

## Comparative evaluation of the efficacy of Chlorhexidine mouthwash as a supplement to regular tooth brushing

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### Abstract

**Introduction:** Chlorhexidine gluconate mouthwash has earned eponym of gold standard to treat and/or prevent periodontal disease. The present study was carried out with an aim to evaluate the efficacy of CHX mouthwash as a supplement to regular toothbrushing.

**Materials and Methods:** The present study was carried out in 40 patients to evaluate CHX mouth rinses i.e Chlorhexidine gluconate (Vyrex Mouthwash (0.2% w/v), as a supplement to regular tooth brushing on plaque accumulation and gingival inflammation in chronic generalized gingivitis patients in gingival inflammation, taste alteration & gingival score were evaluate at 14, 21 & 28 day.

**Results:** No statistical significant difference was observed in two groups with respect to gingival inflammation, plaque accumulation, taste alteration & gingival score.

**Conclusion:** However, Chlorhexidine & Toothbrushing significantly reduced plaque growth & gingivitis, but chlorhexidine was more effective against plaque regrowth. 0.2% Chlorhexidine remains the gold standard as an antimicrobial agent.

**Keywords:** Plaque, Gingival inflammation, Chlorhexidine, Toothbrushing.

### Introduction

It is believed that dental plaque is the main etiological factor that causes caries, gingivitis and periodontal disease.<sup>1</sup> A direct relationship has been demonstrated between plaque levels and the severity of gingivitis. According to WHO (1978) Dental plaque is defined as a specific but highly variable structural entity resulting from sequential colonization of micro-organisms on tooth surfaces, restorations and other parts of oral cavity which consists of salivary components like mucin, desquamated epithelial cells, debris and microorganisms all embedded in a gelatinous extracellular matrix.<sup>2</sup>

Mouthwashes have the ability to deliver therapeutic ingredients to all accessible surfaces of mouth including interproximal surfaces and remain effective for extended period of time depending on their composition (substantivity). The various chemical agents used in different type of commercially available mouthwashes are bisbiguanide (Chlorhexidine), essential oil (Listerine™) phenolic compounds (Triclosan), pyrimidines (Floxuridine), quaternary ammonium compounds (Cetylpyridium chloride), oxygenating agents (Hydrogen peroxide), halogen (Amine fluoride), heavy metal salts (Zinc).

The various mechanical plaque control methods include toothbrushing with a dentifrice, dental floss, interdental aids and tongue cleaning.<sup>10</sup> Mechanical plaque control by a toothbrush is the most dependable oral hygiene measure. Brushing twice a day with a toothpaste is the current clinical recommendation. Toothpastes may be fluoridated or natural toothpastes without triclosan or fluoride, containing natural ingredients such as special mineral salts (sodium fluoride and sodium chloride), and plant extracts (lemon, eucalyptus, rosemary, chamomile, sage and myrrh). The purpose of oral hygiene using toothpaste is to reduce oral bacterial flora. Mouth bacteria have been linked to plaque, tooth decay and

toothache.<sup>11</sup> During toothbrushing, the removal of dental plaque is achieved primarily through direct contact between the filaments of the toothbrush and the surfaces of the teeth and soft tissues.<sup>12</sup> Regular mechanical tooth cleaning is directed towards maintaining a level of plaque quantitatively and/ qualitatively which is compatible with gingival health, and not rendering the tooth surface bacteria free. Limitations of tooth-brushing include lack of dexterity, difficult access and individual differences to clean specific areas of the mouth.<sup>13</sup>

### Materials and Methods

The study was carried out in 40 BDS students of Institute of Dental Studies & Technologies, Kadrabad, Modinagar, Uttar Pradesh according to following Inclusion criteria & Exclusion criteria:

#### Inclusion Criteria

1. Both sexes diagnosed with chronic generalized gingivitis, with presence of  $\geq 20$  teeth with clinical signs of inflammation confined to gingiva only.
2. Teeth showing no attachment loss.
3. Bleeding on probing in  $\geq 20\%$  teeth.

#### Exclusion Criteria

1. Patients on medications influencing gingival tissues.
2. Patients suffering from any systemic disease.
3. Pregnant or lactating woman.
4. Patient who have undergone any periodontal therapy in last 6 months.
5. Smokers

### Treatment Protocol

Screening of the Volunteers was done according to the inclusion and exclusion criteria. The treatment protocol was explained to all the patients and a written informed consent

was taken from each subject. A total of 40 subjects were included in this study.

Demographic details of each subject were recorded. Initial screening in the form of full mouth indices which included Modified Gingival Index- MGI (RR Lobene, T Weatherford, N.M. Ross, R.A Lamm, and L. Menaker 1986) for gingival inflammation, Turesky–Gillmore–Glickman (Modification of Quigley Hein Plaque Index, 1962) for plaque assessment, Approximal Plaque Index (Lange, 1986) for plaque assessment, and Gingival Bleeding Index (Ainamo & Bay, 1975) for gingival bleeding were recorded in a tabulated proforma (Annexure no III). The selected subjects were recalled on appropriate day (Baseline/ Day 0) and professional scaling and polishing of teeth was done to render the mouth plaque free. All the four indices were recorded again after scaling and polishing at baseline/Day 0 and for all the subjects were provided with the same toothbrush and toothpaste and asked to continue their habitual brushing technique twice a day for the next 14 days. The subjects were also asked to refrain from any other oral hygiene measures (mouthrinses or use of any interdental aids) during the entire course of this study. All the subjects were recalled and all the four clinical parameters were recorded again on Day 7 and Day 14.

At Day 14 after recording of the clinical parameters, the remaining 40 subjects underwent full mouth scaling and polishing and were divided into following four groups of 20 each.

**Group A:** Toothbrushing alone twice daily for the next 14 days (20 Volunteers).

**Group B:** Toothbrushing twice daily followed by 10ml of chlorhexidine digluconate mouthwash (0.2%) which was diluted with 10ml of water and was prescribed twice daily for 60 seconds.(20 Volunteers).

All the subjects were recalled at Day 21 & Day 28 and all the clinical parameters were recorded again.

All clinical parameters at all time intervals for all the groups were recorded in a tabulated performa.



**Fig. 1 (A):** Armamentarium used in the study

Clinical photographs of all the parameters (Modified Gingival Index, Turesky–Gillmore–Glickman (Modification of Quigley Hein Plaque Index 1962), Approximal Index, Gingival Bleeding Index) at BL, 14 & 28 days for Group 1 (Fig. 1 A, B), Group 2 (Fig. 2 A, B, C), were taken and the data for only BL, 14 & 28 days was statistically analysed for inter and intragroup comparison.



**Fig. 1 (B):** Toothbrush and toothpaste



**Fig. 1 (C):** Chlorhexidine mouthwash used for the study

## Results

During the evaluation period of seven days, the subjects were recalled for assessing the side effects on 14 & 21 day was statistically analysed for inter and intragroup comparison.

A randomized clinical study was done to evaluate the efficacy of three mouthrinses as a supplement to regular toothbrushing on plaque accumulation and gingival inflammation in chronic generalized gingivitis patients. A total of 40 student volunteers from Institute of Dental Studies & Technologies, Kadrabad, Modinagar (U.P) participated in this study. The subjects included were 18 males and 22 females. The ethical committee of Institute of Dental Studies and Technologies approved the study design.

The informed consent from all the patients were taken and demographic details of each subjects was recorded. Initial screening in the form of full mouth indices which included Modified Gingival Index -MGI (RR Lobene, T Weatherford, N.M. Ross, R.A Lamm, and L.Menaker1986) for gingival inflammation, Turesky–Gillmore–Glickman,(Modification of Quigley Hein Plaque Index,

1962), Approximal Plaque Index (Lange, 1986) for plaque assessment, and Gingival Bleeding Index (Ainamo & Bay, 1975) for gingival bleeding were recorded in a tabulated proforma. The selected subjects were recalled on Baseline/Day 0 and professional scaling and polishing of teeth was done to render the mouth plaque free. All the four indices were recorded again after scaling and polishing at baseline and the subjects were provided with the same toothbrush and toothpaste and asked to continue their habitual brushing technique twice a day for the next 14 days. The subjects were asked to refrain from all other oral hygiene measures (mouthrinses or use of any interdental aids). All the subjects were recalled and all the four clinical parameters were recorded again on Day 7 and Day 14.

At Day 14 after recording of the clinical parameters, subjects underwent full mouth scaling and polishing and were divided into following four groups.

Group A: Colgate toothbrush along with Colgate toothpaste (Advance protection) were used twice daily for the next 14 days. [5 males (25.0%), 15 females (75.0%) with mean age of  $22.25 \pm 2.55$  years].

Group B: Colgate toothbrush along with Colgate toothpaste (Advance protection) were used twice daily followed by 10ml of chlorhexidine digluconate mouthwash (0.2%) which was diluted with 10ml of water and was prescribed twice daily for 60 seconds for the next 14 days. [4 males (20.0%), 16 females (80.0%) with mean age of  $22.65 \pm 1.46$  years].

All the volunteers were asked to maintain a time gap of 30 minutes between toothbrushing and mouth rinsing. All the subjects were recalled at Day 21 & Day 28 and all the clinical parameters were recorded in a tabulated proforma.

The collected data at (BL, 7, 14, 21, 28 days) was statistically analysed and intragroup and intergroup comparisons were done at 0, 14 and 28 days.

### Modified Gingival Index (MGI)

#### Intragroup Comparison (Table 1, 2)

##### Group 1

The mean MGI was  $0.75 \pm 0.08$  at baseline, which decreased to  $0.61 \pm 0.12$  at 14 days which was further reduced to  $0.49 \pm 0.16$  at 28 days. (Table 1)

When pre and post treatment measurements of difference of mean MGI were compared using repeated measures of ANOVA with Bonferroni post hoc test, it was found that the MGI scores at 14 days and 28 days were significantly lower than baseline ( $0.14 \pm 0.1$ ,  $p < 0.001$  &  $0.26 \pm 0.13$ ,  $p < 0.001$ ) respectively. Similarly the measurements were found to be significantly lower from 14- 28 days ( $0.12 \pm 0.12$ ,  $p = 0.001$ ) measurements. (Table 2)

##### Group 2

The mean MGI was  $0.82 \pm 0.13$  at baseline, which was reduced to  $0.68 \pm 0.11$  at 14 days which further reduced to  $0.45 \pm 0.11$  at 28 days. (Table 1)

When pre and post treatment measurements of difference of mean MGI were compared using repeated measures of ANOVA with Bonferroni post hoc test it was found that the MGI scores at 14 days and 28 days were

significantly lower than baseline ( $0.14 \pm 0.18$ ,  $p < 0.007$  & ( $0.37 \pm 0.16$ ,  $p < 0.001$ ) resp. Similarly the measurements were found to be significantly lower from 14-28 days ( $0.23 \pm 0.11$ ,  $p < 0.001$ ) measurements. (Table 2)

**Table 1:** Mean modified gingival index (MGI) for all groups at baseline (BL), 14 and 28 says

	Group I Mean $\pm$ SD	Group II Mean $\pm$ SD
MGI at BL	$0.75 \pm 0.08$	$0.82 \pm 0.13$
MGI at 14 days	$0.61 \pm 0.12$	$0.68 \pm 0.11$
MGI at 28 days	$0.49 \pm 0.16$	$0.45 \pm 0.11$

**Table 2:** Intra group comparison of modified gingival index (MGI) at different time intervals

	Group I Mean $\pm$ SD, p <sup>b</sup> value	Group II Mean $\pm$ SD, p <sup>b</sup> value
Diff in MGI From BL to 14 days	$0.14 \pm 0.1$ <b>&lt;0.001, S</b>	$0.14 \pm 0.18$ <b>0.007, S</b>
Diff in MGI From BL to 28 days	$0.26 \pm 0.13$ <b>&lt;0.001, S</b>	$0.37 \pm 0.16$ <b>&lt;0.001, S</b>
Diff in MGI From 14 to 28 days	$0.12 \pm 0.12$ <b>0.001, S</b>	$0.23 \pm 0.11$ <b>&lt;0.001, S</b>

<sup>b</sup>Repeated measures of ANOVA with Bonferroni post hoc test

### Intergroup Comparison

#### Turesky-Gillmore-Glickman- Modification Of quigley Hein plaque index, (PI) Intragroup Comparison (Table 3, 4)

##### Group 1

The mean PI was  $0 \pm 0$  at baseline, which was increased to  $0.56 \pm 0.17$  at 14 days which then reduced to  $0.40 \pm 0.15$  at 28 days. (Table 3)

When pre and post treatment measurements of difference of mean PI were compared using Repeated measures of ANOVA with Bonferroni post hoc test it was found that the PI score at 14 days and 28 days were significantly higher than baseline ( $-0.56 \pm 0.17$ ,  $p < 0.001$  &  $-0.40 \pm 0.15$ ,  $p < 0.001$ ) respectively. However the measurements were found to be significantly lower from 14-28 days ( $0.16 \pm 0.09$ ,  $p < 0.001$ ) measurements. (Table 4)

##### Group 2

The mean PI was  $0 \pm 0$  at baseline, which was increased to  $0.66 \pm 0.08$  at 14 days which then reduced to  $0.49 \pm 0.06$  at 28 days. (Table 3)

When pre and post treatment measurements of difference of mean PI were compared using Repeated measures of ANOVA with Bonferroni post hoc test then it was found that the PI score at 14 days & 28 days was significantly higher than baseline ( $-0.66 \pm 0.08$ ,  $p < 0.001$  &  $-0.49 \pm 0.06$ ,  $p < 0.001$ ) resp. The difference in PI measurements were significantly lower from 14 days to 28 days ( $0.16 \pm 0.07$ ,  $p < 0.001$ ). (Table 4)

**Table 3: (A)** Mean Turesky-Gillmore-Glickman- Modification of Quigley Hein Plaque Index, (Pi) for all groups at Baseline (BL), 14 and 28 days

	Group I	Group II	Group III	Group IV
MPI at BL Mean± SD	0 ± 0	0 ± 0	0 ± 0	0 ± 0
MPI at 14 days Mean ± SD	0.56 ± 0.17	0.66 ± 0.08	0.65 ± 0.12	0.76 ± 0.09
MPI at 28 days Mean ± SD	0.40 ± 0.15	0.49 ± 0.06	0.57 ± 0.17	0.77 ± 0.14

<sup>b</sup>Repeated measures of ANOVA with Boneferroni post hoc test

**Table 4: (B)** Intra Group Comparison of Turesky-Gillmore-Glickman- modification of Quigley Hein plaque index, (pi) at different time intervals

	Group I	Group II	Group III	Group IV
Diff in MPI From BL to 14 days Mean ± SD, p value	-0.56 ± 0.17 <0.001, S	-0.66 ± 0.08 <0.001, S	-0.65 ± 0.12 <0.001, S	-0.76 ± 0.09 <0.001, S
Diff in MPI From BL to 28 days Mean ± SD, p value	-0.40 ± 0.15 <0.001, S	-0.49 ± 0.06 <0.001, S	-0.57 ± 0.17 <0.001, S	-0.77 ± 0.14 <0.001, S
Diffin MPI From 14 to 28 days Mean ± SD, p value	0.16 ± 0.09 <0.001, S	0.16 ± 0.07 <0.001, S	0.08 ± 0.12 0.023, S	-0.01 ± 0.12 0.99, NS

<sup>b</sup>Repeated measures of ANOVA with Boneferroni post hoc test

**Table 5: A)** Mean approximal plaque index (API) for all groups: at baseline (BL), 14 and 28 days

	Group I Mean ± SD	Group II Mean ± SD	Group III Mean ± SD	Group IV Mean ± SD
API at BL	0 ± 0	0 ± 0	0 ± 0	0 ± 0
API at 14 days	47.12 ± 14.15	59.42 ± 8.57	60.88 ± 10.4	67.03 ± 13.39
API at 28 days	30.8 ± 10.18	41.59 ± 7.91	49.88 ± 17.19	64.12 ± 11.43

**Table 6: B)** Intra group comparison of approximal plaque index (API) at Different Time Intervals

	Group I Mean ± SD, p value	Group II Mean ± SD, p value	Group III Mean ± SD, p value	Group IV Mean ± SD, p value
Diff in API From BL to 14 days	-47.12 ± 14.15 <0.001, S	-59.42 ± 8.57 <0.001, S	-60.88 ± 10.4 <0.001, S	-67.03 ± 13.39 <0.001, S
Diff in API From BL to 28 day	-30.8 ± 10.18 <0.001, S	-41.59 ± 7.91 <0.001, S	-49.88 ± 17.19 <0.001, S	-64.12 ± 11.43 <0.001, S
Diff in API From 14 TO 28 days	16.32 ± 13.66 <0.001, S	17.83 ± 5.16 <0.001, S	11.01 ± 16.25 0.021,S	2.91 ± 13.96 0.96, NS

### Approximal Plaque Index (API)

#### Intragroup Comparison (Table 5, 6)

##### Group 1

The mean API was 0 ± 0 at baseline, which increased to 47.12 ± 14.15 at 14 days which then reduced to 30.8 ± 10.18 at 28 days. (Table 5)

When pre and post treatment measurements of difference of mean API were compared using repeated measures of ANOVA with Boneferroni post hoc test, it was found that the API score at 14 days and 28 days were significantly higher than baseline (-47.12 ± 14.15,  $p < 0.001$  & -30.8 ± 10.18,  $p < 0.001$ ) respectively. However the measurements were found to be significantly lower from 14 - 28 days (16.32 ± 13.66,  $p < 0.001$ ) measurements. (Table 6)

##### Group 2

The mean API was 0 ± 0 baseline, which increased to 59.42 ± 8.57 at 14 days and then reduced to 41.59 ± 7.91 at 28 days. (Table 5)

When pre and post treatment measurements of difference of mean API were compared using repeated measures of ANOVA with Boneferroni post hoc test it was found that the measurements at 14 days and 28 days were significantly higher than baseline (-59.42 ± 8.57,  $p < 0.001$  & -41.59 ± 7.91,  $p < 0.001$ ) resp. The measurements were found to be significantly lower from 14- 28 days (17.83 ± 5.16,  $p < 0.001$ ) measurements. (Table 6)

## Discussion

It is well established that supragingival plaque initiates gingivitis and its removal reduces and controls gingivitis. Effective plaque control is crucial for the maintenance of periodontal health. The various mechanical plaque control methods include toothbrushing with a dentifrice, dental floss, interdental aids and tongue cleaning. Mechanical plaque control by a toothbrush along with dentifrice is the most dependable oral hygiene measure.<sup>4</sup> The toothbrush, however, does not reach the interproximal surfaces of the teeth as efficiently as it reaches the facial, lingual and occlusal surfaces. Chemical plaque control agents are used as an adjunct to mechanical plaque control methods to inhibit the supragingival plaque formation and the development of gingivitis.<sup>3</sup> Daily rinsing with an effective antimicrobial mouthwash may help to reduce the total microbial burden in the oral cavity more specifically in the interproximal surface thereby contributing to better oral hygiene. Mouthwashes have the ability to deliver therapeutic ingredients to all surfaces of mouth and remain effective for extended period of time depending on their composition.

Chlorhexidine (CHX) is regarded as the 'Gold Standard' antiplaque treatment and is particularly effective against gingivitis according to Van Leeuwen MPC et al (2011). This mouthwash is widely used as an adjunct for the treatment of periodontitis. However, the long-term and daily use of CHX is associated with side effects, such as objectionable taste, tooth discoloration, desquamation, and soreness of oral mucosa. The activity of this mouthwash is Ph dependent and is greatly reduced in the presence of organic matter. The side effects caused by this mouthwash limit the acceptability to users and the long-term use of a 0.2% CHX antiseptic in preventive dentistry. Manufacturers have tried to modify the taste of their mouthwashes, but the bitter taste of CHX is evidently difficult to mask.

Therefore a randomized clinical trial was carried out in Department of Periodontology, Institute of Dental Studies And Technologies, Modinagar, Ghaziabad, to evaluate efficacy of three mouthrinses as supplement to regular toothbrushing on plaque accumulation and gingival inflammation in chronic generalized gingivitis patients. The present study, included 22 males and 27 females with age range of 18-30 years (mean age of 21.58±2.09 years).

The subjects selected were dental students and dental auxiliary staff. They had a clear understanding of how to clean their teeth and probably more so than the general population. As important was the compliance achieved with this dentate and hygiene aware population who performed according to protocol. Oral hygiene instructions were given to all the subjects and were given the same manual toothbrush (Colgate/Soft) and toothpaste (Colgate/Advance protection) for standardization and were instructed to brush twice daily with habitual brushing technique as recommended by McCracken et al 2003<sup>7</sup> as the oral environment is dark and moist and the bacteria producing dental plaque thrive in such environment, it takes 12 hours for the bacteria to repopulate and cause destruction of the

oral cavity; therefore to minimize such effect brushing twice daily was recommended. Brushing time of 2-3 minutes is standardized so as to avoid variation in the plaque removing efficacy, which may vary between the subjects i.e 8 to 30 seconds and also it is the minimum time required for optimum plaque control. Subjects were advised to refrain from use of any additional plaque control measures like interdental aids because it could have affected the outcome of the study. Third molars were not included because of the difficulties in visibility and accessibility. In Group 1, all were instructed to brush twice daily i.e 2 minutes in the morning and 2 minutes in the night before going to bed using the assigned toothbrush with dentifrice. In Group 2, along with toothbrushing, 10ml of chlorhexidine digluconate mouthwash was diluted with 10ml of water and was prescribed twice daily for 60 seconds. The mouthwash was prescribed twice daily since the substantivity of chlorhexidine is 12 hours.

In each participating subject full mouth Modified Gingival Index-MGI (RR Lobene, T Weatherford, N.M. Ross, R.A Lamm, And L. Menaker 1986)<sup>8</sup> for gingival inflammation, Turesky-Gillmore-Glickman (Modification of Quigley Hein Plaque Index, 1962)<sup>8</sup> and Approximal Plaque Index (Lange, 1986)<sup>9</sup> for plaque assessment, and Gingival Bleeding Index (Ainamo & Bay, 1975)<sup>10</sup> for gingival bleeding were recorded by a single examiner blinded to treatment at 4 sites per tooth were recorded at BL/0,7,14,21 and at 28days. All these indices collectively demonstrated the amount of plaque control and reduction in bleeding thereby reducing gingival inflammation. The bleeding was induced by probing the gingival sulcus and is assessed depending upon the appearance within ten seconds of probing.

Though an manual probe i.e william's probe was used to induce bleeding in our study, a pressure sensitive automated probe should always be preferred in such clinical trials.

Clinical measurements were analysed statistically by means of Chi-square test, One way Analysis of Variance & Repeated Measures of Analysis of Variance (ANOVA) Test, POST-HOC tests (or post-hoc comparison tests)-Bonferroni test and Shapiro-Wilk test

The present study demonstrated a decrease in, MGI, PI, API and BOP scores in each group at all time periods (0, 14 days, 28 days).

In the present study, the modified gingival index was significantly reduced at 14 days ( $p < 0.001$ ) which was further reduced at 28 days ( $p < 0.001$ ) from baseline. Similarly the measurements were found to significantly decrease from 14 -28 days ( $p = 0.001$ ). These results are in accordance with the study of Singh et al,<sup>11</sup> Kraivaphan P,<sup>12</sup> Creeth J<sup>13</sup> and Rover JA<sup>14</sup> who found that toothbrushing can significantly reduce gingival scores. However Okpalugo J et al in 2009<sup>4</sup> further stated that no brands of toothpaste can remove bacteria by 50%. Therefore, there is a need for further microbiological research into the possible value of toothpaste for reducing oral bacterial flora.

When pre and post treatment measurements of MGI were compared in subjects using toothbrushing along with 0.2% chlorhexidine, then it was found that MGI measurements significantly reduce from baseline to 14 days ( $p < 0.007$ ) and then to 28 days ( $p < 0.001$ ) and also from 14 to 28 days ( $p < 0.001$ ) These results are in accordance with the study of Sikka G et al<sup>15</sup> who found that toothbrushing along with chlorhexidine can significantly reduce gingival score along with reduction in gingival inflammation and also showed that chlorhexidine remains a gold standard in improving the gingival status. Further Rath SK<sup>16</sup> compared two concentration of CHX and concluded that low concentration of (0.12%) CHX for better patient compliance with the optimum clinical results. However, in the present study concentration of 0.2% CHX was used. Herrera D in 2013<sup>17</sup> further reported that there was significant increase in staining scores after using chlorhexidine, however no such staining was observed in our study. The reason might be in Herrera's metaanalysis, the follow up period was of four weeks duration and our study had a follow up period of 14 days only. Sharma A (2009)<sup>18</sup> reported urticaria due to chlorhexidine mouthwash which was confirmed by skin prick test but no such allergic reaction was seen in our study. Also similar to study of Lang NP<sup>19</sup> no taste alteration with CHX was seen in our study.

In the present study baseline plaque score were brought to zero by professional oral prophylaxis. When mean PI was compared in Toothbrushing alone group it was seen that the PI score significantly increased at 14 & 28 days ( $p < 0.001$ ). The results suggest that patient might not be consistently maintaining oral hygiene. However scores significantly reduced from 14 to 28 days when oral hygiene instruction were reinforced. Similar results were obtained with API. These findings are in accordance with the study of Rover et al<sup>14</sup> who reported that toothbrushing can significantly reduce the plaque score but as suggested by Okpalugo J et al in 2009<sup>4</sup> need for further research into the possible value of toothpaste for reducing oral bacterial flora is required.

When mean plaque score obtained from PI & API were compared in subjects using toothbrushing along with 0.2% chlorhexidine mouthwash then it was found that the score at 14 days & 28 days was significantly higher than baseline ( $p < 0.001$ ). The baseline score were brought to zero by oral prophylaxis as suggested by Fabricio B<sup>20</sup> who reinforce the necessity of biofilm disruption before the initiation of CHX mouthrinse. However, the mean difference in PI measurement were significantly lower from 14 days to 28 days ( $p < 0.001$ ). These results are in accordance with the study of Loe H in 1970<sup>21</sup> who found that daily application of 2% solution of chlorhexidine gluconate prevented plaque formation completely. Upon discontinuation of the chlorhexidine treatment, plaque formed at normal rates, suggesting that there is no appreciable effect beyond a 24 hour period and complete inhibition of plaque and prevention of gingivitis may be achieved by daily application of chlorhexidine, provided the agent is administered in such a way that it reaches all tooth surfaces. Binny and Addy<sup>22</sup> also reported similar reduction in plaque

when toothbrushing was combined with chlorhexidine digluconate rinse.

When the mean GBI compared in subjects using Toothbrushing along with chlorhexidine mouthwash, it was found that the GBI score at 14 days and 28 days were significantly lower than baseline ( $p < 0.035$  and  $p < 0.001$  respectively). The measurements also significantly decreased from 14- 28 days ( $p < 0.001$ ). These results are in accordance with the study of Finkelstein and Yost<sup>23</sup> who concluded that antimicrobial rinses causes a significant reduction in gingival inflammation and bleeding on probing. Van Strydonck DAC et al<sup>24</sup> also reported similar results and suggested that toothbrushing along with chlorhexidine mouthrinse significantly reduce gingival score and bleeding on probing in chronic generalized gingivitis patients. Also according to Lang NP in 1986<sup>25</sup> who suggested that chlorhexidine with a substantivity of 8-12 hours is considered highly effective and has immediate bactericidal action on plaque bacteria and also improve the gingival status.

The present study concluded that CHX is considered the Gold standard because of its superior antiplaque effects, which is a result of its superior degree of persistence on the tooth surface. AAs compared to this benchmark, Herbal mouthwash was slightly effective. CHX rinsing can cause a number of local side effects, such as extrinsic tooth and tongue brown staining, taste disturbance, and enhanced supragingival calculus formation. CHX rinsing can also cause desquamation of the oral mucosa, but this is less common. On the other hand because of its natural ingredients.

The present study was undertaken to evaluate the efficacy of Chlorhexidine mouthwash as a supplement to regular toothbrushing on plaque accumulation and gingival inflammation in chronic generalized gingivitis patients.

A total of 40 student volunteers from Institute of Dental Studies & Technologies, Kadrabad, Modinagar (U.P) participated in this study. The subjects included were 22 males (13.8%) and 18 females (86.3%), with age range of 18-30 years (mean age of  $21.58 \pm 2.09$  years).

Demographic details of each subjects was recorded. Initial screening in the form of full mouth indices which included Modified Gingival Index - (MGI) (RR Lobene, T Weatherford, N.M. Ross, R.A Lamm, And L Menaker 1986) for gingival inflammation, Turesky-Gillmore-Glickman (Modification of Quigley Hein Plaque Index, 1962),

Approximal Plaque Index (Lange, 1986) for plaque assessment, and Gingival Bleeding Index (Ainamo & Bay, 1975) for gingival bleeding were recorded in a tabulated proforma The selected subjects were recalled on appropriate day (Baseline/ Day 0) and professional scaling and polishing of teeth was done to render the mouth plaque free. All the four indices were recorded again after scaling and polishing at baseline and the subjects were provided with the same toothbrush and toothpaste and asked to continue their habitual brushing technique twice a day for the next 14 days. The subjects were also asked to refrain from all other

oral hygiene measures (mouthrinses or use of any interdental aids). All the subjects were recalled and all the four clinical parameters were recorded again on Day 7 and Day 14. At Day 14 after recording of the clinical parameters, subjects underwent full mouth scaling and polishing and were divided into following four groups.

Group A: Colgate toothbrush along with Colgate toothpaste (Advance protection) were used twice daily for the next 14 days. [5 males (25.0%), 15 females (75.0%) with mean age of  $22.25 \pm 2.55$  years].

Group B: Colgate toothbrush along with Colgate toothpaste (Advance protection) were used twice daily followed by 10ml of chlorhexidine digluconate mouthwash (0.2%) which was diluted with 10ml of water and was prescribed twice daily for 60 seconds for the next 14 days. [4 males (20.0%), 16 females (80.0%) with mean age of  $22.65 \pm 1.46$  years].

All the volunteers were be asked to maintain a time gap of 30 minutes between toothbrushing and mouthrinsing. All the subjects were recalled at Day 21 & Day 28 and all the clinical parameters were recorded in a tabulated performa. The collected data was statistically analysed Results were analysed and the following conclusion were made from the study:

1. In our study the Mechanical plaque control by a toothbrush is the most dependable oral hygiene measure. Previous literature and the present study both suggest the necessity of biofilm disruption before the initiation of mouthrinses. Thus most efficient, safe and economical method of removing plaque is toothbrushing with a dentifrice and mouthrinses are used only to improve its efficacy.
2. Chlorohexidine was more effective against plaque regrowth. 0.2% Chlorohexidine remains the gold standard as an antimicrobial agent.

**Conflict of Interest:** None.

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**How to cite this article:** Kour K, Kaur S, Singh P. Comparative evaluation of the efficacy of Chlorohexidine mouthwash as a supplement to regular tooth brushing. *Int J Oral Health Dent* 2019;5(2):97-103.