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"Comparison of the Efficacy of a Cetylpyridinium Chloride versus a Propolis Mouthrinse in Post Surgical Plaque Control and Early Wound Healing After Conventional Flap Surgery"

Dr. Purvi K. Sampat
Post graduate, Department of Periodontology, Dr. G.D. Pol Foundation Y.M.T Dent
Corresponding Author: Dr. Purvi K. Sampat

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I. Introduction

Chronic periodontitis (CP) is defined as an inflammatory disease of the supporting tissues of the teeth caused by groups of specific microorganisms, resulting in progressive destruction of the periodontal ligament and alveolar bone with pocket formation, recession or both. [1]The treatment of chronic periodontitis involves mechanical removal of the subgingival biofilm, and the establishment of a local environment and microflora compatible with periodontal health.[1]The **periodontal flap** procedure is most frequently employed for pocket elimination/reduction, particularly for moderate and deep pockets.

The days following flap procedure may be associated with bleeding, pain, swelling and infection.[5]It has been shown that the early stages of post-surgical wound healing are associated with inflammation which, in turn, enhances biofilm formation.[6,7]If plaque formation is hindered, periodontal wounds heal faster and show less complications.[8,9,10,11]The first seven days following periodontal therapy is the time period in which patients can carry out oral hygiene practices with least efficiency due to pain on touch and due to the presence of sutures. An effective antimicrobial mouthwash used during the first post surgical week could be of clinical benefit.[13]

Quaternary ammonium compound, **cetylpyridinium chloride (CPC)** has a plaque and calculus inhibiting effect.[14]It is a cationic surface active agent.[1]

Propolis is the generic name for a complex resinous mixture collected by honey bees (*apis mellifera*), from the buds and exudates of various plants. Once collected, this material is enriched with the bee's saliva and enzyme containing secretions and used in the construction, adaptation and protection of hives.[16]**Aristotle** has coined the word Propolis. It is derived from the Greek word '**pro**' meaning 'for' or 'in defence of' and '**polis**' meaning 'the city'. Hence, Propolis means '**defender of the city/hive'**. [17]

Hence, the **present study** was conducted **to compare the clinical efficacy of a mouthrinse containing cetylpyridinium chloride versus a mouthrinse containing propolis, following conventional flap surgery.**

II. Materials And Method

***Study design*:** This was a single-centre, longitudinal, single masked (subjects only), randomized parallel arm study design.
Source of data: The subjects were selected from the out patient department, Department of Periodontology, YMT dental college and hospital; according to the inclusion and exclusion criteria.

Inclusion criteria:
1.Subjects, of either sex, within the age group of 20-55 years.
2.Systemically healthy subjects.
3.Subjects having probing pocket depth of ≥ 5mm after phase I therapy and presence of horizontal bone loss as determined by orthopantomograph (OPG).
Exclusion criteria:
1.Smokers & Tobacco chewers (AHA Guidelines).

2.Pregnant or lactating women and those using oral contraceptive pills.
3.Subjects who have taken antibiotics or anti-inflammatory drugs in the past 3 months.
4. Subjects with history of any gingival and/ or periodontal surgical treatment in the past 6 months.
5.Subjects allergic to CPC or propolis.
6.Subjects with objection to use of animal products.

Methodology

- A total of 50 individuals were assessed for eligibility according to the inclusion and exclusion criteria.
- A total of **30 subjects**diagnosed with chronic periodontitis requiring periodontal flap surgery were selected for the study. Sample size was determined using the mean and standard deviation values from literature using the formula

$$n = \frac{2 (Z_{\alpha} + Z_{\beta})^2 [s]^2}{d^2}$$

where Z_{α} is the z variate of alpha error i.e. a constant with value 1.96, Z_{β} is the z variate of beta error i.e. a constant with value 0.84.

- Informed signed written consent was obtained before the start of the study after informing the study protocol to the subjects in a language best understood by them.
- A detailed case history of all the subjects was recorded. Oral hygiene instructions were given to all the subjects participating in the study.
- Appropriate tooth brushing technique and frequency of brushing was explained and demonstrated to all the subjects. The toothbrush and toothpaste prescribed were standardized.

The following *clinical parameters were recorded*:

Clinical Parameter		Day
Plaque Index (**Loe, 1967**)[59]	baseline (presurgical – on the day of surgery)	10^{th}, $20^{th}$and 30^{th}days postoperatively
Modified Gingival Index (**Lobene et al, 1986**)[60]	baseline (presurgical – on the day of surgery)	10^{th}, $20^{th}$and 30^{th}days postoperatively
Visual Analogue Scale ratings for pain (**Matthews DC, McCulloch CAG, 1993)**[61]	----------	1^{st}, 10^{th}, $20^{th}$and 30^{th}days postoperatively
Wound Healing Index (**Lien Hui Huang, 2005**)[62]	----------	10^{th}, $20^{th}$and 30^{th}days postoperatively

Conventional periodontal flap surgery (Kirkland flap surgery) was carried out at the selected surgical site. Periodontal dressing was given and the subjects were randomized by lottery method into one of the 2 groups.

1. **GROUP-1 (CPC GROUP) (Colgate Plax®)**

Fifteen subjects, were prescribed a postsurgical protocol in which he/she **rinsed with 10 ml of a mouthrinse containing cetylpyridinium chloride twice daily for 1 min, for 10 days** beginning from the day of surgery, 1 hour after tooth brushing. Following this procedure, eating, rinsing, or drinking any fluid was not permitted for the subsequent hour.

2. **GROUP-2 (PROPOLIS GROUP) (Nature's Defence)**

Fifteen subjects, were prescribed a postsurgical protocol in which he/she **rinsed with 10 ml of a mouthrinse containing propolis twice daily for 1 min, for 10 days** beginning from the day
of surgery, 1 hour after tooth brushing. Following this procedure, eating, rinsing or drinking any fluid was not permitted for the subsequent hour.

There are no conflict of interest related to this study.

III. Statistical Procedures

Data obtained was compiled on a **MS Office Excel Sheet** (v 2010). Data was subject to statistical analysis using Statistical package for **Social Sciences** (SPSS v 21.0, IBM). Normality of data was checked using **Shapiro-Wilk** test data followed a normal distribution hence parametric tests have been used for statistical comparisons. Comparison of numerical values between the 2 groups was done using **t test**. For intra

group comparison repeated measures **ANOVA** has been used followed by **Tukey's Post Hoc test.** Comparison of change in numerical values over time intervals from baseline or initial values between the 2 groups was done using **t test.** For all the statistical tests, $p < 0.05$ was considered to be statistically significant.

IV. Results

For Plaque Index , in group 1 and 2, on **intragroup comparison**, there was highest value for the plaque score on the 10^{th}day with a significant increase in the scores from baseline ($p = 0.00$). This was followed by a significant reduction in scores from the 10^{th} day to the 20^{th}day ($p = 0.00$) and from the 10^{th}day to the 30^{th}day ($p = 0.00$). **(Table 1, 3)** However, from baseline to 20 days ($p= 0.91$) and baseline to 30 days ($p =1.00$) there was no significant change in plaque index. (**Table 2, 4**)

For Plaque Index, on inter group comparison, at all time intervals there was a statistically non significant difference seen for the values between the 2 groups ($p > 0.05$). (**Table 5**) **On inter group comparison, change in variables from initial values over various time intervals** there was a statistically non significant difference seen for the change in values between the 2 groups ($p > 0.05$). (**Table 6**)

For Modified Gingival Index , in group 1 and 2, on **intragroup comparison**, there was highest value for the plaque score on the 10^{th}day with a significant increase in the scores from baseline ($p = 0.00$). This was followed by a significant reduction in scores from the 10^{th} day to the 20^{th}day ($p = 0.00$) and from the 10^{th}day to the 30^{th}day ($p = 0.00$). **(Table 7, 9)** However, from baseline to 20 days ($p= 0.91$) and baseline to 30 days ($p =1.00$) there was no significant change in plaque index. (**Table 8, 10**)

For Modified Gingival Index, on inter group comparison, at all time intervals there was a statistically non significant difference seen for the values between the 2 groups ($p > 0.05$). (**Table 11**) **On inter group comparison, change in variables from initial values over various time intervals** there was a statistically non significant difference seen for the change in values between the 2 groups ($p > 0.05$). (**Table 12**)

In **group 1 and 2**, on **intra group comparison**, **VAS scores for pain** were highest when recorded on the 1^{st}day with a statistically significant reduction in scores from the 1^{st}day to the 10^{th}day ($p = 0.00$) to the 20^{th}day to the 30^{th}day ($p = 0.00$). (**Table 13, 15**). There was a statistically significant reduction in scores between $1^{st}$to 10^{th}day ($p = 0.00$), $1^{st}$to 20^{th}day ($p = 0.00$) and $1^{st}$to 30^{th}day ($p =$ 0.00). **(Table 14, 16)**

On inter group comparison, on days 1, 10, 20, 30 there was a statistically non significant difference seen for the values between the 2 groups ($p > 0.05$). (T**able 17)**.**On inter group comparison, change in variables from initial values over various time intervals,** there was a statistically non significant difference seen for the change in values between the 2 groups ($p > 0.05$). (T**able 18**)

In **group 1 and 2**, on **intra group comparison**, for **Wound Healing Index (WHI),** the highest values were obtained on the 10^{th}day. **(Table 19, 21).** There was a statistically highly significant difference seen for the values of WHI between all time intervals ($p < 0.01$) except between 20 days and 30 days where it was statistically non significant ($p > 0.05$). **(Table 20, 22)**

On inter group comparison of variables of the WHI on 10, 20, 30 days , there was a statistically non significant difference seen for the values between the 2 groups ($p > 0.05$). **(Table 23). On inter group comparison change in variables from 10 to 20 days and 10 to 30 days,** there was a statistically non significant difference seen for the change in values for the variables between the 2 groups ($p > 0.05$). **(Table 24)** Same values were obtained on 20^{th} day and 30^{th} day. Therefore there was no difference from 20^{th} to 30^{th} day.

Table 1 - Plaque Index - Intra group values for Group 1 (CPC Group) at specific time periods

Time	N	Mean	Std. Deviation	Std. Error	F	p value of repeated measures ANOVA
Baseline (B)	15	0.85	0.14	0.036	106.06	0.00**
10 days	15	1.74	0.23	0.058		
20 days	15	0.89	0.15	0.038		
30 days	15	0.85	0.13	0.03		

** = statistically highly significant difference ($p<0.01$)

Table 2-Plaque Index -Intra group pairwise comparison over time intervals for Group 1 (CPC group)

(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	p value
Baseline	10 days	-0.89	0.06	0.00**
Baseline	20 days	-0.04	0.06	0.91#
Baseline	30 days	-0.01	0.06	1.00#
10 days	20 days	0.85	0.06	0.00**
10 days	30 days	0.89	0.06	0.00**
20 days	30 days	0.03	0.06	0.95#

** = statistically highly significant difference (p<0.01) # = non significant difference (p>0.05)

Table 3 – Plaque Index -Intra group values for Group 2 (Propolis Group) at specific time intervals

Time	N	Mean	Std. Deviation	Std. Error	F	p value of repeated measures ANOVA
Baseline	15	0.78	0.13	0.03	86.17	0.00**
10 days	15	1.67	0.28	0.072		
20 days	15	0.85	0.15	0.038		
30 days	15	0.81	0.12	0.03		

** = statistically highly significant difference (p<0.01)

Table 4 –Plaque Index -Intra group pairwise comparison over time intervals for Group 2 (Propolis Group)

(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	p value
Baseline	10 days	-0.89	0.06	0.00**
Baseline	20 days	-0.07	0.06	0.74#
Baseline	30 days	-0.03	0.06	0.98#
10 days	20 days	0.83	0.06	0.00**
10 days	30 days	0.87	0.06	0.00**
20 days	30 days	0.04	0.06	0.93#

** = statistically highly significant difference (p<0.01) # = non significant difference (p>0.05)

Table 5 - Plaque Index - Inter group comparison at baseline, 10, 20 & 30 days

Time interval	Groups	N	Mean	Std. Deviation	Std. Error Mean	T value	p value of t test
Baseline	CPC	15	0.85	0.14	0.04	1.36	0.18#
	Propolis	15	0.78	0.13	0.03		
10 days	CPC	15	1.74	0.23	0.06	0.72	0.48#
	Propolis	15	1.67	0.28	0.07		
20 days	CPC	15	0.89	0.15	0.04	0.75	0.46#
	Propolis	15	0.85	0.15	0.04		
30 days	CPC	15	0.85	0.13	0.03	1.04	0.31#
	Propolis	15	0.81	0.12	0.03		

= non significant difference (p>0.05)

Table 6 - Plaque Index- Inter group comparison showing change in values from baseline over various time intervals

	Groups	N	Mean	Std. Deviation	Std. Error Mean	T value	p value of t test
10 days - Baseline	CPC	15	0.89	0.25	0.06	0.00	1.00#
	Propolis	15	0.89	0.33	0.09		
20 days - Baseline	CPC	15	0.04	0.06	0.02	-0.89	0.38#
	Propolis	15	0.07	0.09	0.03		
30 days - Baseline	CPC	15	0.01	0.09	0.02	-0.54	0.59#
	Propolis	15	0.03	0.10	0.03		

#= non significant difference (p>0.05)

Table 7 - Modified Gingival Index - Intra group values for Group 1 (CPC Group) at specific time periods

Time	N	Mean	Std. Deviation	Std. Error	F	p value of repeated measures ANOVA
Baseline	15	0.81	0.12	0.03	140.22	0.00**
10 days	15	1.71	0.21	0.05		
20 days	15	0.85	0.09	0.02		
30 days	15	0.81	0.13	0.03		

** = statistically highly significant difference (p<0.01)

Table 8 – Modified Gingival Index - Intra group pairwise comparison over time intervals for Group 1 (CPC Group)

(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	p value
Baseline	10 days	-0.90	0.05	0.00**
Baseline	20 days	-0.04	0.05	0.87#
Baseline	30 days	-0.01	0.053	0.99#
10 days	20 days	0.86	0.053	0.00**
10 days	30 days	0.89	0.053	0.00**
20 days	30 days	0.03	0.053	0.92#

** = statistically highly significant difference (p<0.01) # = non significant difference (p>0.05)

Table 9 - Modified gingival index - Intra group values for Group 2 (Propolis Group) at specific time periods

Time	N	Mean	Std. Deviation	Std. Error	F	p value of repeated measures ANOVA
Baseline	15	0.79	0.09	0.02	106.55	0.00**
10 days	15	1.69	0.27	0.07		
20 days	15	0.83	0.13	0.03		
30 days	15	0.79	0.09	0.02		

** = statistically highly significant difference (p<0.01)

Table 10 - Modified Gingival Index - Intra group pairwise comparison over time intervals for Group 2 (Propolis Group)

(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	Sig.
Baseline	10 days	-0.90	0.06	0.00**
Baseline	20 days	-0.05	0.06	0.87#
Baseline	30 days	-0.01	0.06	1.00#
10 days	20 days	0.85	0.06	0.00**
10 days	30 days	0.89	0.06	0.00**
20 days	30 days	0.04	0.06	0.91#

** = statistically highly significant difference (p<0.01) # = non significant difference (p>0.05)

Table 11 - Modified Gingival Index - Inter group comparison of variables at baseline, 10, 20 and 30 days

Time interval	Groups	N	Mean	Std. Deviation	Std. Error Mean	T value	p value of t test
Baseline	CPC	15	0.81	0.12	0.03	0.523	0.605#
	Propolis	15	0.79	0.09	0.02		
10 days	CPC	15	1.71	0.21	0.05	0.23	0.82#
	Propolis	15	1.69	0.27	0.07		
20 days	CPC	15	0.85	0.09	0.02	0.32	0.75#
	Propolis	15	0.83	0.13	0.03		
30 days	CPC	15	0.81	0.14	0.04	0.47	0.65#
	Propolis	15	0.79	0.09	0.02		

= non significant difference (p>0.05)

Table 12 - Modified Gingival Index - Inter group comparison showing change in values from baseline values to over time intervals

Time interval	Groups	N	Mean	Std. Deviation	Std. Error Mean	T value	p value of t test
10 days -Baseline	CPC	15	0.90	0.24	0.06	0.00	1.00#
	Propolis	15	0.90	0.31	0.08		
20 days – Baseline	CPC	15	0.04	0.12	0.03	-0.14	0.89#
	Propolis	15	0.05	0.11	0.04		
30 days -Baseline	CPC	15	0.01	0.13	0.03	0.00	1.00#
	Propolis	15	0.01	0.12	0.03		

= non significant difference (p>0.05)

Table 13 - VAS - Intra group values for Group 1 (CPC Group) at specific time periods

Time	N	Mean	Std. Deviation	Std. Error	F	p value of repeated measures ANOVA
1 day	15	4.87	0.99	0.26	97.29	0.00**
10 days	15	3.27	1.16	0.30		
20 days	15	1.33	0.49	0.13		
30 days	15	0.13	0.35	0.09		

** = statistically highly significant difference (p<0.01)

Table 14 - VAS - Intra group pairwise comparison over time intervals for Group 1 (CPC Group)

(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	p value
1 day	10 days	1.60	0.30	0.00**
1 day	20 days	3.53	0.30	0.00**
1 day	30 days	4.73	0.30	0.00**
10 days	20 days	1.93	0.30	0.00**
10 days	30 days	3.13	0.30	0.00**
20 days	30 days	1.20	0.30	0.001**

** = statistically highly significant difference (p<0.01)

Table 15 –VAS - Intra group values for Group 2 (Propolis Group) at specific time periods

Time	N	Mean	Std. Deviation	Std. Error	F	p value of repeated measures ANOVA
1 day	15	4.87	1.13	0.29	79.33	0.00**
10 days	15	2.80	1.21	0.32		
20 days	15	1.27	0.46	0.12		
30 days	15	0.20	0.41	0.11		

** = statistically highly significant difference (p<0.01)

Table 16 –VAS-Intra group pairwise comparison over time intervals for Group 2 (Propolis)

(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	Sig.
1 day	10 days	2.07	0.32	0.00**
1 day	20 days	3.60	0.32	0.00**
1 day	30 days	4.67	0.32	0.00**
10 days	20 days	1.53	0.32	0.00**
10 days	30 days	2.60	0.32	0.00**
20 days	30 days	1.07	0.32	0.009**

** = statistically highly significant difference (p<0.01)

Table 17 - VAS - Inter group comparison of variables at all time intervals at days 1, 10, 20 & 30

Time inetrvals	Groups	N	Mean	Std. Deviation	Std. Error Mean	T value	p value of t test
1 day	CPC	15	4.87	0.990	0.256	0.000	1.000#
	Propolis	15	4.87	1.125	0.291		
10 days	CPC	15	3.27	1.163	0.300	1.078	0.290#
	Propolis	15	2.80	1.207	0.312		
20 days	CPC	15	1.33	0.488	0.126	0.386	0.702#
	Propolis	15	1.27	0.458	0.118		
30 days	CPC	15	0.13	0.352	0.091	-0.475	0.638#
	Propolis	15	0.20	0.414	0.107		

= non significant difference (p>0.05)

Table 18- VAS - Inter group comparison showing change in values from day 1 values to various time intervals

Time intervals	Groups	N	Mean	Std. Deviation	Std. Error Mean	T value	p value of t test
1 day -10 days	CPC	15	1.60	1.12	0.29	-1.22	0.23#
	Propolis	15	2.07	0.96	0.25		
1 day-20 days	CPC	15	3.53	1.19	0.31	-0.14	0.89#
	Propolis	15	3.60	1.35	0.35		
1 day-30 days	CPC	15	4.73	0.96	0.25	0.16	0.87#
	Propolis	15	4.67	1.29	0.33		

= non significant difference (p>0.05)

Table 19 – WHI - Intra group values for Group 1 (CPC Group) at specific time periods

Time	N	Mean	Std. Deviation	Std. Error	F	p value of repeated measures ANOVA
10 days	15	1.33	0.49	0.13	7.00	0.002**
20 days	15	1.00	0.00	0.00		
30 days	15	1.00	0.00	0.00		

** = statistically highly significant difference (p<0.01)

Table 20 – WHI - Intra group pairwise comparison over time intervals for Group 1 (CPC Group)

(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	Sig.
10 days	20 days	0.33	0.103	0.006**
10 days	30 days	0.33	0.103	0.006**
20 days	30 days	0.00	0.103	1.000#

** = statistically highly significant difference (p<0.01) # = non significant difference (p>0.05)

Table 21 – WHI -Intra group values for Group 2 (Propolis Group) at specific time periods

Time	N	Mean	Std. Deviation	Std. Error	F	P value
10 days	15	1.27	0.46	0.12	5.09	0.01*
20 days	15	1.00	0.00	0.00		
30 days	15	1.00	0.00	0.00		

* = statistically significant difference (p<0.05)

Table 22 – WHI - Intra group Pairwise comparison over time intervals for Group 2 (Propolis Group)

(I) TIME	(J) TIME	Mean Difference (I-J)	Std. Error	Sig.
10 days	20 days	0.27	0.096	0.023*
10 days	30 days	0.27	0.096	0.023*
20 days	30 days	0.00	0.096	1.000#

* = statistically significant difference (p<0.05) # = non significant difference (p>0.05)

Table 23 – WHI - Inter group comparison of variables at day 10, 20 and 30

Time interval	**Groups**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**T value**	**p value of t test**
10 days	CPC	15	1.33	0.49	0.126	0.386	0.702#
	Propolis	15	1.27	0.46	0.118		
20 days	CPC	15	1.00	0.00	0.00	----	----
	Propolis	15	1.00	0.00	0.00		
30 days	CPC	15	1.00	0.00	0.00	----	----
	Propolis	15	1.00	0.00	0.00		

= non significant difference (p>0.05)

Table 24 – WHI - Inter group comparison showing change in values from day 10 values to various time intervals

Time Intervals	**Groups**	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**	**T value**	**p value of t test**
10-20 days	CPC	15	0.33	0.49	0.13	0.386	0.702#
	Propolis	15	0.27	0.46	0.12		
10-30 days	CPC	15	0.33	0.49	0.13	0.386	0.702#
	Propolis	15	0.27	0.46	0.12		

= non significant difference (p>0.05)

V. Discussion

This study was conducted to compare the efficacy of CPC mouthrinse versus Propolis mouthrinse, following conventional flap surgery.

Plaque inhibitory and anti inflammatory action of **CPC** noted in the present study, is in accordance with its efficacy in various studies of **gingivitis** reported by **Van Leeuwen MPC, Van der Weijden GA. (2015); Rahman B, Alkawas S, Adel O, Hawas N. (2014); Costa X, Herrera D, Serrano J, Sanz M. (2010)** over various time intervals**; Haps S, Slot DE, Van der Weijden GA. (2008)** in a **systematic review.**

Plaque inhibitory and anti inflammatory results of **Propolis** noted in the present study are in accordance with the various studies on **gingivitis** by **Sharkawy H, Anees M, Dyke T. (2018), Niedzielska I et al. (2016); Pereira E et al. (2011).**[43]

The comparable results obtained in the present study between both the groups are in accordance with the study performed by **Bretz W, Paulino N, Nor J, Moreira A. (2014)** in which similar results were obtained on the usage of **CPC versus Propolis** mouthwashes as an adjunct to scaling in subjects with **gingivitis** for a period of 21 days**.**

. Whereas, the results of the present study are similar to **Gkatzonis AM, Vassilopoulos SI, Karoussis IK, Kaminari A, Madianos PN, Vrotsos IA. (2018)** who reported an improved healing between 7thand 14thpostsurgical day. The present results are in accordance with a study by **Lamba M, Sinha A. Jithendra KD. (2016)** which indicated that when coe pak is mixed with propolis, reduced VAS scores are obtained than with coe pack alone.

The results of the present study are in accordance with **Cheshire PD, Griffiths GS, Griffiths BM, Newman HN. (1996)**[75]in which highest pain was present between day 0 and 2 post periodontal flap surgery and reduced in the following days. Also, according to a study by **Laugisch O. (2016)**[80]in which the patients felt discomfort during the first postoperative week following periodontal flap surgery.

Cetylpyridinium chloride (CPC) has a broad antimicrobial spectrum, with rapid killing of gram positive pathogens and yeast in particular[14]by disrupting the permeability of the cytoplasmic membrane.[15]

Propolis contains several chemical compounds, including various phenolic compounds like flavonoids (galangin, quercetin), cinnamic acid and its derivatives (chlorogenic acid, ferrulic acid, caffeic acid phenethyl ester), various steroids, amino acids and volatile aldehydes and ketones.[77]

Flavonoids and cinnamic acid derivatives have been considered as the main biologically active components in propolis.[16]The **anti inflammatory** property of propolis is due to the presence of **caffeic acid phenethyl ester (CAPE)**.

Analgesic property of propolis has been demonstrated by **Agrawal N, Gupta N, Tewari R, Garg A and Singh R in 2014.** But in the present study, propolis did not show any beneficial effect over CPC mouthrinse in reducing pain in the post operative week.

The results of the present study are **contradictory** to that reported by **Wander, 1995, which** reported that the substance **caffeic acid in propolis** causes allergies. There were no allergic reactions reported in the present study. Therefore, caution should be taken by people who are allergic to pollen. Apart from that, it may also irritate the skin area where it is applied on, cause eczema, lesions, psoriasis or mouth sores.

The results of the present study are in accordance with **Cheshire PD, Griffiths GS, Griffiths BM, Newman HN. (1996)**[75]in which highest pain was present between day 0 and 2 post periodontal flap surgery and reduced in the following days. Also, according to a study by **Laugisch O. (2016)**[80]in which the patients felt discomfort during the first postoperative week following periodontal flap surgery.

The possible **limitations** of the present study are that, there is an individual variation and person-specific plaque development and viscosity of saliva.An ideal study should include a cross-over design in the same individual with adequate washout period. This would present significant actual difficulties in the enrollment process and the accomplishment of the study. [2]The sample size of the study is less and further studies with bigger sample size need to be carried out to reach to a definitive conclusion.

VI. Conclusion

CPC mouthrinse and **propolis mouthrinse** showed similar efficacy in the control of plaque formation and reduction of gingival inflammation, post periodontal flap surgery. Patient's experience of pain and the healing of surgical wound, was also similar for the patients, in both the groups. None of the mouthrinse was superior over the other. Therefore, to conclude, it may be reported that **CPC mouthrinse as well as Propolis mouthrinse** are effective and safe for use, post periodontal flap surgery, without superiority of one over the other.