scores, removing subgingival plaque and establishing a subgingival microflora consistent with periodontal health^[5,6].

If chlorhexidine is used as the coolant in the ultrasonic handpiece during debridement, it could be hypothesized that it might have a more pronounced effect, because irrigation would take place over a period of several minutes. This would result in obtaining better access for its administration and absorption to the root surface. This hypothesis has been tested by a few investigators^[1,5]. Unfortunately, the results have been inconsistent due to methodological diversity. Previous studies limited the delivery of chlorhexidine to a single appointment. A repeated treatment technique may, in theory, result in a more marked improvement than a single delivery technique.

The present study, therefore, aimed to compare the effects of 2 weekly applications of ultrasonic debridement using chlorhexidine 0.2% versus water as the irrigant

and also to compare these with conventional ultrasonic debridement continued with chlorhexidine oral rinse.

MATERIALS AND METHODS

This study was conducted in 2003 for 10 months. Thirty patients with moderate adult periodontitis were selected for this study from those attending for treatment in the periodontal clinic of the University of Mashhad, Dental School. The following criteria was used in patient selection: 1) good medical health, non-pregnant and no risk factors for increased susceptibility to bacterial endocarditis, 2) no current medications or antibiotics within the past two months, 3) moderate adult periodontitis who had at least one site with 4 mm or more pocket depth among their six lower anterior teeth and without a history of professional periodontal treatment within the past six months. An informed consent was obtained prior to participation.

Experimental design: At the first visit, all patients were instructed tooth brushing using the Bass technique and interdental cleaning aids and given similar toothbrushes and toothpastes.

Patients were randomly divided into three treatment groups. The treatment groups included: Group A: Ultrasonic scaling and root planing with 0.2% chlorhexidine (CHX) (Sharedaru Phrmaceutical Co, Iran) delivered through the tip of ultrasonically activated scaler (Cavitron, Dentsply), Group B: Ultrasonic scaling and root planing using distilled water followed by oral rinse of 0.2% CHX twice a day for six weeks, Group C: Ultrasonic scaling and root planing using distilled water alone as control. Ultrasonic scaling was repeated for all patients one week later using the same irrigant as their first treatment visits.

Clinical measurements: At the second visit, the six lower anterior teeth were subjected to examination comprising the following clinical parameters: Plaque Index^[7], Gingival Index^[8], the percentage of sites with bleeding on probing using the Gingival Bleeding Index^[9], Probing Pocket Depth (PPD) as well as Clinical Attachment Level (CAL). Using a William’s periodontal probe, PPD and the distance from CEJ to the depth of pocket CAL were recorded at six sites on each tooth.

Following the baseline measurements, the entire dentition was ultrasonically scaled and irrigated according to the treatment protocol for each group. After one week, the same procedure was repeated for all groups until all supra- and subgingival calculus was removed according to both visual and tactile inspection. The patients in the

group B continued CHX oral rinse twice daily for six weeks. Oral hygiene instruction was reinforced at this point and throughout the study. Above mentioned Indices were measured again after six weeks.

The data showed a normal distribution and hence, were analyzed using the analysis of variance (ANOVA) followed by multiple comparisons using the Tukey test. To examine the association between the treatment technique and the percentage of sites with PPD>4 mm the chi-square test was performed.

RESULTS

All the data presented for the various treatments were based on ten subjects per treatment type. There were no significant differences in the clinical parameters between test and control groups at the baseline examination. The PI significantly reduced at six weeks post-treatment relative to baseline in all groups. Plaque index of Group B decreased significantly more than group A (p=0.019) (Table 1). There were no statistically significant differences among Gingival Index of the 3 Groups (Table 2). Table 3 shows a significant reduction at six weeks post treatment between treated groups in the % of sites with bleeding. GBI of Group B decreased significantly (p=0.022) more than A but not C. Table 4 shows the mean probing depths which were relatively decreased in all treated groups, six weeks

Table 1: Plaque index of the 3 treatment groups before and after treatments

Time	Treatments		
	A	B	C
Before treatment	1.71±0.53	1.87±0.61	1.81±0.49
After treatment	1.19±0.52	0.52±0.48	0.88±0.39
Reduction	0.53±0.65 (28%)	1.35±0.76* (85%)	0.93±0.32 (58%)

* Significant difference (p=0.019) observed between groups A and B

Table 2: Gingival Index of the 3 treatment groups before and after treatments

Time	Treatments		
	A	B	C
Before treatment	1.97±0.19	1.78±0.39	1.85±0.14
After treatment	1.56±0.21	1.12±0.31	1.40±0.31
Healing	0.40±0.26 (19%)	0.66±0.47 (39%)	0.45±0.29 (27%)

Table 3: Gingival Bleeding Index of the 3 treatment groups before and after treatments

Time	Treatments		
	A	B	C
Before treatment	0.90±0.12	0.82±0.16	0.56±0.12
After treatment	0.64±0.15	0.28±0.18	0.50±0.25
Healing	0.26±0.15 (32%)	0.53±0.21* (69%)	0.36±0.25 (17%)

* Significant difference (p=0.022) observed between Groups A and B

Table 4: Probing pocket depth of the 3 treatment groups before and after treatments

Time	Treatments		
	A	B	C
Before treatment	5.08±1.38	4.85±0.67	4.44±0.22
After treatment	3.49±1.49	2.95±0.72	2.57±0.94
Healing	1.59±0.49 (31%)	1.90±0.66 (39%)	1.87±0.82 (42%)

Table 5: Clinical attachment level of the 3 different groups before and after treatments

Time	Treatments		
	A	B	C
Before treatment	5.52±1.34	5.62±0.96	4.24±0.48
After treatment	4.62±1.31	3.95±1.04	3.18±0.91
Healing	0.90±0.67 (16%)	1.67±0.70 (29%)	1.62±1.12 (25%)

Table 6: Number of pockets of 4 mm or deeper among the 3 treatment groups before and after treatments

Time	Treatments		
	A	B	C
Before treatment	113	116	75
After treatment	38	30	20

No significant difference ($\chi^2=1.05$)

post-instrumentation. There was, however, no significant difference in probing pocket depth reductions of the examined groups.

Table 5 shows a trend toward decreased attachment level. Gain was relatively observed in all examined groups. However, no significant difference was observed between groups. No significant difference was observed in the numbers of pockets with PPD>4 mm depth between examined groups. A relative reduction was seen in all of them (Table 6).

DISCUSSION

In theory, the combination of the cleaning efficacy of the ultrasonic scaler in removing calculus and plaque with the antimicrobial action of the chlorhexidine should improve treatment results. Therefore, the present study was designed to evaluate the clinical effect of 0.2% chlorhexidine in the treatment of moderate periodontitis when used as irrigant for an ultrasonic handpiece. In general, our data indicate that oral rinse using CHX is superior to a single ultrasonic subgingival scaling using CHX as coolant. Hallmon and Reese^[10] performed a systematic review on manual versus ultrasonically driven instrumentation with or without antibacterial irrigation. They concluded that manual and mechanically-driven instrumentation appears comparable in affecting improved clinical outcomes. Furthermore, adjunctive subgingival irrigation plus manual instrumentation and subgingival tissue treatment result in similar clinical outcomes when compared to manual instrumentation alone^[10].

Plaque Index: In this study a significant difference ($p=0.019$) was observed between Group B and A with respect to plaque Index which corresponds to the study of Reynolds *et al.*^[11] while the mean % of sites with plaque did not vary significantly in the study of Taggart *et al.*^[5] and Chapple *et al.*^[1]. Although we did not investigate the composition of subgingival microflora.

Gingival Index: No significant difference was noted between Gingival Indexes of groups, which is not in agreement with the study of Reynolds *et al.*^[11]. Vinholis *et al.*^[12] found improvement in clinical parameters and significantly greater decrease in GI and bleeding as a result of CHX irrigation during scaling and root planing compared to scaling alone.

Gingival bleeding index: Significant difference (0.022) was observed between Groups A and B which is not in agreement with study of Chapple *et al.*^[1] and Taggart *et al.*^[5].

Probing pocket depth: There was no significant difference in probing pocket depth and number of 4 mm or more pocket depths of the examined groups, which corresponds with the result obtained by Taggart *et al.*^[5] and Chapple *et al.*^[1] and is not in agreement with the study of Reynolds *et al.*^[11]. Hanes and Purvis^[13] reported no evidence of adjunctive effect on probing depth reduction as a result of CHX irrigation during scaling and root planing compared to scaling and root planing alone.

Attachment level: There was a trend towards decreased attachment level. Gain was relatively observed in all examined groups. The lack of significant difference observed between Groups A and B which is not in agreement with the research of Chapple *et al.*^[1] and Taggart *et al.*^[5].

This study confirmed and extended the results of many previous studies which showed that scaling and root planing, in combination with good supra gingival plaque control, results in marked resolutions of the clinical signs of periodontal disease. In this study, no significant differences were noted between the three treatment groups with respect to GI, PPD and the number of pockets of 4 mm or more pocket depths. These results are in agreement with other reports on similar trials^[1,5]. However, Diallo *et al.*^[14] reported that CHX irrigation improved the periodontal treatment.

Some investigators have found a slight adjunctive effect, where an ultrasonic Instrument was used with chlorhexidine^[1]. However, these observations were not significant. In this investigation, unlike others, we used a 2 consecutive treatment appointment regime to deliver the

chlorhexidine to the bottom of pockets. This approach was chosen to increase the substantivity of the antimicrobial agent. The results, however, proved this was yet far from sufficient to produce a clinical advantage over the routine treatments.

In this study as a whole, group B showed a greater clinical benefit of treatment modality, which could be due to using chlorhexidine as a mouth rinse. It seems that a short exposure to the chemical during ultrasonic scaling and root planing may be insufficient for a clinically detectable effect to take place.

The effect of CHX rinse may have clinical ramifications beyond that are concerned by periodontists. It has been reported that oral rinse using antibacterial agents such as chlorhexidine may reduce the amount of bacterial cross contamination following periodontal ultrasonic scaling^[15].

Ultrasonic cleaning of root canal using antibacterial agents such as chlorhexidine and sodium hypochlorite has also been suggested and investigated^[16].

It has been reported that periodontal treatment may not only decrease periodontopathic bacteria, but also increase the proportion of cariogenic bacteria if it is not supplemented with long-term use of antibacterial mouth rinses such as chlorhexidine. These findings indicate that chlorhexidine mouthwash may, in addition to its beneficial periodontal effects, be protective to host against the cariogenic bacterial shift of the oral microflora^[17].

CONCLUSIONS

Using chlorhexidine (0.2%) as an irrigant during ultrasonic scaling and root planing has no clinical advantages to conventional ultrasonic debridement with water. Also, it is concluded that use of chlorhexidine (0.2%) as a mouthwash with mechanical plaque control and ultrasonic debridement significantly reduces dental plaque and improves healing.

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