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Effect of Different Mouthwashes on Gingival Health of Dental Students

Reaam A. Fadhil
BDS, (Master student)

Saher S.Gasgoos
BDS, MSc. (Asst. Prof.)

Ministry of Health-Nineveh Health Directorate

Depart. of Pedodontic, Ortho. and Preventive Dentistry
College of Dentistry, University of Mosul

الخلاصة

الأهداف: تهدف الدراسة إلى تقييم تأثير انواع مختلفة من الغسولات الفموية على تقليل التهاب اللثة وان كان هناك فرق بين الغسولات المستخدمة لتقليل التهاب اللثة. **المواد وطرائق العمل**: المشاركون في الدراسة هم طلبة كلية طب الاسنان (٨٨ طالبا, ٤٤ ذكور و٤٤ اناث) الذين تتراوح اعمارهم بين (١٨-٢٥) سنة لديهم التهاب اللثة بسيط او متوسط الشدة ناجم عن تراكم الصفيحات الجرثومية . تم تقسيم الطلبة عشوائيا الى اربعة مجاميع في كل مجموعة ٢٢ مشاركا, استخدم الطلبة في المجموعة الاولى الغسول kin gingival بينما استخدم الطلبة في المجموعة الثانية الغسول Wisdom daily gum health, استخدم الطلبة في المجموعة الثالثة الغسول LACALUT aktivواستخدم الطلبة في المجموعة الرابعة الغسول KIN B5Gums. تم اعطاء جميع الطلبة تعليمات حول استخدام الغسول مرتين يوميا صباحا ومساءا لمدة اربعة عشر يوما باستخدام ١٠ملم من الغرغرة لمدة ٣٠ ثانية بعد تنظيف الاسنان بالفرشاة والمعجون بمدة لا تقل عن خمسة دقائق. اجري الفحص على الطلبة باستخدام مؤشر التهاب اللثة (GI) في الفحص الاول والفحص الثاني بعد ١٤ يوما .**النتائج**: اظهرت الدراسة فرقا معنويا عاليا بين الفحصين الاول والثاني حيث لوحظ انخفاضا واضحا في التهاب اللثة. وهناك فرق معنوي عالي بين الغسولات الفموية المستخدمة في تأثيرها على التهاب اللثة قد يعود الى اختلاف المكونات الكيميائية الفعالة في هذه الغسولات حيث ان الغسول الثالث أفضل من الغسول الاول والثاني والرابع ولا يوجد فرق معنوي بين الغسولات الاول و الثاني و الرابع. **الاستنتاجات**: في هذه الدراسة ابدت الانواع الاربعة من الغسولات الفموية فعالية جيدة في علاج التهاب اللثة سريريا وكان الغسول LACALUT aktiv هو الأفضل والاكثر فعالية.

ABSTRACT

Aims: To evaluate and compare the effectiveness of different mouthwashes in decreasing the gingival inflammation. **Materials and Methods:** The participants were (88) dental students, aged between 18 to 25 years (44 males and 44 females). The students with mild to moderate gingivitis were randomly divided into four groups, 22 Participants for each one. In Group A, participants were advised kin gingival mouthwash, Group B participants used Wisdom daily gum health mouthwashes, Group C participants are given LACALUT aktiv mouthwashes, and KIN B5Gums mouthwash was given to Group D. The students were advised to use 10 ml of given mouthwash for 30 seconds, twice a day, not immediately after tooth brushing (at least 5minutes after tooth brushing), for 14 days. The parameter was recorded for gingival index (GI) at 0 and 14 days. **Results**: The reduction in the gingival inflammation is highly significant on day 14 (T1) compared to baseline values (T 0). There are highly significant differences among the four types of mouthwashes used for the reduction of gingival inflammation. These results prove that the four mouthwashes used have variable efficiency on gingival inflammation depending on their major active chemical components. Mouthwash C is the most effective one in reducing gingival inflammation. Mouthwash A, mouthwash B and mouthwash D have no significant differences between them. **Conclusions**: In this study, all the mouthwashes were used showed clinical efficacy in reducing gingival inflammation. The mouthwash LACALUT aktiv is the most effective one**.**

Keywords: Mouthwashes, Gingival Health, Dental Students.

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INTRODUCTION

Gingivitis is the mildest sort of periodontal disease caused by the dental plaque that accumulates on teeth nearby the gingiva [(1)]. A direct relationship has been verified between dental plaque levels and the severity of gingivitis [(2)]. Chemotherapeutic agents have been suggested to be useful adjuncts to the daily oral home care within the control of gingivitis [(3)]. A number of chemical agents are advocated like Chlorhexidine, quaternary ammonium compounds (Cetylpyridinium chloride), essential oils and triclosan as mouthwash. The chlorhexidine gluconate is considered as the gold standard in dentistry for the prevention of bacterial plaque [(2)]. Chlorhexidine mouthwash is very effective but it has certain side effects as brown discoloration in the teeth, bitter taste and oral mucosal erosion [(4)]. The 0.2% concentration of chlorhexidine has been utilized for years as a therapeutic and preventive agent [(5)]. The Chlorhexidine has an elevated substantivity, which is a main cause for its superior antimicrobial efficiency [(6)]. In spite of the popularity of the antimicrobial agents usually found in markets, there is little information about their efficacy on the control of bacterial plaque. Therefore, this study is to gather information about the efficacy of the commonly available antimicrobial agents used to prevent dental plaque accumulation and gingivitis. The actual available products should carefully be tested, since added ingredients for commercial mouthwashes enhanced taste, flavor and color, could decrease the effect of the highly reactive chlorhexidine molecule.

MATERIALS AND METHODS

Study design

This study was a parallel, single blinded, randomized comparative clinical study. The study was conducted during the period 2019-2020 at College of Dentistry, University of Mosul. The study was approved by Research Ethics Committee board (University of Mosul, College of Dentistry, REC reference No. POP/R2.10/1/21).

Subjects and materials used

The Participants, dental students were selected with age range from 18-25 years old (44 males and 44 females). Students having mild to moderate gingivitis were randomly divided into four groups (22 student in each group) to receive four types of commonly available mouthwashes in Mosul city, one type for each group. These are as follow:

- Group A: Chlorhexidine Digluconate 0.12% with 0.05 % (226 ppm) Sodium Fluoride, Aqua, Sorbitol, Glycerin, PEG-40 Hydrogenated Castor oil, Allantoin Panthenol, Sodium Methylparaben, Aroma, Citric Acid, Methyl Salicylate, Sodium Saccharin, Cetylpyridinium Chloride, Menthol, Sodium Propylparaben, Eugenol, d-Limonene, Cinnamal (kin gingival mouthwash).

- Group B: Chlorhexidine Digluconate 0.12% with 0.05 % (225 ppm) Sodium Fluoride, Citric acid, Potassium citrate, Sodium saccharine, Aqua, Glycerine, Sorbitol, PEG-40 hydrogenated Caster oil, Aroma (Wisdom daily gum health mouthwash).
- Group C: Chlorhexidine Digluconate 0.2% with aluminum fluoride of 225 ppm (Olaflur), Potassium Acesulfame , Aqua, Glycerin, PEG-40 Hydrogenated Castor oil, Propylene Glycol, Aroma, Zinc sulfate, Aluminum lactate (LACALUT aktiv mouthwash).
- Group D: Cetylpyridinium chloride (CPC) 0.05%, provitamin B5 and vitamin B3, zinc lactate, Xylitol 1.00%, Sodium fluoride 226 ppm (0.05%) mouthwash (GingiKIN B5 / KIN B5 Gums Mouthwash).

Inclusion and exclusion criteria

To be eligible for the study the subsequent inclusion and exclusion criteria were be applied:

Inclusion criteria:

Students who gave informed consent, agreement to delay any elective dental treatment as an oral prophylaxis, and agreement to fulfill the study visits was included within the study. The ages of the students are between 18 to 25 years, having mild to moderate gingivitis which defined by the gingival index [8] score between 0.1-2.0 (by Loe and Silness will record) was included in this study. According to the selection criteria, individual should have a dentition with minimum 25 teeth within an oral cavity free from any major hard or soft tissue lesions. No orthodontic appliances, no known allergy to any of the components of mouthwash or any other material used in this study and no antibiotic use for at least 3 months before this study, no recognized systemic diseases, not pregnant or lactating females and having no mouth breathing habit.

Exclusion criteria:

Uncooperative students, students with severe mal-alignment teeth, orthodontic appliances and removable partial dentures, students already using mouthwash, tobacco consumers, or having smoke or hookah. Students with any medical or pharmacological history that may compromise the conduct of the study were excluded. The students were excluded from the study if they were diagnosed with non-plaque induced gingivitis or use systemic antibiotics within 3 months before enrolment. Exclusion criteria were designed to standardize all samples.

Sample size

The total sample size was 88 students divided into 4 groups, 22 students for each group (11males and 11 females) to possess a two-sided five percent (5%) significance level and a power of eighty percent (80%), so given an anticipated dropout rate of 10% [7].

Instruments and equipments

1. Disposable Gloves and masks.

2. Dental Mirrors.
3. Periodontal probes (WHO probes).
4. Kidney dishes.
5. Disposable cups and towels.
6. Dental chair with suitable light.

Methods

Gingival index

This was assessed according to the criteria of gingival index of Loe and Silness, 1963[8], the criteria as follow:

Scores	Criteria
0	Absence of inflammation (normal gingival)
1	Mild inflammation, slight change in color and slight edema, no bleeding on probing.
2	Moderate inflammation, moderate glazing, redness, edema, hypertrophy and bleeding on probing.
3	Severe inflammation, marked redness and hypertrophy, ulceration, and tendency to spontaneous bleeding.

According to the classification introduced by Loe and Silness the severity of the gingival inflammation was be assessed, in which:

Score range	Severity of gingivitis
0.1 – 1.0	Mild
1.1 – 2.0	Moderate
2.1 – 3.0	Sever

Clinical examination

Clinical examination was carried out for each student under standardized condition. Students were examined using plane mirrors and WHO periodontal probes, Students were on dental chairs. A special form was recorded firstly prior to clinical examination for each student include general information and some questioners to standardized the sample.

Periodontal clinical examination

The clinical examination was done in sequence to exam at least 5 to 6 students daily until reach the required sample size. The gingival index (GI) by Loe and Silness [8] was recorded, all records was maintained on a record chart.

Before the baseline examination, the students were refrained from conducting oral hygiene for at least eight hours, but not more than 18 hours [9] ceased eating, drinking for the same periods.

First examination (T1)

At baseline (T1) gingivitis was be evaluated with Gingival Index (GI) [8]: the examiner was carefully established color, the texture of gingiva using the periodontal probe sliding along all the gingival sulcus to detect bleeding on probing of

each for the four tooth surfaces (mesial, buccal, distal and then oral) of indexed teeth (16, 12, 24, 36, 32, 44) then, the examiner assigned, to each of them, a score from 0 - 3. The gingival index was assessed at baseline to recruit students by gingivitis severity. Each student was received motivation, oral hygiene and mouthwash usage instructions were given. All mouthwashes were over-wrapped to maintain the blinded study design. All the students were still on their daily regular tooth brushing using standardize tooth brush and toothpaste using modified bass method brushing technique. The instructions to use the mouthwash were explained and prescribed in the same way to each participant, as follows:

Oral rinse (vigorous swishing in mouth) with 10 ml of given mouthwash for 30 seconds, twice a day (in the morning and in the evening), not immediately after tooth brushing, according to manufacturer instructions, for 14 days[7]. Students must also wait until all traces of toothpaste are removed before rinsing with Chlorhexidine so best utilized mouthwash at least five minutes after the tooth brushing. A measuring cup was given for each patient to measure the quantity of the mouthwash to be used. They were asked not to eat or drink anything at least half-an-hour after using the rinse.

Final examination (T2)

Compliance was be checked with the help of a reminder sheet to be filled by the students daily after using the mouthwash to note down the time at which they rinse on. These compliance sheets were checked by the investigator during subsequent examinations (T2). At the end of the study, the participants were asked to return their (empty or not) bottles of mouthwashes to measure the remaining fluid. In the subsequent examinations (T2) the examiner was posed a direct question to participant to check if the mouthwash was used according to instruction for 14 days (if not participant has been excluded from study).

RESULTS

Preliminarily, the Kolmogorov-Smirnov test used to examine data distribution; it confirmed that data is normally distributed.

Changes from baseline (T1) to different time interval (T2) in Loe and Silness gingival index [8] was analyzed by paired t-test (Intragroup). The paired t-test was executed independently for each mouthwash, to analyze the data pre and post treatment. Variables represented the variations between observation times (T1 and T2).

The results were considered statistically significant if they occurred with probability less than or equal to 0.05 ($p \leq 0.05$). The paired t-test result showed that there are significant differences (decrease) between pre and post treatment where the differences of mean Loe and Silness gingival index between 0 to 14th day were (0.7723 ±0.0863, 0.8162 ±0.1811, 0.5548

±0.1539 and 0 .7355 ±0.1403) respectively in groups A, B, C and D as seen in Table (1).

The ANOVA test was used to check if there are statistically significant differences among the four mouthwashes groups. Duncan's post hoc was applied for the multiple comparisons. The ANOVA results for Loe and Silness gingival index [8] showed that there are significant differences between mouthwashes groups. Duncan's post hoc statistical result showed that mouthwash C is more effective than other types of mouthwashes. Also there are no significant differences in reduction of gingivitis between mouthwashes A, B and D as showed in Tables (2) and (3).

Table (1): Loe and Silness gingival index Paired Differences results

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	df	Sig. (2-tailed)
Pair 1	**A1 – A2**	.7723636	.0863348	.0184066	.7340849	.8106423	41.961	21	**.000****
Pair 2	**B1 - B2**	.8162545	.1811695	.0386255	.7359285	.8965806	21.133	21	**.000****
Pair 3	**C1 - C2**	.5548773	.1539014	.0328119	.4866412	.6231133	16.911	21	**.000****
Pair 4	**D1 - D2**	.7355500	.1403312	.0299187	.6733306	.7977694	24.585	21	**.000****

Df: Degree of Freedom ,**Highly Statistically Significant Difference at $p \leq 0.01$ between pre and post treatment.

Table (2): Loe and Silness gingival index ANOVA statistical result

Anova	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.434	3	.478	18.906	**.000****
Within Groups	2.124	84	.025		
Total	3.558	87			

Df: Degree of Freedom ,**Highly Statistically Significant Difference at $p \leq 0.01$ For Each Group of mouthwashes.

Table (3): Duncan's post hoc multiple comparisons

Mouthwashes groups	Mean	N	Std. Deviation
A	.204509 B	22	.1011614
B	.263155 B	22	.1326465
C	.533936 A	22	.2224691
D	.266250 B	22	.1543574
Total	.316963	88	.2022371

***** Different Letters Indicate Statistically Significant Difference Within the Same Column (Vertically) at $p \leq 0.05$.

DISCUSSION

The primary outcome observed in this study is the reduction gingival inflammation after the use of the mouthwashes. The reduction in gingival inflammation is highly significant on day 14 (T2) compared to baseline values (T 1). The reduction in gingival inflammation was marginally better with the group C on day 14 (T2) compared to other groups of mouthwashes. There are positive significant differences between pre and post treatment on reduction of gingivitis for all mouthwashes used in this study. This may be due to the different active antimicrobial substances of mouthwashes used in this study as chlorhexidine (CHX) 0.12%, CHX 0.2% and cetylpyridinium chloride (CPC) 0.05%. The differences of means gingival index of Loe and Silness (GI) was statistically significant ($p < 0.05$) between T1 to T2 for group A; has CHX 0.12%, group B; has CHX 0.12% and group C; has CHX 0. 2%. This result is in agreement with Leyes *et al*., 2002 [10] who concluded that there are significant reductions in gingival inflammations of people utilizing chlorhexidine gluconate 0.12% and agreement with another Study carried out by Mogharehabed *et al.,* 2016 [11] revealed that mouthwashes contain 0.12% CHX and 0.05% sodium fluoride significantly decreased the mean scores of gingival indices after 2 weeks of using. Also the result of this study is agreement with Guerraa *et al.,* 2019 [7] who concluded that CHX 0.2% has a positive effect on reducing gingivitis. Differences of means gingival index of Loe and Silness (GI) for group D, has 0.05% cetylpyridinium chloride (CPC) between T1 to T2 been statistically significant. This result is in agreement with other study reported in the peer-reviewed literature as a systematic review showing a statistically significant reduction in gingivitis when CPC mouthwash used [12].

In table (2) ANOVA test (among the four mouthwashes groups) demonstrated that there was a significant difference in Loe and Silness gingival index mean values of all groups. This may be due to different constitutes of each mouthwash used in this study. Where Duncan's post hoc multiple comparisons among the four mouthwashes groups table (3) showed that the mouthwash C is more effective than other types of mouthwashes this may be due to the fact that this type of mouthwash contains aluminum lactate (not found in others types of mouthwashes used in this study) which act as astringent with hemostatic properties so reduce the sign of gingival inflammation. This result is in partial agreement with Putt *et al.,* 1996 [13] due to methodology (patients was children) and also agreement with Al-Oqaidy *et al.,* 2018 [14] their study results showed that mouthwash C (Lacalut active) has the best effect comparing to the other types of mouthwashes in reducing bacteria and ultimately gingivitis. Also may be due to the concentration of CHX in the mouthwash C (0.2%) which is effective in

reducing gingivitis this result is similar to *Goutham et al*, 2013 [15] , where the other mouthwashes contain CHX 0.١٢% (group A and B) and CPC 0.05% (group D).

There are no significant differences in reduction of gingivitis between mouthwashes A, B and D as revealed in table (3) where all of them contain efficient substances in reducing gingival inflammation as CHX 0.12% (group A and B mouthwashes), CPC 0.05% (group D mouthwash).

CONCLUSIONS

In this study, all four mouth rinses used to have good clinical efficacy in reducing gingival inflammation when utilized alongside tooth brushing with toothpaste. The lacalut Activ mouthwash is more effective in reducing gingivitis comparing to other mouthwashes used in this study. In terms of efficacy in gingivitis reduction, there is no difference among KIN B5, Wisdom daily gum and KIN gingival mouthwashes.

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