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Original Article

Comparison of the effects of Persica and protact mouthwash on gingival healing after crown lengthening surgery - A double-blinded randomized clinical trial

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ABSTRACT

Background: Plaque control is one of the main issues after crown lengthening surgery. It is advised to use mouthwashes since mechanical plaque control is not possible due to the presence of the wound. Thus, the present study aims to compare the effectiveness of Persica and Protact mouthwash on gingival healing after crown lengthening surgery.

Materials and Methods: In this double-blind clinical trial, 33 candidates were randomly divided into three groups (n = 11). The first group used 0.2% chlorhexidine (CHX) mouthwash; the second group used Persica mouthwash; and the third group used Protact mouthwash. Patients were followed for 14 days and changes in their plaque index (PI), gingival index (GI), stain index (SI), tongue taste, and color were recorded. Data were analyzed using SPSS V.22 using the Kruskal–Wallis, Wilcoxon, and Chi-square tests. The significance level was considered to be < 0.05.

Results: The PI decreases significantly after 14 days in the CHX group (P = 0.011), however, this difference was not significant in the other two groups. Moreover, the GI and SI were not significantly different in any of the groups (P > 0.05). The changes in the tongue color and taste were only observed in the CHX group and patient dissatisfaction was higher in this group.

Conclusion: CHX is the gold standard for patients who have undergone clinical crown lengthening surgery; nevertheless, considering its side effects and bad taste, Persica and Protact herbal mouthwashes can be used in more sensitive and uncooperative individuals.

Key Words: Crown lengthening, dental plaque index, mouthwash, periodontal index

INTRODUCTION

Clinical crown lengthening surgery is a procedure that aims to increase the amount of dental tissue present in the oral cavity. Esthetic and restorative reasons are the main indications for this type of surgery.[1] After the surgery, inflammation occurs in the surrounding tissues due to trauma and the healing process.[2] It is essential to prevent microbial plaque development and wound infection to enhance the area and accelerate the healing process.[3] Mechanical plaque control might not be possible due to the patient's pain and

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discomfort in the injured area; therefore, the chemical plaque control method is often recommended.[4,5]

Mouthwashes are one of the greatest antimicrobial agents for chemical plaque control, and the majority of the studies focus on solutions that contain chlorhexidine (CHX). Dental practitioners use CHX as an inhibitor of dental plaque and caries on smooth surfaces, however, this chemical agent has several unfavorable side effects, including altered taste perception, dry mouth, burning sensation in the oral cavity, gingival recession, tooth discoloration, and adverse systemic effects if swallowed.[6,7]

Using plant extracts and essential oils has grown in the modern era. These extracts and essential oils are particularly popular in the manufacture of mouthwashes and have different antimicrobial effects on various microorganisms.[8,9] Persica and Protact are among these herbal mouthwashes.

Protact is a type of herbal mouthwash that contains *Zataria multiflora* extract. *Z. multiflora* is native to Iran, Afghanistan, and Pakistan and is utilized in the food, cosmetic, health, and medical industries.[10] This plant has antiseptic, antifungal, antioxidant, immune system stimulant, spasmolytic, pain reliever, pest control, and antimicrobial properties. It is advised to use this plant, either in powder or mouthwash form, for eliminating oral infections, halitosis, and gingival discomfort.[11]

Persica is another kind of herbal mouthwash that contains Mentha, Salvadora persica, and Achillea millefolium extracts. Salvadora persica has been utilized in the Middle East to promote dental and oral health for more than 1400 years.[12] This extract can reduce microbial plaque, caries, gingival bleeding, periodontal diseases, and gingivitis.[13,14] Furthermore, Achillea millefolium has antimicrobial and anti-inflammatory properties. Mentha is added to the mixture owing to its antimicrobial effects as well as its pleasant smell and taste.[15]

The idea of keeping the teeth in the oral cavity for a longer period and the advancement of dental procedures have led to an increase in the demand for crown lengthening surgery. Proper healing in the surgical site requires excellent infection control using chemical techniques. Therefore, the current study aimed to compare the effect of two herbal mouthwashes (Protact and Persica) in patients undergoing clinical crown lengthening surgery.

MATERIALS AND METHODS

Study design

The current double-blind clinical trial was conducted on candidates for clinical crown lengthening surgery, referring to the Mazandaran University of Medical Sciences dental clinic in 2022–2023, using the available sampling method. The study protocol obtained ethical approval from the Mazandaran University of Medical Sciences (ethics code: IR.MAZUMS.REC.1401.491) and the Iranian Registry of Clinical Trials (IRCT20170502033770N2).

After explaining the purpose of the study, informed consent was obtained from the patients. The sample size was calculated based on Kamali's investigation[16] which suggested the probability of discoloration in CHX and Persica mouthwashes to be 60.6% and 9.1%, respectively. Considering their findings, the significance level (α) of 5%, the power of the test (β-1) of 80%, and a 10% possibility of dropouts, 11 participants were required for each group (33 individuals in total).

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 \times (p_1 \times q_1 \times p_2 \times q_2)}{(p_1 - p_2)}$$

The inclusion criteria were as follows:

- Candidates for crown lengthening surgery who were 18–60 years old
- Absence of systemic diseases
- Patients' consent for participation in the study.[3]

The exclusion criteria were as follows:

- Antibiotic consumption for 10 days in the past 3 months
- Allergic to CHX or herbal mouthwashes
- Consumption of contraceptives (interferes with gingival healing) or corticosteroids
- pregnant or breastfeeding patients
- Cigarettes or alcohol intake
- Presence of pathological lesions in the oral mucosa
- Presence of orthodontic appliances or movable removable prostheses
- Presence of periodontitis
- Discolored teeth due to systemic factors or drugs.[3,17]

Randomization

The random block method was used to assign the samples to groups (type of mouthwash). First, the samples were matched in terms of age, sex, periodontium status, and oral hygiene. Individuals

with similar status were placed in a block. According to the total number of required samples (33 samples) and the number of mouthwashes, 11 blocks with homogenized samples were considered as three samples in each block (number of mouthwashes). The group type was selected for each person through random allocation software 2.

Intervention

The participants were randomly divided into three groups as follows:

a. The CHX group (A): They were asked to rinse their mouths with 10 ml of CHX mouthwash 0.2% (Najo, Iran) for 30s every 12 h for 2 weeks
b. The Persica group (B): They were asked to rinse their mouths with a solution containing 15 drops of Persica mouthwash and 15 ml of water for 20s four times a day based on the manufacturer's recommendation for 2 weeks
c. The Protact group (C): They were asked to rinse their mouths with 10 ml of Protact mouthwash (Zolang Respina, Iran) for 30s every 8 h for 2 weeks.

All the patients were prescribed 400 mg of ibuprofen and were prohibited from eating and drinking for 30 min after the surgery.

Blinding

The mouthwashes were kept in dark-colored bottles with the same appearance, with different labels, and the mouthwash instructions brochure was given to the patients in identical envelopes with different labels according to the mouthwashes' labels. Therefore, the participants and the dentist were unaware of the type of mouthwash. To homogenize the study, all patients were given the same type of soft toothbrush, dental floss, and toothpaste. It should be noted that the patients were prohibited from brushing and flossing the surgical area for a week.

Seven days after the surgery, the patients returned for suture removal, and they were instructed to brush all their teeth using the charters method. The patients had their second follow-up visit 14 days postsurgery.

Measuring the variables

One week before the surgery, the patients were taught the correct method of brushing (modified Bass) and flossing. After scaling and root planning, the gingival index (GI) and the plaque index (PI) were recorded. Since the scaling and root planning were done on the patients, the stain index (SI) of the target teeth was considered to be zero. The patients were asked to use the prescribed mouthwash, starting on the night of surgery. One week after the surgery, the patients had their second visit to remove the sutures. The GI, PI, and SI indices of the target teeth as well as the tongue color change and mouthwash taste, were recorded for the second time, 14 days after the surgery.[3]

The GI was measured according to the Löe and Silness method. The scores were as follows: 0 - normal gingiva without inflammation, 1 - mild inflammation, slight discoloration, mild edema and no bleeding during probing, 2 - moderate inflammation, redness, edema and bleeding during probing, 3 - severe inflammation, marked redness and edema, the presence of wounds and the tendency of spontaneous bleeding.[18]

The PI was measured according to the Silness and Löe method. The scores were as follows: 0 - no plaque at all 1 - a superficial layer of plaque which is not observable, 2 - visible plaque without the need of an explorer, 3 - a large amount of soft debris on the gingival margins and interproximal areas.[19]

SI was measured by the Lobene method. The scores were as follows: 0 - no stain, 1 - mild stain (yellow to brown or pale gray), 2 - moderate stain (medium brown), 3 - severe stain (brown or dark black). Furthermore, the scoring of the stained area was as follows: 0 - no stain, 1- the stain covering one-third of the area, 2 - the stain covering one-third to two-thirds of the area, and 3 - the stain covering two-thirds or more than two-thirds of the area.[20]

Color change of the tongue was measured according to the Claydon criterion, which was divided into three categories: color change of less than half of the tongue, more than half of the tongue, or no color change in the anterior two-thirds of the tongue.[3]

The taste of the mouthwash was divided into five categories: very bad, bad, normal, good, very good, and the patient gave a score from 1 to 5, respectively.[3]

The researcher responsible for the measurements was calibrated before the start of the experiment in order to repeat the measurement of the variables. Before the procedure, 10 patients requiring clinical crown lengthening surgery were included. GI, PI, and SI parameters were measured two days apart. The intraclass correlation coefficient (Pearson's correlation coefficient) as a measure of researcher repeatability for GI, PI, and SI variables was 0.85, 0.82, and 0.89, respectively. All procedures were performed by a periodontist (H.A.) in Sari Dental Faculty.

Statistical analysis

In this study, descriptive indices such as mean, standard deviation, frequency, and percentage were used. Analysis of variance and Chi-square tests were used to compare the demographic variables in three groups. Furthermore, nonparametric Kruskal–Wallis, Wilcoxon, GEE regression, and Chi-square tests were used to compare the response variables in three groups. SPSS software version 22 was used for statistical calculations, and the significance level was considered to be < 0.05.

RESULTS

In this study, 33 patients requiring clinical crown lengthening surgery were randomly divided into three groups, of which 18 participants (54.5%) were women and 15 participants (45.5%) were men. There was no significant difference in the frequency of participants in the three groups based on sex (P = 0.693). The average age of the individuals was 33.39 ± 9.37 years. No statistical difference was observed between the groups in terms of their age (P = 0.712). Among the measured teeth, 48.5% were in the maxilla and 51.5% were in the mandible. Furthermore, 33.3% of them were anterior teeth and 66.7% were posterior teeth.

The PI and GI in the three groups were reported separately on the first and fourteenth days. On the first day, the average PI had a significant difference between the three groups (P = 0.003), and the highest and lowest were in the CHX and the Persica group, respectively. On the fourteenth day, the PI showed no significant difference between the three groups (P = 0.616). However, the Persica group had the lowest value, and the other two groups were almost equal. By comparing the values on the first and fourteenth days, the PI index decreased significantly in the CHX group (P = 0.011), but no significant difference was observed in the other two groups [Table 1 and Figure 1].

As observed in Table 2, Persica mouthwash had a significantly lower PI index than CHX mouthwash (P < 0.001). Moreover, the PI in Protact was 0.32 lower than CHX mouthwash, but this difference was not statistically significant (P = 0.132). In general, the PI index decreased by 0.27 on the fourteenth day compared to the first day, but this difference was not significant (P = 0.114).

The GI on the first day had the highest amount in the CHX group and the lowest in the Persica group; however, there was no significant difference between the groups (P = 0.281). On the fourteenth day, the GI in the Persica group had the lowest value, but there was no significant difference between the three groups (P = 0.080). Comparing the values on the first and fourteenth days revealed no significant difference between the groups [Table 2 and Figure 2].

Persica mouthwash had a significantly lower GI than CHX mouthwash (P = 0.008). The GI in protact was 0.18 lower than CHX mouthwash, but this difference was not statistically significant (P = 0.411). In general, the GI on the fourteenth day decreased by 0.3 compared to the 1st day, but this difference was not significant (P = 0.093) [Table 2].

The findings of SI by intensity and by area are demonstrated in Table 3. The Kruskal–Wallis test revealed no significant difference among the groups in terms of intensity (P = 0.846) or area (P = 0.746).

Among the study population, only three cases in the CHX group experienced tongue discoloration in less than half of the tongue. No discoloration of any type was observed among the other groups. The findings

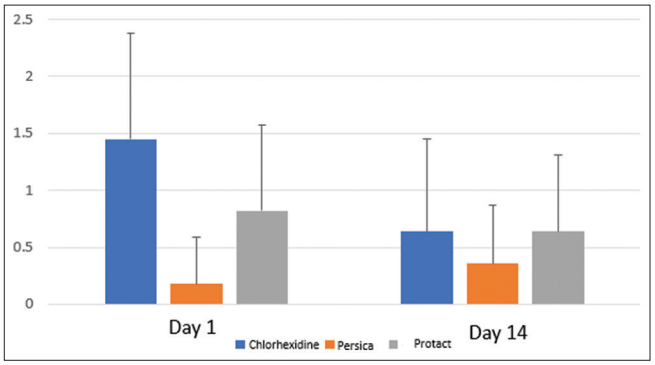

Figure 1: Comparison of the plaque index among the groups. PI: Plaque index.

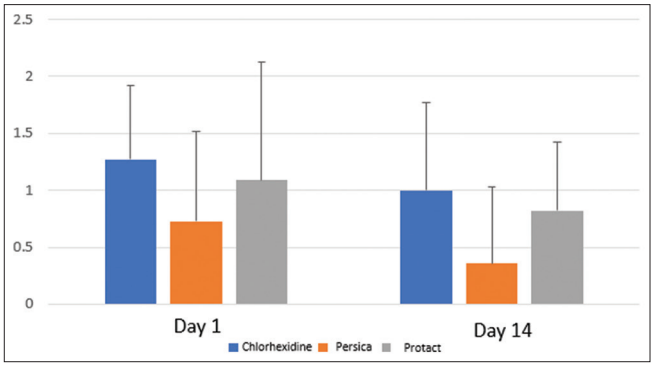

Figure 2: Comparison of the gingival index among the groups. GI: Gingival index.

Table 1: Comparison of the plaque index and gingival index on the 1st and 14th day after the surgery among the groups

Variable	Group	Day 1		Day 14		*P**
		Mean±SD	Mean rank	Mean±SD	Mean rank	
PI	CHX	1.45±0.93	23.32	0.64±0.81	17.68	0.011
	Persica	0.18±0.41	10.27	0.36±0.51	14.95	0.317
	Protact	0.82±0.75	17.50	0.64±0.60	18.36	0.414
	*P**	0.003		0.616		
GI	CHX	1.27±0.65	19.95	1.00±0.77	20.27	0.454
	Persica	0.73±0.79	13.77	0.36±0.67	12.18	0.305
	Protact	1.09±1.04	17.27	0.82±0.60	18.55	0.426
	*P**	0.281		0.080		

*Wilcoxon test. SD: Standard deviation; CHX: Chlorhexidine; GI: Gingival index; PI: Plaque index

Table 2: Comparison of the simultaneous effect of the type of mouthwash and day on plaque index and gingival index

Variables	Regression coefficient	SD	CI 95%	*P*
PI				
Mouthwash				
CHX				
Persica	−0.77	0.21	−1.19–−0.36	>0.001
Protact	−0.32	0.21	−0.73–0.10	0.132
Time				
Day 1	Reference			
Day 14	−0.27	0.17	−0.61–0.07	0.114
GI				
Mouthwash				
CHX	Reference			
Persica	−0.59	0.22	−1.02–−0.16	0.008
Protact	−0.18	0.22	−0.62–0.25	0.411
Time				
Day 1	Reference			
Day 14	−0.30	0.18	−0.66–0.05	0.093

CI: Confidence interval; SD: Standard deviation; CHX: Chlorhexidine; GI: Gingival index; PI: Plaque index

of the Chi-square test suggested no significant difference between the three groups in terms of tongue discoloration ($P = 0.091$).

Satisfaction with the taste of mouthwash was reported in Table 4. Although satisfaction with Persica and Protact mouthwashes was more than CHX, no statistical difference was observed among the groups ($P = 0.010$).

DISCUSSION

Clinical tooth lengthening surgery is one of the most frequent treatments in periodontics.[21] In order to promote faster healing with fewer complications,

Table 3: Comparison of the stain index according to intensity and area in different groups

Variables	Mean±SD	Mean rank
SI index by intensity		
CHX	0.55±0.69	18.14
Persica	0.36±051	16.14
Protact	0.45±0.69	16.73
*P**	0.846	
SI index by region		
CHX	0.73±1.01	18.55
Persica	0.45±0.69	16.50
Protact	0.36±0.51	15.95
*P**	0.746	

*Wilcoxon test. SI: Stain index; SD: Standard deviation; CHX: Chlorhexidine

Table 4: Comparison of the taste satisfaction in different groups

Group	Very bad	Bad	Normal	Good	Very good
CHX	4	3	2	2	0
Persica	0	0	3	8	0
Protact	0	1	2	8	0
*P**			0.010		

*Chi-square test. CHX: Chlorhexidine

microbiological contamination in the surgical site needs to be controlled. One of the best antimicrobial agents for the chemical control of plaque is the use of mouthwashes. There are various mouthwashes used for different purposes.

Khoshbakht *et al.* conducted a study to assess the effectiveness of Protact, frankincense herbal mouthwash, their combination, and CHX mouthwash on patients with gingivitis. They suggested that CHX mouthwash had the most side effects and Protact mouthwash was more satisfying among the patients, which was in line with the current investigation. However, their findings found that the PI, GI, and bleeding on probing (BOP) were significantly reduced in all groups during the third week of their study,[22] which was inconsistent with the current investigation. The difference among these studies might be due to using different types of mouthwashes on different candidates as well as disparity in the study duration.

Mohammadi *et al.*'s study evaluated the effectiveness of herbal and CHX mouthwashes on patients undergoing clinical crown lengthening surgery. Patients were randomly divided into four groups using normal saline, CHX, herbal, and herbal + CHX mouthwashes. Findings suggested significant improvement in modified GI and PI in the herbal group, nevertheless, no statistical difference was discovered between CHX and herbal mouthwashes,[3]

which was different from the current study's findings. This difference with the results obtained from the present study can be caused by more samples and different compositions of herbal mouthwash (presence of Mentha piperita and Tanacetum balsamita extracts). Moreover, the CHX group had the most adverse effects, which is almost in line with the present study.

CHX is the gold standard among the chemical mouthwashes available on the market for assessing the efficacy of other products. Similar to this study, numerous studies have compared the efficacy of other mouthwashes using CHX; among which Tiwari *et al*.'s study measured the effectiveness of Herbostra herbal mouthwash with CHX[23] and Deshmukh *et al*. compared the effectiveness of probiotic and herbal mouthwashes (Hiora) with CHX.[24]

CHX has many beneficial effects and is the most widely used mouthwash.[25] However, CHX has a number of negative effects that deteriorate over time, including discoloration of the teeth and tongue, altered taste perception, and carcinogenic properties.[26] Therefore, recent studies are searching for other mouthwashes with high quality and low adverse effects.

Mouthwash containing *Z. multiflora* extract has been shown to be effective in plaque removal.[11] Moreover, studies have suggested strong antimicrobial effects of this substance on oral streptococcus, as well as Gram-positive and Gram-negative bacteria. Additionally, this mouthwash has been used to manage oral mucositis, recurrent aphthous stomatitis, and some oral fungi (*Candida albicans* and *Candida tropicalis*).[27]

According to Akhavan Karbasi *et al*., Persica mouthwash can be used to treat gingivitis since it greatly reduces gingival bleeding.[27] Mojtahedzadeh *et al*. also found that Persica mouthwash improves periodontal indicators similarly to CHX.[28] Unlike chemical mouthwashes, this solution is not contraindicated for children or pregnant women. On the other hand, Salvadora Persica has antimicrobial, anti-inflammatory, anti-plaque, and pain-relieving qualities, which are suggested for treating periodontal diseases and preventing dental caries.[28-30] In addition, Achillea millefolium has anti-hemorrhage, anti-inflammatory, antiviral, and antimicrobial properties.[31]

In the present study, CHX caused a significant reduction in the PI; however, no significant change was observed in the patients' GI and SI after using any of the aforementioned mouthwashes. This could be attributed to nonrandomization based on the initial PI in the current study, and also the lack of complete compliance with the instructions and inappropriate cooperation of the patients, the difference in their diet, poor oral hygiene, and fear of cleaning the surgical site. On the other hand, the lack of clinical trial studies using Protact mouthwash to compare the findings was another limitation of the current study. Therefore, conducting more clinical trial studies with larger sample sizes is suggested to investigate the effect of Protact mouthwash on other intra-oral surgeries.

CONCLUSION

The current findings revealed that no significant difference was observed in the GI and SI of the patients in any of the groups. Nevertheless, the CHX had the highest patient dissatisfaction and adverse effects. Therefore, according to the obtained results, CHX remains their first choice for patients who have undergone clinical crown lengthening surgery. However, given its unpleasant taste and potential side effects, particularly when used for longer than 2 weeks, patients with less tolerance and lower cooperation can use alternative options such as herbal mouthwashes in addition to mechanical plaque control techniques.

Ethics approval and consent to participate

The study protocol obtained ethical approval from the Mazandaran University of Medical Sciences (ethics code: IR.MAZUMS.REC.1401.491) and the Iranian Registry of Clinical Trials (IRCT20170502033770N2, Registration Date: 2023/06/11).

Authors' contribution

All of the authors took part in the conduct of study, manuscript preparation and editing. H.E and M.S conceptualized and designed the research. Z.T and T.M collected the data. L.J and T.E reviewed and edited the initial manuscript. M.M wrote the initial draft. A.H interpreted the data.

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Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

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