Original Research Paper

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"Efficacy of 0.2% chlorhexidine gluconate and 0.1% octenidine dihydrochloride mouth rinses in patients with plaque induced gingivitis: Double blinded randomised case control study."

Abstract:

Aims: The study aims at making a comparative study of two commercially available mouth rinses, 0.2% chlorhexidine gluconate and 0.1%octenidine dihydrochloride for assessing their efficacy as an antiplaque agent in patient with plaque induced gingivitis.

Methods and Material: In double-blinded experimental study forty-five patients with dental plaque induced gingivitis, divided into 3 groups of 15 patients each, were advised 0.2% chlorhexidine gluconate (CHX) and 0.1%octenidine dihydrochloride (OCT) and distilled water as a mouth rinses respectively. Clinical parameters viz, Plaque Index, Modified Gingival Index and Gingival Bleeding Index were assessed (day 0, 5,10 and15). Microbial count was also assessed from the collected plaque samples (at day 0 and on day 15). Antimicrobial susceptibility test was also done.

Statistical analysis used: One- way ANOVA with post hoc test using Tukey, Paired- t test, Mann-Whitney U test, The Kruskal-Wallis test, Wilcoxon signed-rank test

Results: There was significant difference in mean plaque index between the different groups. There was a significant reduction in plaque index for 0.2% CHX The mean modified gingival index was higher in group belonging to 0.1% OCT compared to 0.2% CHX that was statistically significant ($p = 0.005$). Similarly, the mean gingival bleeding index was significantly higher in group belonging to 0.1% OCT compared to 0.2% CHX ($p = 0.005$). On day 15 change in the microbial count was statistically significant for 0.2% CHX ($p = 0.026$).and 0.1% OCT ($p = 0.001$).

Conclusions: The antimicrobial and antiplaque efficacy (in vivo and in vitro) of 0.1% octenidine dihydrochloride containing mouth rinse was comparatively higher than that containing 0.2% chlorhexidine gluconate thereby demonstrating the former's potential usefulness in controlling plaque and gingivitis.

Key-words: Gingivitis, Plaque, Mouth rinse, Efficacy, Octenidine, Chlorhexidine.

Introduction:

Dental plaque is a predominant factor in the initiation and progression of gingival and periodontal diseases and, therefore, plaque control represents the key element of good oral hygiene practice. [1] Dental plaque induced-gingivitis can cause periodontitis leading to the destruction of gingival and bone tissues. [2] This necessitates reducing the bacterial population in oral biofilms which produce metabolites that lead to gingivitis. Clinical studies have shown a definite relationship between dental biofilm and periodontal diseases. [2, 3] Though the most common tool that disrupts supra-gingival plaque are the toothbrush, dental floss, interdental brushes, etc., many patients face difficulty in maintaining oral hygiene. This leads to an accumulation of significant amounts of bacterial plaque containing virulent pathogens. [4] Despite one's best efforts, these mechanical aids may fail to adequately remove plaque biofilm or reduce the pathogenic bacteria below the patient's threshold for disease. [5] There are also

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disabled and elderly individuals, for whom maintaining adequate oral hygiene can be a significant problem. [6] For such individuals, therapeutic mouth rinse is often recommended as an adjunct to mechanical plaque control. Chlorhexidine is one of the most effective and widely used antimicrobials for plaque inhibition. It is a cationic bisguanide with a broad spectrum antiseptic and antimicrobial effect.[3] Though effective, chlorhexidine has been reported to cause notable side effects. [7] Another more recently recommended mouth rinse is octenidine dihydrochloride, a new bispyridine antimicrobial compound, has been shown to possess potential antiplaque and antimicrobial activity [8, 9] in both monkeys and humans.[10,.11] The existing data suggested that a mouth rinse containing 0.1% octenidine dihydrochloride may be adequate for beneficial clinical effects upon the accumulation of plaque and treating gingivitis. [12]

The present work relates to in vivo and in vitro testing of efficacy of 0.2% Chlorhexidine gluconate and 0.1% Octenidine dihydrochloride available in the local market under the brand names Rexidin (Indoco Remedies Ltd.) and Orahex Pro (Abbott Healthcare Pvt. Ltd.) respectively on plaque induced gingivitis.

Material and Methods:

Study population

Forty-five systemically healthy subjects 22 females and 23 males, aged 18-30 years (mean age 24.5 years), who reported to the Department of Periodontology during the period 4th November 2018 to 6th December 2018 were enrolled for this double-blinded experimental study after obtaining informed consent from them to participate in the study. The study protocol and consent proposal were approved by the institutional ethics committee vide memo under HCDSH/ADM/BNF/2019/119.

Inclusion criteria:

1. Presence of mild to moderate chronic gingival inflammation
2. No periodontal pockets
3. Subjects who had not any infection, systemic or oral, in the last six months and had not taken any drug during the same period.
4. Subjects not using mouthwash or any other chemical antiplaque agent as adjunctive oral hygiene methods.
5. Subjects having dentition ≥ 20 teeth (minimum of five teeth per quadrant).

Exclusion Criteria:

Subjects having
1. a history of smoking or chewing paan/betelnut/Guthka,
2. pregnancy and lactation,
3. orthodontic or prosthodontic appliances,
4. allergy to components of mouth rinse used in the study, and
5. any oral lesions.

Study design:

On the first day (day 0), plaques were disclosed using a two-tone disclosing solution (Alpha Plac, DPI, Mumbai). For standardization, all participants received a thorough supragingival scaling and root planning using hand instruments, ultrasonic scalers, and rotating brushes and polishing paste. To confirm that all plaque deposits had been removed, a second disclosing session was carried out and remaining plaques if any were removed. The enrolled patients were randomly divided into three groups, namely Group A, Group B, and Group C, each consisting of 15 subjects using the lottery method. Subjects in each group were given opaque labelled plastic bottles which were kept ready before hand for each group. Each bottle contained selected mouthrinse [0.2% Chlorhexidine, 0.1% Octenidine dihydrochloride, and distilled water (DW)] which was unknown to the investigator as well as the subjects. Colgate toothbrush and Colgate total toothpaste were provided to each subject and they were instructed to brush their teeth by the modified Bass technique twice a day and use 10 ml of the provided mouth rinse for one minute(after 30 minutes prior to brushing) every 12 hours (twice daily) for a period of 15 days. Group A subjects were provided with 0.2% chlorhexidine gluconate (0.2% CHX), and group B subjects were provided with 0.1% octenidine dihydrochloride (0.1% OCT) while the subjects belonging to group C that constituted the control were given distilled water (DW) as a mouth rinse. Plaque index, modified gingival index, and gingival bleeding index were carefully recorded at an interval of (day 0, 5, 10 and 15) every five days.

Plaque sampling:

The supragingival plaque samples from each participant were collected in the morning between 9:30 am to 11:00 am just before the start of the study i.e., at baseline (day 0) and on day15. Participants had been instructed to avoid eating, drinking, and brushing for 2 hours before the plaque samples were collected. Samples of supragingival plaque

(approximately 1 mg) were collected with a sterile Gracey curette from the buccal and lingual lower molar surface of 26 and 46. The samples were then placed separately in sterile containers having one ml thioglycolate media (Transporting media) and was carried to the laboratory for microbial investigation.

Antimicrobial Assay:

The collected plaque samples were pre-incubated at 37°C for 30 minutes and shaken vigorously in a vortex mixer for one minute. Serial 10-fold dilutions were made up to 1:106 using 1% sterile saline (0.09% NaCl). From the serial dilutions, 0.1 mL was transferred on to the blood agar plates which were then incubated for 24 hours after which colony-forming units in each culture plate was counted using colony counting machine. Antimicrobial susceptibility test was performed using well diffusion method following the technique used by Prasad et al. (2016). [13]

Data management and statistical analysis:

Participants taking part sincerely followed the protocol of the study. During the study period, no side effects were observed in any participant. We investigated the plaque index (PI), modified gingival index (MGI), gingival bleeding index (GBI), microbial colony count (CFU/mL) and antimicrobial susceptibility of the three mouth rinses viz. 0.2% CHX, 0.1% OCT and DW (control). All clinical data were carefully recorded and the results for intergroup and intragroup comparison of the clinical and microbiological parameters were entered in MS-Excel and the statistical analysis was performed using SPSS version 20. Statistical tests used were paired't' test and One way ANOVA followed by Post Hoc Tukey's test. The results for intragroup and intergroup comparison of microbiologic plaque samples were statistically analyzed using Wilcoxon Signed Rank test and Kruskal Wallis ANOVA followed by Mann Whitney test. Once the statistical analysis of the results obtained for each of the three random groups was completed, the contents of the labelled opaque bottles were decoded for further analysis to determine and compare the efficacy of selected moutrinses on plaque induced gingivitis.

Results:

The mean plaque index scores in different groups:

Groups	N	Mean± Std. Deviation			
		0	5 days	10 days	15 days
0.2% CHX	15	1.64± 0.23	1.29± 0.21	1.17± 0.19	0.98± 0.19
0.1% OCT	15	1.51± 0.30	1.12± 0.30	0.97±0.26	0.70± 0.36
DW	15	1.53± 0.29	1.24± 0.31	1.29± 0.30	1.33± 0.31

Table 1: Mean plaque index of three groups 0.2% CHX, 0.1% OCT and DW groups.
ANOVA [P<0.001] with Tukey HSD; P <0.05 Significant.

Group comparisons		Mean Difference	Range	p- value
0.2% CHX	0.1% OCT	0.284	0.022-0.547	0.031
DW	0.2% CHX	0.347	0.084-0.609	0.007
DW	0.1% OCT	0.632	0.369-0.894	0.001

Table 2: Comparison of plaque index among groups after 15 days

The mean PI scores of the two experimental groups (0.2% CHX, 0.1% OCT) and the control group (DW) considered in this study are given in (Table 1, Table 2). One way ANOVA revealed that there was a statistically significant difference between 0.2% CHX group and DW group (p=0.007), and between 0.1% OCT group and DW group (p=0.001). A Tukey's post hoc test revealed that the mean PI on day 15 was higher in DW group (1.33± 0.31) followed by 0.2% CHX (0.98± 0.19) and 0.1% OCT group (0.70± 0.36). However, the mean PI scores of 0.2% CHX group and 0.1% OCT group subjects (p = 0.031) were statistically insignificant. A repeated-measures ANOVA with a Greenhouse-Geisser correction and paired- t-test revealed that the mean PI differed significantly between the time points i.e., on days 0,5,10 and 15. Post hoc tests using the Bonferroni correction showed that in comparison to baseline (day 0) there was a reduction in PI on day 5, 10, and 15. The mean difference (±SE) noted at selected time points was 0.346 ± 0.025, 0.466 ± 0.021 and 0.657± 0.029 respectively for 0.2% CHX group; 0.39± 0.012, 0.53± 0.014 and 0.81± 0.045 respectively for 0.1% OCT group and 0.29± 0.010, 0.24± 0.009 and 0.20± 0.071 respectively for the DW (control) group. When reduction in

PI scores on day 10 and 15 was compared with that on day 5, the value, were 0.120± 0.022 and 0.311± 0.025 for 0.2% CHX group; 0.14± 0.018 and 0.41± 0.052 for 0.1% OCT group and 0.09± 0.074 and 0.04± 0.070 for DW group. Similarly, when mean PI reduction on day 15 was compared to that of day 10, the mean difference was 0.191± 0.015 for 0.2% CHX; 0.27± 0.042 for 0.1% OCT; and 0.05± 0.013 for DW groups. All of the above values were statistically significant. (Table 3)

		0.2% CHX		0.1% OCT		DW	
Days		MD ± SE	p-value	MD ± SE	p-value	MD ± SE	p-value
0	5	0.346± 0.025	0.001	0.39± 0.012	0.001	0.29± 0.010	0.001
	10	0.466± 0.021	0.001	0.53± 0.014	0.001	0.24± 0.009	0.001
	15	0.657± 0.029	0.001	0.81± 0.045	0.001	0.20± 0.071	0.071
5							
	10	0.120± 0.022	0.001	0.14± 0.018	0.001	0.09± 0.074	1.00
	15	0.346± 0.025	0.001	0.41± 0.052	0.001	0.04± 0.070	1.00
10							
	15	0.191± 0.015	0.001	0.27± 0.042	0.001	0.05± 0.013	0.008

MD= Mean Difference; SE = Standard Error; Paired t-Test, P <0.05 Significant.

Table 3: Pairwise comparison of plaque index at 0, 5, 10 and 15 days for 0.2% CHX, 0.1% OCT and DW groups.

Groups	N	Mean± Std. Deviation			
		0	5 days	10 days	15 days
0.2% CHX	15	2.18± 0.45	1.55± 0.44	1.49± 0.38	1.39± 0.43
0.1% OCT	15	2.27± 0.47	1.81± 0.31	1.57±0. 51	1.39± 0.44
DW	15	2.02± 0.46	1.74± 0.57	1.86± 0.26	1.95± 0.51

Table 4: Mean modified gingival index of three groups 0.2% CHX, 0.1% OCT and DW groups.

Group comparisons		Mean Difference	Range	p- value
0.1% OCT	0.2% CHX	0.006	-0.395-0.408	0.005
DW	0.2% CHX	0.560	0.004-0.158	0.004
DW	0.1% OCT	0.553	0.005-0.151	0.005

ANOVA [P<0.001] with Tukey HSD; P <0.05 Significant.

Table 5: Comparison of modified gingival index among groups after 15 days.

The mean modified gingival index scores in different groups: The mean MGI score was significantly different between 0.2% CHX and DW group (p=0.005) and 0.1% OCT and DW groups (p=0.004). Tukey post hoc test demonstrated that the mean MGI on day 15 was highest in DW group (1.95± 0.51) followed by 0.2% CHX group (1.39± 0.43) and 0.1% OCT group (1.39± 0.44). (Table 4 and Table 5)

A repeated-measures ANOVA with a Greenhouse-Geisser correction and paired- t-test revealed that the

mean MGI differed significantly between the time points (days 0,5,10 and 15). Post hoc tests using the Bonferroni correction showed that in comparison to baseline (day 0) there was a reduction in MGI score on day 5, 10, and 15. The mean difference (±SE) was 0.63 ± 0.075, 0.69 ± 0.071 and 0.79± 0.077 respectively for 0.2% CHX group; 0.45± 0.053, 0.70± 0.062 and 0.87± 0.068 respectively for 0.1% OCT group and 0.28± 0.042, 0.16± 0.055 and 0.06± 0.061 respectively for DW group. When reduction in MGI score on day 10 and 15 was compared with that on day 5, the value were 0.06± 0.013 and 0.16± 0.021 for 0.2% CHX group; 0.24± 0.034 and 0.42± 0.042 for 0.1% OCT group and 0.20± 0.36 and 0.08± 0.032 for DW group. Similarly when mean MGI score reduction on day 15 was compared to that of day 10, the mean difference values were 0.10± 0.017 for 0.2% CHX; 0.17± 0.021 for 0.1% OCT group; and 0.12± 0.033 for DW groups. All of the above values were statistically significant. (**Table 6)**

		0.2% CHX		0.1% OCT		DW	
Days		MD ± SE	p-value	MD ± SE	p-value	MD ± SE	p-value
0	5	0.63± 0.075	0.001	0.45± 0.053	0.001	0.28± 0.042	0.001
	10	0.69± 0.071	0.001	0.70± 0.062	0.001	0.16± 0.055	0.069
	15	0.79± 0.077	0.001	0.87± 0.068	0.001	0.06± 0.061	1.000
5							
	10	0.06± 0.013	0.001	0.24± 0.034	0.001	0.20± 0.036	0.001
	15	0.16± 0.021	0.001	0.42± 0.042	0.001	0.08± 0.032	0.105
10							
	15	0.10± 0.017	0.001	0.17± 0.021	0.001	0.12± 0.033	0.015

MD= Mean Difference; SE= Standard Error; Paired t-Test, P <0.05 Significant.

Table 6: Pairwise comparison of modified gingival index at 0, 5, 10 and 15 days for 0.2% CHX. 0.1% OCT and DW groups.

The mean gingival bleeding index scores in different groups: One way ANOVA revealed that there was a statistically significant difference in the mean GBI between 0.2% CHX group and DW group (p=0.010) and between 0.1% OCT and DW group (p=0.005). A Tukey's post hoc test for pairwise comparisons showed that the mean GBI on day 15 of patients belonging to DW group was higher (42.85±6.86) as compared to 0.2% CHX group and 0.1% OCT group which had mean GBI 36.70±4.49 and 35.69±4.82 respectively. (Table 7 and Table 8).

Groups	N	Mean± Std. Deviation			
		0	5 days	10 days	15 days
0.2% CHX	15	89.91 ±6.82	44.03 ±5.32	42.15 ±4.84	36.70± 4.49
0.1% OCT	15	92.25 ±5.30	37.49 ±4.93	35.32 ±5.73	35.69± 4.82
DW	15	91.36 ±4.43	42.49 ±8.67	41.73 ±7.04	42.85± 6.86

Table 7: Mean gingival bleeding index of three groups 0.2% CHX, 0.1% OCT and DW groups.

Group comparisons		Mean Difference	Range	p-value
DW	0.2% CHX	6.146	1.276-11.017	0.010
DW	0.1% OCT	7.153	2.283-12.024	0.005

ANOVA [P<0.001] with Tukey HSD; P <0.05 Significant.

Table 8: Comparison of mean gingival bleeding index among groups after 15 days.

A repeated-measures ANOVA with a Greenhouse-Geisser correction and paired- t-test revealed that the mean GBI score differed significantly between the time points (day 0,5,10 and 15). Post hoc tests using the Bonferroni correction determined that in comparison to baseline (day 0) there was a reduction in GBI score on day 5, 10, and 15. The mean difference for 0.2% CHX group (±SE) were 45.87± 2.489, 47.75± 2.109 and 53.20± 1.957 respectively; 54.76± 1.378, 56.93± 1.477 and 56.56± 1.122 respectively for 0.1% OCT group and 48.87± 1.855, 49.63± 1.510 and 48.51± 1.508 respectively for DW group. When reduction in GBI score for 0.2% CHX group on day 10 and 15 was compared with those on day 5, the mean differences were 1.88± 1.211 and 7.33± 1.173 respectively. Similarly, for 0.1% OCT group, the mean difference on day 10 and 15 were 2.17± 0.406 and 1.80± 0.764 respectively. For DW group, when the reduction in MGI on days 5 and ten was compared with that on day 15, the mean difference was 0.36 ± 0.895 and 1.12± 0.596 respectively. All of the above values were statistically significant. (Table 9 and Table 10).

Days		0.2% CHX		0.1% OCT	
		MD ± SE	p-value	MD ± SE	p-value
0	5	45.87± 2.489	0.001	54.76±1.378	0.001
	10	47.75± 2.109	0.001	56.93±1.477	0.001
	15	53.20± 1.957	0.001	56.56±1.122	0.001
5					
	10	1.88± 1.211	0.857	2.17± 0.406	0.001
	15	7.33± 1.173	0.001	1.80± 0.764	0.201
10					
	15	5.45± 0.437	0.001	0.37± 0.795	0.795

MD= Mean Difference; SE = Standard Error; Paired t-Test, P <0.05 Significant.

Table 9: Pairwise comparison of gingival bleeding index at 0, 5, 10 and 15 days for 0.2% CHX and 0.1% OCT.

Days		Mean Difference	Std. Error	p- value
0	5	48.87	1.855	0.001
	10	49.63	1.510	0.001
	15	48.51	1.508	0.001
15				
	5	0.36	0.895	1.000
	10	1.12	0.596	0.486

Paired t-Test, P <0.05 Significant

Table 10: Pairwise comparison of gingival bleeding index at 0, 5, 10 and 15 days for DW group.

Microbial colony count and Antimicrobial assay:

A Wilcoxon signed-rank test showed that on day 15, there was statistically significant change in the microbial colony count for both 0.2% CHX (Z= -2.230, p = 0.026) and 0.1% OCT (Z= -3.413, p = 0.001) groups. However there was no significant change in microbial colony count (p=0.051) for DW group. (Table 11) Intergroup comparison of the microbial colony count when subjected to Kruskal-Wallis test revealed that there were a statistically significant differences, between the values obtained at baseline ($\chi 2(2) = 8.341$, p = 0.015) and day 15 ($\chi 2(2) = 1.245$, p = 0.001) for all three groups. (Table 12)

	0.2% CHX			0.1% OCT			DW		
Days	N	Mean ±SD	p-value	N	Mean ±SD	p-value	N	Mean ±SD	p-value
0	15	378 ± 144.4	0.026	15	456± 75.0	0.001	15	283 ± 90.3	0.051
15	15	292 ± 105.3		15	220 ± 44.6		15	267± 99.3	

N – Number; SD- Standard Deviation; Wilcoxon signed-rank test, P <0.05 Significant

Table 11: Pairwise comparison of microbial count at baseline and 15 days for 0.2% CHX. 0.1% OCT and DW groups.

	Median	Chi-Square	p- value
Baseline	450	8.341	0.015
15th day	220	1.245	0.001

Kruskal-Wallis test, p <0.05 Significant

Table 12: Intergroup comparison of microbial count at baseline and 15 days for 0.2% CHX, 0.1% OCT and DW groups.

The antimicrobial susceptibility test demonstrated that the mean zone of inhibition for 0.2% CHX, 0.1% OCT and DW groups were 20.0 ± 4.75, 20.70 ± 4.85 and 0.03 ± 0.13 (mean ± SD) respectively. Intergroup comparison of the results obtained for 0.2% CHX, 0.1% OCT with DW (control) showed a mean difference (±SE) of (p=0.001) and, 20.03 ± 1.43, 20.7 ± 1.43 (p=0.001) respectively. Further, a similar comparison between 0.2% CHX and 0.1% OCT groups showed a mean difference of 0.66 ± 1.43 (p=0.888). (Table 13 and Table 14)

CHX, 0.1% OCT and DW groups.

Groups	N	Mean	Std. Deviation
0.2% CHX	15	20.0	4.75
0.1% OCT	15	20.7	4.85
DW	15	0.03	0.13

Table 13: Mean zone of inhibition of three groups 0.2% CHX, 0.1% OCT and DW groups

Groups		Mean Difference	Std. Error	p- value
0.2% CHX	Distilled water	20.03	1.43	0.001
0.1% Octenidine	0.2% CHX	0.66	1.43	0.888
	Distilled water	20.7	1.43	0.001

ANOVA [P<0.001] with Tukey HSD; P <0.05 Significant

Table 14: Intergroup comparison of zone of inhibition for 0.2% CHX, 0.1% OCT and DW groups

Discussions:

There is a strong correlation between dental plaque and gingivitis which is the most common pathological condition among adults. [14, 15] Although mechanical methods of plaque control are considered the standard for oral hygiene regimens, aimed at preventing plaque-related oral diseases, epidemiologic data indicate that the theoretical potential for such methods is not often achieved. It has been widely accepted that many patients are unable to maintain adequate levels of oral hygiene using mechanical methods alone. This has led to the adjunctive use of antimicrobial mouth rinses in oral hygiene regimens to help prevent and control supragingival plaque and gingivitis. The classical experiments of Loeet al. (1965) demonstrated that the accumulation of microbial plaque predictably resulted in the development of generalized gingivitis. Likewise, plaque removal reversed clinical inflammation to healthy gingiva. A large number of studies have confirmed these findings both in humans and in experimental animals. [1, 16, 17, 18, 19] Rinsing twice a day with 10 ml of a 0.2% CHX inhibits the dental plaque formation and its efficacy against gingivitis is well documented in the literature. [20-23] Although chlorhexidine is considered to be the gold standard due to many positive effects, it is accompanied by side effects such as extrinsic staining of the tooth, [24, 25]desquamation of gingiva, discoloration of the tongue and teeth, pain in the mucosa [20, 22, 23, 25, 26],and anaphylactic reactions.[27-29] Another mouthwash containing 0.1% OCT is also being used as a potent plaque inhibitor. [11, 31-34] The present study was conducted with a view to compare the efficacy of the above two mouth rinses against plaque-induced gingivitis using PI, GBI, MGI, microbial colony count, and antimicrobial susceptibility test.

The results of our study confirmed that the elimination of plaque and gingivitis could be benefitted using both 0.2% CHX and 0.1% OCT which are largely similar to those reported in a previous short-term study. [30] The results of present experimental study have also amply demonstrated that the antimicrobial activity of 0.1% OCT was relatively higher than 0.2% CHX. This finding is in line with the findings of Doganet al. [31] and Robrishet al. [32] Further, the study revealed that the mean PI reduction on day 15 was higher in 0.1% OCT group (0.70± 0.36) than 0.2% CHX group (0.98± 0.19), a result similar to those of Welket al.[33] In the present study, 0.1% OCT showed superiority over 0.2% CHX in terms of Minimum Inhibitory Concentration, and a result similar to that of Beiswangeretet al.[34] Further 0.1% OCT have been found to have lower cytotoxic effects on gingival fibroblasts and epithelial cells compared to 0.2% CHX and due to this 0.1% OCT as a mouth rinse can be considered as a potential alternative to 0.2% CHX. [35] However, further long term clinical and microbiological studies on individuals of different sexes and age groups as well as pregnant and nursing women are necessarily needed to

evaluate safety and efficacy of 0.1% octenidinedihydrochloride containing mouth rinse.

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