# Effect of Different Mouthwashes and Text Messages on Plaque Accumulation for Dental Students

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## الخلاصة

**الأهداف:** تهدف الدراسة الى تقييم ومقارنة تأثير اربعة انواع من الغسولات الفموية على تقليل الصفيحات الجرثومية بالاضـافة الـى تقييم تـأثير الرسائل النصية على استجابة المرضى. **المواد وطرائق العمل:** المشاركون في الدراسة هم طلبة كلية طب الاسنان (٨٨ طالبا,٤٤ ذكور و٤٤ اناث) تتراوح اعمارهم بين (١٨-٢٥) سنة لديهم التهاب اللثة. تم تقسيم الطلبة عشوائيا الى اربعة مجاميع في كل مجموعـة ٢٢ مشـاركا, استخدم الطلبة في المجموعة الاولى الغسول kin gingival بينمـا استخدم الطلبة في المجموعـة الثانيـة الغسـول ,Wisdom daily gum health استخدم الطلبة في المجموعة الثالثة الغسول LACALUT aktiv واستخدم الطلبة في المجموعة الرابعة الغسول KIN B5Gums تـم اعطـاء جميع الطلبة تعليمات حول استخدام الغسول مرتين يوميا لمدة ١٤ يوما باستخدام ١٠ملم من الغسول لمدة ٣٠ثانية بعد تنظيف الاسنان بمدة لا تقل عن٥ دقائق. اجري الفحص على الطلبة باستخدام مؤشرال(TQHPI)في الفحص الاول والفحص الثاني بعد ١٤ يومـا. تـم ارسـال رسـائل نصـية مرتين يوميا عن طريق اجهزة الهاتف المحمول الى نصف الطلبة من كافة المجاميع تذكرهم باستخدام الغسول. **النتـائج:** اظهرت الدراسـة فرقـا معنويا عاليا بين الفحصين الاول والثاني حيث لوحظ انخفاضا واضحا لكمية الصفيحات الجرثومية. وهناك فرق معنـوي بـين الغسـولات الفمويـة المستخدمة في تأثيرها على الصفيحات الجرثومية قد يعود الى اختلاف المكونات الكيميائية الفعالـة فـي هـذه الغسـولات حيـث ان الغسـول الثالـث والرابع أفضل من الغسول الاول والثاني و الغسول الاول افضل من الثاني و الغسول الثالث لم يختلف معنويا عن الغسول الرابع ولاعن الغسول الاول. **الاستنتاجات:** ابدت الانـواع الاربعـة مـن الغسـولات الفمويـة فرقـا واضـحا فـي خفـض تـراكم الصـفيحات الجرثوميـة وكـان الغسـول LACALUT aktiv والغسول KIN B5Gums هما الأفضل. وكان الغسول Wisdom daily gum هو الاقل فعالية.

## ABSTRACT

**Aims**: Study and compare the effectiveness of different mouthwashes on dental plaque and assess the efficiency of text messages on the response of participants. **Materials and Methods**: The study was approved by Research Ethics Committee board (University of Mosul, College of Dentistry, REC reference No. POP/R.10/1/21). The Participants were (88) dental students, aged between 18 to 25 years (44 males and 44 females). Students with mild to moderate gingivitis were randomly divided into four groups, 22Participants for each. In Group A, participants were advised kin gingival mouthwash, Group B participants used Wisdom daily gum health mouthwash, Group C participants were given LACALUT aktiv, and KIN B5Gums was given to Group D. The subjects were advised to use 10ml of mouthwash for 30seconds, twice a day, not immediately after tooth brushing (at least5 minutes after tooth brushing), for 14days. Half of the students in all groups (44students) were motivated on regular intervals by personal text messages, to use mouthwash on regular basis. The parameter was recorded for Plaque index (TQHPI) at day 0 and14. **Results**: The reduction in dental plaque is highly significant on day 14(T1) compared to baseline values (T0). There are highly significant differences among the four types of mouthwashes used on the reduction of dental plaque. Mouthwash in Group C and D were significantly more effective than Group A and B. Mouthwash in Group A was significantly more effective than mouthwash in Group B. Group C mouthwash did not differ significantly from Group D nor Group A mouthwash in plaque build-up reduction. **Conclusions**: The four mouthwashes used has good efficacy in reducing dental plaque and there were differences in efficiency between them. KIN B5Gums and LACALUT aktiv mouthwashes were the most effective. Wisdom daily gum mouthwash was the least effective.

**Keywords**: Mouthwashes, Text Messages, Plaque, Dental Students

## INTRODUCTION

The mouth is the mirror of the body and therefore the health of the mouth has been closely related to systemic health. Periodontal disease is one of the most frequent oral diseases in the world [1].Gingivitis, the mildest sort of periodontal disease, is caused by the dental plaque that accumulates on teeth nearby the gingiva [2]. A direct relationship has been verified between dental plaque levels and the severity of gingivitis [3]. Although mechanical plaque control may effectively prevent gingivitis if carefully applied, the wide distribution of gingivitis presented in the general population shows that additional measures can prove beneficial. Chemotherapeutic agents have been suggested to be useful adjuncts to the daily oral home care within the control of dental plaque and gingivitis [1]. A number of chemical agents are advocated like fluorides, Chlorhexidine, quaternary ammonium compounds (Cetylpyridinium chloride), essential oils, triclosan and sanguinarine, which are either available like a toothpaste/dentifrice or as mouthwash (mouthwash). Among these, chlorhexidine gluconate is considered as the gold standard in dentistry for the prevention of bacterial plaque [3]. Mouthwashes containing chlorhexidine are usually available over the counter [4]. Chlorhexidine mouthwash is very effective but has certain side effects as brown discoloration in the teeth, bitter taste and oral mucosal erosion

[5].Text messages are relatively inexpensive, easily modified, sent directly to individuals, and a part of many individuals' daily life. Many studies utilize text messages as a reminder to help improve health care services [6].

Despite 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. Furthermore, to help the clinicians to select of the most effective plaque-preventing mouthwash when different products are existing.

## MATERIALS AND METHODS

### Study design

This study was a parallel, single-blinded, randomized comparative clinical study. The study was conducted during the periods 2019-2020 at Dental College of Mosul University.

### Subjects and materials used

The participants, dental students were selected from the age group 18 to 25 years [7] (44 males and 44 females). The students with mild to moderate gingivitis were randomly divided into four groups (22 student in each group) to receive four types of commonly available mouthwashes in Mo-

sul 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 applied:

### Inclusion criteria:

Students with no systemic disease, who gave an informed consent, agreement to delay any elective dental treatment as 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 was defined by gingival index score between 0.1-2.0 (by Loe and Silness will record), plaque index of 1 or more (by Turesky-Gilmore-Glickman modification of Quigley Hein plaque index) was included in this study.

### Exclusion criteria:

Uncooperative students, students with severe mal-alignment of teeth, orthodontic appliances, 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.

### Sample size and randomization

The sample size was defined in 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]. Sample size was involved total 88 students, half of them are males and others half are females. Randomization; a computer-generated list of random selected numbers was used to allocate the participants into four groups of 22 participants each. The

randomization sequence was be created using SPSS Statistic Software 18.0.

**Instrument and Equipments**

1. Disposable Gloves and masks.
2. Dental Mirrors.
3. Periodontal probes (WHO probes).
4. Kidney dishes.
5. MGS Disclosing tablets.
6. Disposable cups and towels.
7. Dental chair with suitable light.

**Methods**

**Dental/ Clinical examination**

Clinical examination was carried out for each student under standardized conditions. Students were examined using plane mirrors and WHO periodontal probes, sitting on dental chairs. A special form was recorded firstly before clinical examination includes general information and some questioners to standardize the sample. Interventions; All students signed informal consent and undergone to the same treatment. The same operator was performing all treatments and all outcome measurements.

**Plaque index**

Plaque was scored using Turesky-Gilmore-Glickman modification of Quigley-Hein plaque (TQHPI) [8], With the TQHPI, facial and lingual non restored surfaces of all the teeth except third molars were scored after using disclosing agents, and The Scoring was as follows:

| Scores | Criteria |
| --- | --- |
| 0 | No plaque |
| 1 | Separate flecks of plaque at the cervical margin of the tooth |
| 2 | A thin continuous band of plaque (up to one mm) at the cervical margin of the tooth |
| 3 | A band of plaque wider than one mm but covering less than one-third of the crown of the tooth |
| 4 | Plaque covering at least one-third but less than two-thirds of the crown of the tooth |
| 5 | Plaque covering two-thirds or more of the crown of the tooth |

**Periodontal clinical examination**

The clinical examination was done in sequence to examine at least 5 to 6 students daily until reaching the required sample size. The Turesky-Gilmore-Glickman modification of Quigley-Hein plaque index was recorded at 0 then 14 days and all records were maintained on a record chart. Before the baseline examination, the students were refrained from conducting oral hygiene for at least eight hours, but no more than 18 hours [9] and also from eating, drinking in these period.

**First examination (T0)**

At baseline (T0) plaque was be evaluated with Turesky-Gilmore-Glickman modification of Quigley-Hein plaque index. A disclosing agent containing erythrosine and food green was used to disclose plaque before recording; MGS Disclosing tablets was be used (as seen in the Figure). Each student has 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 toothbrush and toothpaste with modified bass method brushing technique. The instructions to use the mouthwash to be explained and prescribed in the same way to each participant, as follows:



**Figure (1) :** MGS disclosing tablets

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. And best utilized time of mouthwash is at least five minutes after the tooth brushing. A measuring cup was given for the each patient to measure the quantity of the mouthwash to use. They were asked not to eat or drink

anything for half-an-hour after using the rinse.

Half of students in each group (11 students) were motivated on regular intervals by personal text messages, to use mouthwash on regular basis. Text messages were done twice a day, after breakfast and after dinner to remind and ensure the usage. These text messages were made every day to half of the students in each group (11 students).

**Final examination (T1)**

Compliance was 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 (T1). 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 was be excluded from study). In the day 14 (T1), all the mentioned clinical parameters were be re-assessed by same examiner under standard dental office and light source.

## RESULTS

Preliminarily, the Kolmogorov-Smirnov test used to examine data distribution; it confirmed that data is normally distributed. Changes from baseline (T0) to different time interval (T1) in TQHPI plaque index 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 (T0, T1). 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 TQHPI Plaque index between 0 to 14th day were (1.8733 ±.7061, 2.1619 ±.7270, 1.3408 ±.5352 and 1.6631 ±.3601) respectively in groups A, B, C and D as seen in Tables (1).

**Table (1):** TQHPI Plaque index Paired t test Statistical results

| Mouthwashes groups | | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | T | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Lower | Upper | | | |
| Pair 1 | A1 – A2 | 1.8733818 | .7061088 | .1505429 | 1.5603107 | 2.1864529 | 12.444 | 21 | **.000**\*\* |
| Pair 2 | B1 - B2 | 2.1619727 | .7270731 | .1550125 | 1.8396066 | 2.4843389 | 13.947 | 21 | **.000**\*\* |
| Pair 3 | C1 - C2 | 1.3408182 | .5352414 | .1141139 | 1.1035054 | 1.5781309 | 11.750 | 21 | **.000**\*\* |
| Pair 4 | D1 - D2 | 1.6631682 | .3601566 | .0767856 | 1.5034837 | 1.8228527 | 21.660 | 21 | **.000**\*\* |

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

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. ANOVA analysis for TQHPI Plaque index data (Table 2) and the Duncan's post hoc multiple comparisons (Table 3) illustrated the statistically significant differences among the four groups of mouthwashes. Mouthwashes in Group D and Group C were significantly more effective than mouthwashes in Group A and B in reducing plaque formation. Mouthwash in group A was significantly more effective than mouthwash in Group B. Group C mouthwash not differ

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significantly from group D mouthwash nor group A mouthwash in plaque build-up reduction.

Statistical analysis (Independent t-test) was done; between the Students who received text messages (44) to remember them to use mouthwashes and other who did not receive (44); to show if there is a significant difference between them. The Statistical test was analyzed post treatment scores for plaque Turesky-Gilmore-Glickman modification of Quigley-Hein plaque index (TQHPI).

Table (4): illustrates that there is no significant difference on plaque reduction between two groups.

**Table (2):** TQHPI Plaque index ANOVA statistical result

| ANOVA | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| **Between Groups** | 6.226 | 3 | 2.075 | 7.594 | **.000**** |
| **Within Groups** | 22.959 | 84 | .273 | | |
| **Total** | 29.185 | 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** | 1.853673B | 22 | .4346231 |
| **B** | 1.483727 C | 22 | .5266134 |
| **C** | 2.061550 AB | 22 | .6108977 |
| **D** | 2.185568 A | 22 | .5038342 |
| Total | 1.896130 | 88 | .5791880 |

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

**Table (4):** TQHPI Plaque index independent t -test Statistical results

| Text message groups | N | Mean | T value | Sig | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|---|
| **Group 1** | 44 | 1.950111 | .873 | .385 | .5436387 | .0819566 |
| **Group 2** | 44 | 1.842148 | | | .6141761 | .0925905 |

## DISCUSSION

The primary outcome observed in this study is the reduction in the dental plaque after use of the mouthwashes. The reduction in the dental plaque is highly significant on day 14 (T1) compared to baseline values (T 0). There are highly significant differences between the four types of mouthwashes used on reduction of the dental plaque.

Plaque index (TQHPI) showed high significant reduction between the first (T0) and second (T1) visits in all study groups. This may indicate the good oral hygiene compliance of the participants as well as good maintaining of oral hygiene over the time period of this study, and also may related to the chlorhexidine antimicrobial action (in group A, B and C) that has antimicrobial effects against Gram-positive, Gram-negative, fungi and yeast [10]. A study carried out by Van Strydonck *et al.* [11], showed that Chlorhexidine mouthwash, as an addition to the mechanical oral hygiene, provides significant decreases in the dental plaque formation similar to the result of this study. And also may related to the Cetylpyridinium chloride (CPC) antimicrobial action (group D) The result obtained in this study is in agreement with other studies reported in the systematic review carried out by Haps *et al.* [12]concluded that CPC containing mouthwashes, when used as adjuncts to oral hygiene (tooth brushing), provide significant additional benefit in reducing dental plaque accumulation.

The results of this study prove that the four mouthwashes have variable antiplaque activity depending on their major active chemical components. Where the group D mouthwash (CPC 0.05%) and group C mouthwash (CHX 0.02%) appeared to provide dental plaque similar inhibitory action, and exhibited the best activity on plaque reduction comparing to group A and B. whereas overall group B

mouthwash (CHX 0.01%) was less effective.

Based on this study the mouthwashes containing CPC 0.05% (group D mouthwash) or CHX 0.2% (group C mouthwash) exhibited best activity on plaque reduction; both provide similar plaque inhibitory action this may be due to the antiplaque property of CHX and CPC and concentration of CHX used in mouthwash C was 0.2% and routine oral hygiene methods were also advised. Mouthwash in group A was significantly more effective than mouthwash in Group B this result is in agreement with Zarandi [13] which reveals that Kin Gingival (group A) mouthwash has a greater effect than the chlorhexidine on clinical parameter and is recommended to be used for dental plaque chemical inhibition. Group C mouthwash did not differ significantly from group D mouthwash nor group A mouthwash in plaque build-up reduction where all of them effective antibabacterial and antiplaque substances. Mouthwash in group A was significantly more effective than mouthwash in Group B this result is agreement with Zarandi [13].

Text messages, In this study all the participants (88) was divided always 2 groups the first group (44) did not receive the text messages and the second group (44) received the text messages to remember them to use the mouthwashes , Independent t-test was done to show if there a significant differences between the two groups on plaque reduction.

The Statistical test was analyzed post treatment scores for plaque; Turesky-Gilmore-Glickman modification of Quigley-Hein plaque index (TQHPI), and the result revealed no significant differences on plaque reduction between two groups as showed in Table (4). This may be due to confirmed oral hygiene instructions given to all participants to utilize the mouthwashes twice daily and also may be due to that the participants are dental students who are educated and awareness of adherence to treatments. And also repeated daily messages may be tolerated by participants so that no significant differences present between the two study groups.

## Conclusions

In this study, all four mouthrinses used had good clinical efficacy in reducing dental plaque when utilized alongside tooth brushing with toothpaste. Mouthwashes lacalut Activ and KIN B5 appeared to provide similar plaque inhibitory action. lacalut Activ mouthwash did not differ significantly from KIN B5 mouthwash nor kin gingival mouthwash in plaque build-up reduction. Wisdom daily gum mouthwash was the least effective in reducing dental plaque among the four mouthwashes used in this study. This study showed no difference between text message and without text message groups regarding plaque reductions.

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