

Clinical effects of chlorhexidine, sanguinarine and saline as coolants during ultrasonic scaling on gingivitis in orthodontic patients

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هدفت هذه الدراسة لفحص تأثير الكلورهيكسدين والسانغوينارين، كمبردات خلال التقلح، على التهاب اللثة عند مرضى تقويم الأسنان. شاركت في هذه الدراسة ثمان عشرة أنثى مصابة بالتهاب اللثة. تم قبل بداية الدراسة تسجيل كل من مؤشر اللويحة الجرثومية ومشر التهاب اللثة والسنزف وعمق السرى، وذلك بالنسبة للأسنان التالية: ١٦، ٢١، ٢٥، ٣٦، ٤١ و ٤٥، وأعيد التسجيل بعد أسبوعين وأربعة أسابيع. تم استعمال البيزون لتطبيق الهاميل (الكلورهيكسدين والسنغوانارين والخلول لللحمي) كمبردات لكل مجموعة مؤلفة من ستة مرضى. دلت النتائج على انخفاض كل من مؤشر اللويحة الجرثومية ومشر التهاب اللثة والسنزف وعمق السرى في كافة المجموعات الثلاثة. تعد عملية الغسل، باستعمال الكلورهيكسدين أو السنغوانارين أو الخلول لللحمي مع الأمواج فوق الصوتية إجراءً سريعاً فعالاً بالنسبة لالتهاب اللثة عند مرضى تقويم الأسنان.

This clinical investigation examined the effect of chlorhexidine, sanguinarine and saline as coolants during ultrasonic scaling on gingivitis in orthodontic patients. Eighteen females with gingivitis participated in this study. Plaque Index (PI), Gingival Index (GI), Interdental Bleeding Index (BI) and Probing Depth (PD) were recorded for the following teeth 16, 21, 25, 36, 41 and 45 at baseline, 2 weeks and 4 weeks respectively. The application of solutions (chlorhexidine, sanguinarine and saline) as coolants was delivered by the use of an ultrasonic handpiece (Piezon) in each group consisting of 6 patients. A reduction of the PI, GI, BI and PD was observed in all three groups. Irrigation with chlorhexidine, sanguinarine and saline as coolants respectively is an effective clinical procedure during ultrasonic scaling in orthodontic patients with gingivitis.

Introduction

Ultrasonic scalers appear to be as effective as hand instruments in reducing probing depths and bleeding scores,^{1,2} removing subgingival plaque³ and establishing a subgingival microflora consistent with periodontal health.⁴

Orthodontic patients especially adolescents, often show ineffective plaque control, because of difficulties in performing oral hygiene with fixed orthodontic appliances in place.^{5,6}

Gingivitis together with gingival hyperplasia is often observed during orthodontic treatment.⁷ These pathologic changes reflect the onset of a destructive process in the periodontium.⁸ Numerous studies suggested the use of chlorhexidine mouthrinse in managing this destructive process. It has a favorable effect on plaque control and inflammation. Chlorhexidine in the form of mouthrinse⁹ or subgingival irrigant⁷ has been shown to be useful adjunct in plaque control for patient with fixed orthodontic appliances.

In vivo studies have shown that sanguinarine

was effective in reducing plaque formation and retarding the development of gingivitis.¹⁰ The effect of a single subgingival irrigation of chlorhexidine, sanguinarine or saline on gingivitis in orthodontics patients was a reduction of the plaque index and probing depth by any of the three solutions.¹¹ A clinical and microbiological comparison of the effects of chlorhexidine and water as coolants during ultrasonic scaling and root planing has shown a slight adjunctive effect for chlorhexidine in the reduction of pocket depth.¹² However, the effect on gingivitis of chlorhexidine, sanguinarine and saline as coolants during ultrasonic scaling in orthodontics patients has not been reported.

Therefore, the present study was designed to test the efficacy of chlorhexidine, sanguinarine and saline as coolants during ultrasonic irrigation on gingivitis in orthodontic patients over a 4-week period.

Materials and Methods

Patient Selection

Subjects for this study were selected from the

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Division of Orthodontics at King Saud University, College of Dentistry. Eighteen female subjects qualified on the basis of the following criteria.

1. Must be aged 12 to 18 years and currently undergoing full banded straight wire (Edgewise) treatment with bracket on the anterior teeth and bands on their molars.
2. Existing gingivitis as assessed by bleeding on probing, with no evidence of periodontitis.
3. No known hypersensitivity to chlorhexidine, sanguinarine or saline.
4. Good medical health.
5. No antibiotics taken in the preceding two months.

Preparations

The three commercial preparations used were chlorhexidine containing 0.2% chlorhexidine digluconate (Corsodyl ICI, Macclesfield UK), sanguinarine (Viadent Fort Collins, Colorado, USA), containing 0.3% sanguinarine extract and zinc chloride and saline (Pharmaceutical Solution Industries Ltd., Jeddah, Saudi Arabia) containing 0.9% sodium chloride.

In order to ensure that the investigators would remain blind to the solution used, all three solutions were flavored and colored identically at the School of Pharmacy, King Saud University except for the active ingredient chlorhexidine, sanguinarine and saline.

Randomization and distribution of the test solutions were done by a hygienist, independently of the investigators. Each solution was given a code name and not revealed until the end of the study. At no time did the investigators know that the test solutions were being used as coolants.

Clinical Procedures

Six index teeth which had been used as reliable indicators for the various regions of the mouth were used.¹³ They were teeth no. 16, 21, 25, 36, 41 and 45. The following parameters were recorded at baseline (day 0), 2 weeks (day 14) and 4 weeks (day 28) on each of the teeth: Plaque Index¹⁴ (PI); Gingival Index¹⁵ (GI) and Interdental Bleeding Index¹⁶ (BI).

Probing depth (PD) (mm) was measured with a Michigan periodontal probe (Hu-Friedy, Chicago, III, USA) with a tip diameter of 0.45 mm.

Following the examination, the patients were randomly assigned to one of three groups each consisting of 6 individuals. All measurements were done by a single operator (NB) who was calibrated prior to the study.

A pilot study of 10 subjects revealed a high reliability of measurement. The application of the three solutions as coolants was delivered by the use of an ultrasonic Piezon handpiece (Piezon Master 400, EMS, Switzerland). Piezon is a piezo electric ultrasonic device oscillating at 25000 vps with a straight horizontal action. It comes with a 300 ml detachable plastic bottle which serves as container for any of the solutions used in the study. Each coolant was delivered to the ultrasonic handpiece via separate bottles.

The mouth was instrumented with the ultrasonic hand piece. This was done twice, each time starting with the container full of coolant until emptied. The procedure was done for each patient and lasted twenty minutes.

Patients had previously received oral hygiene instructions and they continued their usual oral hygiene procedures throughout the study. No additional attempts were made to improve the patient's oral hygiene.

Statistical analysis

The data were entered into the microcomputer using FOXPRO (Window Ver 3.0). The Statistical Package for Social Sciences (SPSS Ver. 7.5) was utilized for statistical computations. Repeated measure three-way ANOVA was employed to determine the differences between visits, different types of teeth and solutions.

Results

All eighteen patients completed all the visits. No patient reported adverse reaction or side effects to any of the three solutions used in the ultrasonic handpiece.

The overall differences for plaque index, gingival index, interdental bleeding index and the probing depth between baseline and day 14; and baseline and day 28 were found to be significant ($p < 0.0001$) (Table 1).

Plaque index, gingival index, interdental bleeding, and probing depth all showed a significant decrease from day 0 to day 28 (Table 1). When the clinical effects of chlorhexidine, sanguinarine and saline were compared, there were no significant differences. The results are

Table 1. Descriptive statistics for the four outcome measures.

Variable	n	Mean	Standard Deviation	P Value
Plaque Index (PI)	18			
~ Baseline	18	0.9236	0.23	< 0.001*
~ 2 Weeks	18	0.5833	0.23	
~ 4 Weeks	18	0.4907	0.23	
Bleeding Index (BI)				
~ Baseline	18	0.83	0.20	< 0.001 *
~ 2 Weeks	18	0.48	0.36	
~ 4 Weeks	18	0.22	0.25	
Gingival Index (GI)				
~ Baseline	18	1.1366	0.18	< 0.001*
~ 2 Weeks	18	0.6782	0.30	
~ 4 Weeks	18	0.5833	0.26	
Probing Depth (PB)				
~ Baseline	18	2.8371	0.86	< 0.001*
~ 2 Weeks	18	1.8580	0.39	
~ 4 Weeks	18	1.5458	0.44	

* Baseline versus 2 weeks ** Baseline versus 4 weeks

summarized in Table 2. Figs. 1 to 4 show the mean indices, respectively, between day 0 and day 28 following treatments with the solutions.

In the case of plaque index, gingival index and probing depth, all differences over time were within one unit of measurement. Plaque index decreased from 0.92 to 0.49; gingival index

Table 2. Results of repeated measures analysis of variance across three time points for Plaque Index, Gingival Index, Interdental Bleeding Index and Probing Depth.

Outcome Variable Source	Sum of Squares	dF	Mean Square	F Value	P-Value
<i>Plaque Index</i>					
Visit	11.223	2	5.611	36.370	.000*
Material	.0813	2	0.4065	1.040	.378**
<i>Gingival Index</i>					
Visit	18.905	2	9.453	56.967	.000*
Material	.324	2	.162	3.282	.066**
<i>Interdental Bleeding Index</i>					
Visit	20.321	2	10.160	29.236	.000 *
Material	.104	2	0.521	1.258	.312**
<i>Probing Depth</i>					
Visit	98.051	2	49.025	28.147	.000 *
Material	.218	2	.109	.637	.542**

* P<0.0001 - Highly significant

** Not significant

Fig. 1. Mean Plaque Index by treatment groups on gingivitis in orthodontic patients.

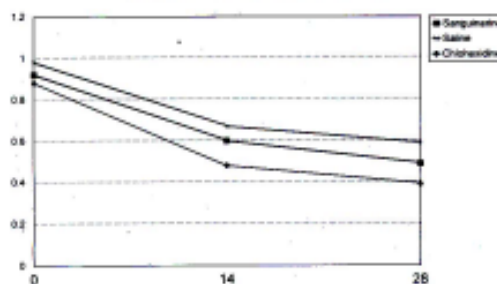


Fig. 2. Mean Gingiva Index by treatment groups on gingivitis in orthodontic patients.

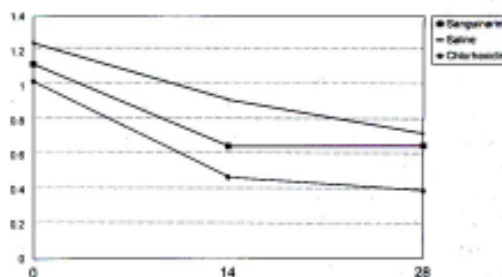


Fig. 3. Mean Bleeding Index by treatment groups on gingivitis in orthodontic patients.

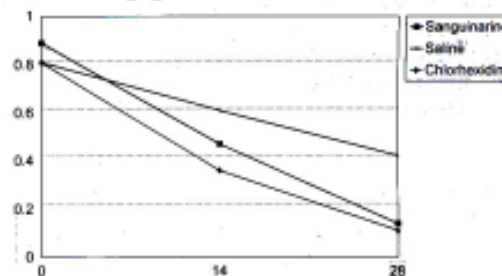
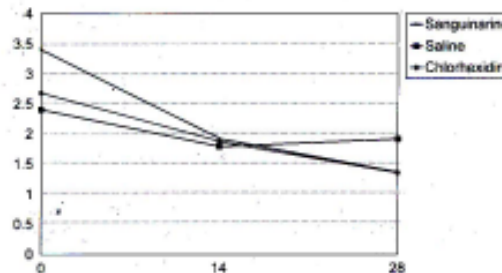


Fig. 4. Mean Probing Depth by treatment groups on gingivitis in orthodontic patients.



decreased from 1.13 to 0.58 and the probing depth decreased from 2.83 to 1.54 over the same interval). The measure of the interdental bleeding index, however, decreased from near unity (0.83) to near zero (0.22), a more meaningful clinical achievement than in the other three measures.

Discussion

The present study was designed to evaluate the clinical effects of chlorhexidine, sanguinarine and saline as coolants for ultrasonic scaling on gingivitis in orthodontic patients. The anti-plaque quality of chlorhexidine had been demonstrated previously.⁹ Sanguinarine antimicrobial properties against plaque forming bacteria had also been established.¹⁷ Subgingival irrigation with either chlorhexidine or saline in patients with periodontitis had been shown to be effective in reducing the pockets with chlorhexidine solution found to be the most effective.¹⁸ Also, chlorhexidine used as a coolant during ultrasonic scaling had a slight adjunctive effect over water in the reduction of pocket depth when used as coolant for the treatment of chronic periodontitis.¹²

The results of this study showed no difference in outcome among the three solutions. The repeated measures consistently indicated an absence of difference between the solutions (Table 2). The reduction of PI, GI, BI and PD took place regardless of whether the teeth had been treated with chlorhexidine, sanguinarine or saline as the coolant during ultrasonic scaling. The changes observed in the plaque and gingival indices did not appear to represent a clinically significant reduction or increase in plaque and gingival levels. This could be because no attempt was made to improve the patient's supragingival plaque control throughout the study, although they had oral hygiene instructions and were told to continue their usual oral hygiene procedures throughout the study.

Studies involving patients with frequent supragingival irrigation with chlorhexidine have shown the solution to be effective in reducing plaque in patients with gingivitis.¹⁹ Dilute solutions of sanguinarine delivered via rinsing or supragingival irrigation were also shown to be effective in controlling plaque as an additional benefit to the use of supragingival irrigation to control gingivitis in humans.²⁰

The small size of the differences actually observed between groups in this study suggested the true absence of a meaningful treatment

(therapeutic) effect. The slight reduction in probing depth seen at two and four weeks could have resulted from variations in the probing technique and also from a reduction in gingival inflammation. The initial shallow probing depths would tend to limit the amount of probing depth reduction expected to occur. However, in-patients with deeper periodontal pockets, frequent subgingival irrigations with chlorhexidine have resulted in significant pocket reduction.²¹

The statistically significant reduction in this study of the interdental bleeding index with all three solutions used has clinical significance. The reduction occurred over a 4-week period and the index decreased significantly. A longer period of observation would allow a better estimate of extinction of the effect. This will offer the chance to see how long it would take for the gingiva to return to baseline condition and determine whether there is a treatment effect over 4 weeks. The reduction in bleeding index after 4 weeks on patients with gingivitis with the different solutions as coolant suggested that the effect could be the result of the ultrasonic irrigation on the supra and subgingival plaque and independent of the solution used.

The results of this study showed that a single visit treatment with ultrasonic irrigation with chlorhexidine, sanguinarine or saline could effectively reduce the inflammation of the interdental papilla on gingivitis in orthodontic patients. The effect of reduced inflammation was over a 4 week period which frequently coincides with scheduled orthodontic appointments during active treatment. This would conveniently allow for repeated treatments at specific interproximal sites that are difficult for plaque control and are the most severely affected by inflammation in orthodontic patients.

The concept of a chemical solution to enhance oral health has long been considered and the importance of such a solution is even greater in orthodontic patients with established gingivitis. Chlorhexidine, sanguinarine and saline as coolant during ultrasonic irrigation may represent an important therapeutic agent in controlling gingival inflammation, gingival bleeding and plaque accumulation. The effect on these clinical parameters was achieved when they were used over a 4 week period.

Conclusion

1. Ultrasonic irrigation with a solution of chlorhexidine, sanguinarine or saline as coolant reduced significantly the interdental bleeding index.

2. There was no difference between chlorhexidine, sanguinarine and saline when used as coolants during ultrasonic irrigation in orthodontics patients with gingivitis.
3. Ultrasonic irrigation with chlorhexidine, sanguinarine or saline as coolant was an effective procedure that could be performed monthly on orthodontic patients

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