

Effectiveness of Chlorhexidine Digluconate Mouth Rinse in Improving Oral Health in Orthodontic Patients with Fixed Appliances

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الخلاصة

الأهداف: تحدد هذه الدراسة إلى تقييم تأثير غرغرة الكلورهكسدين دايلوكوكونيت على الصفيحات الجرثومية ونزيف اللثة في مرضى التقويم الثابت. **المواد وطرائق العمل:** هذه الدراسة تتضمن ٤٢ مريضاً تقويم (٢٩ أنثى و ١٣ ذكراً)، اللذين كانوا يعالجون في عيادة تقويم الأسنان لطلاب الدراسات العليا في كلية طب الأسنان، جامعة الموصل. المرضى في هذه الدراسة كان متوسط أعمارهم ١٨ سنة (بنطاق ١٢-٢٨ سنة). المرضى قسموا إلى مجموعة مراقبة (تفريش اسنان فقط، العدد=٢٠) و مجموعة تجريبية (تفريش اسنان + غرغرة كلورهكسدين دايلوكوكونيت، العدد=٢٢). **النتائج:** العلامات لمؤشرات الصفيحة الجرثومية ونزيف اللثة، بالإضافة لمؤشر عمق اللثة تظهر فرق إحصائي ($p \leq 0.05$) بين الجنسين وبين المجموعتين الأثنين (تفريش، تفريش+غرغرة) لكل الفترات الزمنية الثلاث (اليوم صفر، بعد أسبوعين، بعد أربعة أسابيع). **الاستنتاجات:** استعمال غرغرة كلورهكسدين دايلوكوكونيت تقلل تجمع الصفيحة الجرثومية وعمق الجيب اللثوي ويحسن مؤشر التهاب اللثة.

ABSTRACT

Aims: To evaluate the effect of chlorhexidine digluconate rinsing solution on plaque and gingival bleeding in orthodontic patients with fixed appliances. **Materials and Methods:** This study included 42 orthodontic patients (29 females and 13 males), who were undergoing treatment in orthodontic postgraduate clinic of the collage of Dentistry, Mosul University. The patients of this study had a mean age of 18 years (range 12–28 years). The patients were divided in to control group (brushing only, N=20) and an experimental group (brushing +chlorhexidine digluconate mouth rinse, N=22). Plaque, gingival indices scores, in addition to pocket depth were measured in different three time periods (day 0, two weeks and four weeks). **Results:** Plaque, gingival indices scores, in addition to pocket depth shows statically significant differences at level ($p \leq 0.05$) among different genders between the two groups for each of the three time periods. **Conclusions:** The use of chlorhexidine digluconate based mouth rinses reduced bacterial plaque accumulation, pocket depth and improved the gingival index.

Key words: Chlorhexidine, Fixed appliance, Plaque, Gingivitis.

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INTRODUCTION

Orthodontic appliances protect the plaque from the actions of brushing, mastication and salivary flow. Plaque control is very difficult in patients with fixed orthodontic appliances and the use of chemical agents such as chlorhexidine digluconate have been shown to be useful adjuncts in plaque control for these patients.^(1,2)

Good plaque control is an important factor in the maintenance of dental health during fixed appliance therapy.^(3,4) Brackets, archwires and other appliance components are both a focus for plaque accumu-

lation and obstruction to plaque removal there by promoting gingivitis.⁽⁵⁾ Plaque also harbors cariogenic bacteria potentially capable of hard tissue damage, especially at the bracket margins.^(4,6) While mouth rinses may aid to reduce plaque formation.⁽⁷⁾ And mechanical cleaning of tooth surface can be accomplished in many forms, regular tooth brushing is advised routinely as the means of preventing gingival and dental diseases during orthodontic appliance therapy.⁽⁸⁾ The primary causative factor in the development of gingivitis is the insufficient removal of supragingival plaque. The presence of or-

thodontic fixed appliance makes tooth brushing more difficult and predisposes the patient to plaque buildup on the buccal surfaces of teeth around the brackets. Additionally many orthodontic patients especially children and adolescent, fail to floss because they find this procedure time-consuming and tedious in the presence of orthodontic archwires.⁽⁹⁾

A common strategy to improve mechanical plaque removal is to incorporate a chemo-therapeutic agent, such as an antibacterial mouth rinse in to the oral hygiene regimen.⁽¹⁰⁾ Considerable clinical trial evidence is antibacterial mouth rinses are added to daily oral hygiene measures (tooth brushing and flossing) compared with tooth brushing and flossing alone.⁽¹¹⁾

The safety of chlorhexidine digluconate has been reportedly confirmed; although a drawback of chlorhexidine digluconat is associated staining of the pellicle.⁽¹²⁾ The effect of subgingival irrigation with chlorhexidine on gingivitis in adolescent with fixed orthodontic has been reported by Morrow *et al.*,⁽¹³⁾

The purpose of this study was to evaluate the effect of chlorhexidine digluconat rinsing solution on plaque and gingival bleeding in orthodontic patients with fixed appliances.

MATERIALS AND METHODS

Patient selection:

This study included 42 patients (29 Females and 13 males), who are undergoing treatment in the orthodontic postgraduate clinic of the Collage of Dentistry, Mosul University. The subjects qualified on the basis of the following criteria:

- 12 to 28 years of age with orthodontic fixed appliances.
- Existing gingivitis as assessed by bleeding upon probing.
- No clinical evidences of periodontal diseases
- No Known medical problems or evidence of current antibiotics therapy.

The study population had a mean age of 18 years (range = 12 to 28 years). The patients were divided in to control group (brushing, N=20) and an experimental group (brushing + chlorhexidine digluconate mouth rinse N=22).

Clinical procedures:

Before the beginning of the examination, all of the volunteers were given instructions about how to brush. The following parameters were recorded at base line (day 0), two weeks and four weeks, at each of four surfaces (buccal or labial, mesial, distal and palatal or lingual). The parameters used are plaque index of Loe and Silness,⁽¹⁴⁾ the selected teeth are: upper right first molar, upper right lateral incisors, upper left first premolar, lower left first molar, lower left lateral incisor and lower right first premolar, other parameters used are gingival index and pocket depth of Romfjord,⁽¹⁵⁾ the selected teeth used for indices are: upper right first molar, upper left central incisor, upper left first premolar, lower left first molar, lower right central incisor and lower right first premolar. Recordings of plaque index (Loe and Silness, 1964),⁽¹⁴⁾ according to the following criteria:

- 0: No plaque in gingival area.
- 1: A film of plaque adherent to the gingival margin and the adjacent area of the tooth, the plaque may only be recognized by running a probe across the tooth surface.
- 2: A moderate accumulation of soft deposit within the gingival pocket or on the tooth and gingival margin. This can be recognized with naked eye.
- 3: A heavy accumulation of plaque within gingival pocket or on the tooth and gingival margin.

Ramfjord's index for gingivitis and pocket depth⁽¹⁵⁾ was assessed according to the following criteria:

- G₀: absence of gingival inflammation.
- G₁: mild to moderate inflammatory gingival changes extending all around the tooth.
- G₂: mild to moderately severe gingivitis extending all around the tooth.
- G₃: severe gingivitis characterized by marked redness to bleed and ulceration.
- G₄: If the base of pocket up to 3mm, apical to cemento-enamel junction.
- G₅: If the base of pocket 3–6 mm, apical to cemento-enamel junction.
- G₆: If the base of pocket is more than 6 mm, apical to cemento-enamel junction.

All the clinical parameters were assessed by one trained experienced examiner under standard dental office and light

source conditions using dental mirror and WHO periodontal probe.

Preparations:

The chlorhexidine digluconate mouth rinse (Laboratories Kin S.A E- 08018 Barcelona- Spain) and its composition (0.12% chlorhexidine digluconate, 0% alcohol and 226 ppm sodium fluoride).

RESULTS

The total subjects of (42) orthodontic patients aged 12–28 years were included

in this study consisted of study group (7 males and 15 females) and control group (6 males and 14 females). Mean and Standard Deviations of the total sample (study and control groups) were presented in Tables (1- 3).

Plaque index scores shows statistically significant differences ($p \leq 0.05$), among different genders between the two groups for each of the three time points were illustrated in Table (1) and Figure (1).

Table (1): Descriptive statistics (Means, Standard deviations), *t*- test and *p*- value for Plaque index (PI).

Sex	Group		N	Mean	SD	<i>t</i> -test	df	<i>p</i> -value
Male	Control	PI1	6	1.633	0.4320	1.992	11	0.072
		PI2	6	1.183	0.4491			
		PI3	6	1.117	0.3430			
	Study	PI1	7	1.229	0.2984	7.305	11	0.000*
		PI2	7	0.586	0.3891			
		PI3	7	0.100	0.1291			
Female	Control	PI1	14	1.700	0.6089	2.286	27	0.030*
		PI2	14	1.407	0.6158			
		PI3	14	1.300	0.4243			
	Study	PI1	15	1.293	0.3127	9.303	27	0.000*
		PI2	15	0.787	0.4015			
		PI3	15	0.093	0.2604			
Total	Control	PI1	20	1.680	0.5512	3.005	40	0.005*
		PI2	20	1.340	0.5688			
		PI3	20	1.245	0.4019			
	Study	PI1	22	1.273	0.3027	11.595	40	0.000*
		PI2	22	0.723	0.3999			
		PI3	22	0.095	0.2236			

SD: Standard Deviations; N: number of subjects; df: degree of freedom. * $p \leq 0.05$: significant.

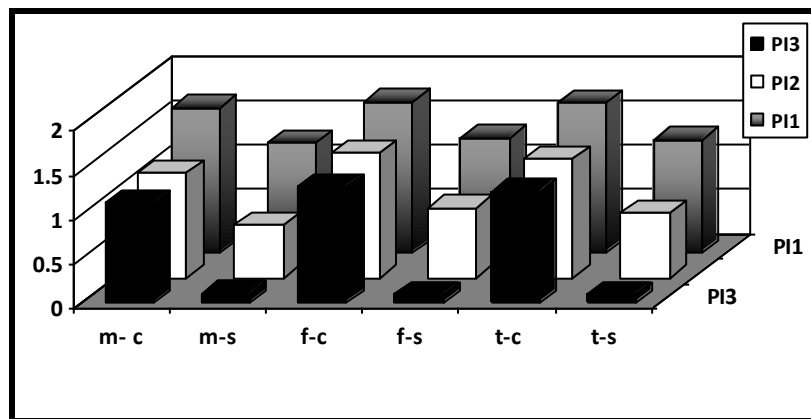


Figure (1): Means of Plaque Index scores (PI), PI1: base line day(0). PI2: 2weeks. PI3:4weeks.

m-c:male-control, m-s: male -study, f-c: female-control, f-s: female-study, t-c:total-control,t-s:total- study.

Table (2) and Figure (2) display significant differences between study and control groups for the gingival index

scores among the total sample males and females for the three periods of time (baseline, after 2 weeks and 4 weeks).

Table (2): Descriptive statistics, *t*-test and *p*-value for Gingival index (GI).

Sex	Group		N	Mean	SD	<i>t</i> -test	df	<i>p</i> -value
Male	Control	GI1	6	1.833	0.4082	2.897	11	0.015*
		GI2	6	1.233	0.3327			
		GI3	6	1.000	0.4817			
	Study	GI1	7	1.057	0.5350	3.704	11	0.003*
		GI2	7	0.500	0.3742			
		GI3	7	0.071	0.124			
Female	Control	GI1	14	1.786	0.5201	2.903	27	0.007*
		GI2	14	1.307	0.4323			
		GI3	14	1.200	0.2828			
	Study	GI1	15	1.293	0.3882	3.380	27	0.002*
		GI2	15	0.793	0.3863			
		GI3	15	0.127	0.2631			
Total	Control	GI1	20	1.800	0.4790	4.097	40	0.000*
		GI2	20	1.285	0.3977			
		GI3	20	1.140	0.3530			
	Study	GI1	22	1.218	0.4415	4.754	40	0.000*
		GI2	22	0.700	0.3988			
		GI3	22	0.109	0.2266			

SD: Standard Deviations; N: number of subjects; df: degree of freedom. * $p \leq 0.05$: significant.

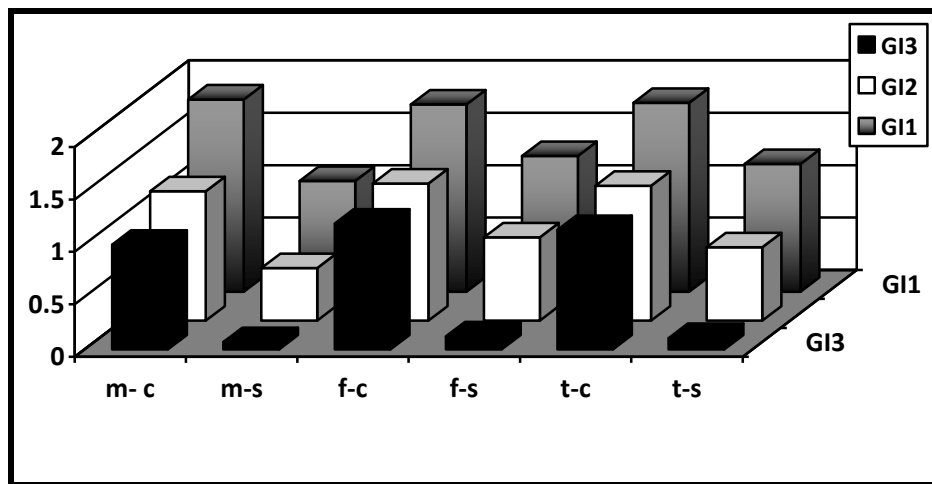


Figure (2): Means of Gingival Index scores (GI). GI1: base line day (0). GI2: 2weeks. GI3: 4weeks.

m-c: male-control, m-s: male -study, f-c: female-control, f-s: female-study, t-c: total-control, t-s: total-study.

The values of pocket depth (Table 3 and Figure 3) reveal that there was significant difference ($p \leq 0.05$) among different genders between the two groups of each of the three periods points.

Statistical analysis recorded a significant difference at $p \leq 0.05$ between study and control groups using descriptive statistics and unpaired *t*-test.

Table (3): Descriptive statistics, *t*- test and *p*- value for Pocket depth index (PD).

Sex	Group		N	Mean	SD	<i>t</i> -test	df	<i>p</i> -value
Male	Control	PD1	6	4.217	0.4021	1.661	11	0.125
		PD2	6	3.833	0.4082			
		PD3	6	3.833	0.4082			
	Study	PD1	7	3.857	0.3780	5.442	11	0.000*
		PD2	7	3.000	0.0000			
		PD3	7	3.000	0.0000			
Female	Control	PD1	14	4.279	0.4726	1.853	27	0.075
		PD2	14	3.929	0.4746			
		PD3	14	3.900	0.4132			
	Study	PD1	15	4.040	0.1549	3.768	27	0.001*
		PD2	15	3.280	0.4523			
		PD3	15	3.067	0.2582			
Total	Control	PD1	20	4.260	0.4430	2.526	40	0.016*
		PD2	20	3.900	0.4472			
		PD3	20	3.880	0.4021			
	Study	PD1	22	3.982	0.2538	5.471	40	0.000*
		PD2	22	3.191	0.3927			
		PD3	22	3.045	0.2132			

SD: Standard Deviations; N: number of subjects; df: degree of freedom. * $p \leq 0.05$: significant.

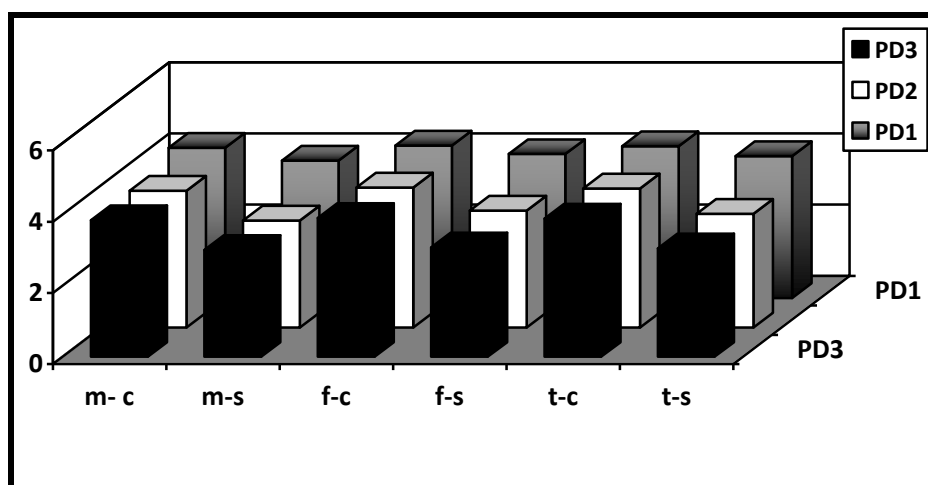


Figure (3): Means of Pocket Depth scores (PD). PD1:base line day (0). PD2: 2weeks. PD3: 4weeks.

m-c:male-control, m-s: male -study, f-c: female-control, f-s: female-study, t-c:total-control-s:total-study.

DISCUSSION

Plaque accumulation and subsequent gingivitis are common in orthodontic patients because of the challenge of controlling oral hygiene with the combination of brackets, bands, wires and elastomeric ligatures are present. Poor oral hygiene can eventually lead to the formation of white spot lesions, decay and hyperplastic gingival tissue that may require interven-

tion by a general dentist upon the completion of orthodontic treatment. (10, 16, 17) After analyzing, the results obtained during our study comparing between experimental group (brushing + 0.12% chlorhexidine digluconate mouth rinse "kin") and control group (brushing only) we observed that immediately after recording all indices (plaque and gingival) at day 0, 14 and 30, there were a marked decrease in the mean

of plaque and gingival indices scores for both males and females orthodontic patients participated in this study, the patients were instructed on a standard effective oral hygiene include efficient daily tooth brushing in addition to inter dental cleaning aids because careful brushing remove plaque from the fronts, back and biting surfaces of the teeth, but even the finest conventional tooth brush cannot remove plaque from the sides, for this job we need either dental floss, dental sticks, or an interdental tooth brushes.⁽¹⁷⁾ Although rinsing with chlorhexidine digluconate should not replace daily tooth brushing, it could be an efficient adjunct to brushing in orthodontic patients who struggle to brush and floss regularly in the presence of fixed appliances.^(11, 18-20) These clinical findings proved the antiplaque and antigingivitis effect of Kin mouth rinse (containing 0.12% chlorhexidine digluconate), as confirmed by numerous studies in the literature.⁽²¹⁻²⁷⁾ Published data in the literature are in agreement with results of our study which evaluated the effect of chlorhexidine digluconate mouth rinse in orthodontic patients when added to their routine oral hygiene regimen (brushing + flossing) over one month period. The brushing + flossing + chlorhexidine group demonstrated significantly better plaque index and gingival index scores than the brushing + flossing only group at all treatment intervals after baseline measurements.^(10,11,28) A study at the University of Richmond, Virginia⁽²⁹⁾ aimed at the evaluating the mouth washes efficiency highlighted the beneficial role of mouth washes containing chlorhexidine on gingivitis and dental plaque formation. The findings of the present study regarding the effect of chlorhexidine mouth washes on the pocket depths demonstrated that the reduction in pocket depths are seen at the second fourth weeks could have resulted from a reduction in gingival inflammation, these results are in accordance with those of other authors.⁽³⁰⁻³⁴⁾ The results may also indicate that the beneficial effect of chlorhexidine mouth wash may be more related to antibacterial, antiplaque and antigingivitis activities of this agent.^(28,35)

CONCLUSIONS

The use of chlorhexidine digluconate based mouth rinses reduces bacterial plaque accumulation, pocket depth and improves the gingival index. Therefore, adding chlorhexidine digluconate mouth rinse to the daily oral hygiene regimen reduces plaque and gingivitis development in orthodontic patients over one month period. It is recommended that orthodontist instruct their patients to rinse once daily with Kin mouth wash in addition to daily brushing and flossing. Kin preferable over all mouth washes due to its maximum effectiveness with less side effects due to its composition (0.12% chlorhexidine digluconate, 0% alcohol and 226 ppm sodium fluoride).

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