

**Systematic review and Meta analysis on chlorhexidine Gluconate and essential oil mouth wash**

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**Citation of this Article:** Dr. Sunayana Manipal, Dr. Sajid T Hussain, Dr. Lubna Fathima, Dr. Venkat, Dr. Deborah Gonmei, Dr. khundrakpam Eremba, “Systematic review and Meta analysis on chlorhexidine Gluconate and essential oil mouth wash”, IJDSIR- May - 2022, Vol. – 5, Issue - 3, P. No. 134 – 141.

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**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

**Abstract**

**Background:** The purpose of this review is to systematically evaluate the effects of an essential-oil mouthwash compared to a chlorhexidine mouthwash with respect to plaque and parameters of gingival inflammation.

**Methods:** PubMed/MEDLINE databases were searched for studies. A meta-analysis was performed, and weighted mean differences were calculated.

**Results:** A total of 17 unique articles were found, of which 11 articles met the eligibility criteria. Essential oil mouthwash provided significantly better effects regarding prophylactic plaque control than chlorhexidine

**Conclusion:** In long-term use, the standardized formulation of essential oil mouth wash is reliable than chlorhexidine mouthwash.

**Keywords:** Chlorhexidine, essential oils, meta-analysis, plaque

## **Introduction**

Man in the recent times has achieved a giant leap in the field of dentistry. With the increase in the knowledge and attitude of the newer technological enhanced patients, the concept of treatment is now increasingly been replaced by prevention<sup>1</sup>. The paradigm is now been shifted from disability limitation to treatment of diseases. Gingivitis is not an exemption here. This reversible form of the disease has seen in the last two decades shows a paradigm shift from treatment to prevention. With improvement at genetic and molecular levels, understanding the disease cause and disease progression has now become easier. With knowledge empowerment in this sector, a lot has been achieved in the treatment and prevention sector. It has been always the mindset of a dental patient that prevention is always better than cure as it is rightly said an ounce of prevention is better than a pound of cure. In the field of dentistry especially with regards to dentistry rings the bell of chlorhexidine in the mind of the dentist. Gingivitis and various forms of periodontal disease have always been attributed to the complex formation of plaque adherence, accumulation, initiation and progression of disease on the bio film. Enriched information is now increasingly been available on the complex mechanism involved in bio film and plaque formation<sup>1</sup>. Listerine the first ever formed essential oil antiseptic was given to the world by Joseph Lawrence Lister in the year 1879<sup>1</sup>. Though this has been introduced almost a millennium to chlorhexidine the usage of essential oil mouth washes was has been limited for the treatment of halitosis in the dental field. With the antiseptic chlorhexidine discovery in the 1940's when it was first introduced to the world by Imperial Chemical Industries in England<sup>1</sup>. 1950's saw chlorhexidine as a popular general antiseptic in

comparison with essential oil mouth wash<sup>2</sup>. The ability to inhibit oral plaque by chlorhexidine was first observed by Schroeder in 1969<sup>3</sup> and it was evidenced in a more scientific manner by Loe and Schiott 1972<sup>4</sup>. From time immemorial plaque build-up was challenged indispensable by chlorhexidine gluconate with practically no replacement or alternate strategies available for it. Since then, a war is waged as to which is mightier – chlorhexidine or essential oil mouth wash!

Chlorhexidine (CHX) is a broad-spectrum antimicrobial agent that destroys the cell membrane by precipitation and coagulation of the cytoplasmic proteins of the microbial flora. Chlorhexidine mouth rinses are available in the form of 0.2% and 0.12% and it has been show that their efficacy is similar at similar doses<sup>5</sup>. Essential oil mouth wash also inhibits plaque formation by destroying the cell membrane in addition to interference with the inflammatory process. The prophylactic usage of gold standard chlorhexidine and essential oil mouth wash remains a debatable topic. With the usage of antibiotics, chlorhexidine has been scrutinized in the recent times due to complication of resistance and increased staining properties, the usage of chlorhexidine is now warranted. Reports by both the American and British professional societies have now given an insight so as to the usage of prophylactic usage of mouth rinses. Chlorhexidine is still considered as the gold standard for its antimicrobial action but due to increased plaque formation, staining capacity and resistance may now limit its continued use<sup>1</sup>. These Arguments bring us to light about the fact that - chlorhexidine can still be considered as a gold standard for prophylactic prevention or the time has come for its reconsideration.

**Materials and methods**

For this Meta analysis, studies that were randomized clinical trials (RCTs) or controlled trials in healthy human subjects comparing the effects of chlorhexidine gluconate and essential oil mouth washes on plaque levels for atleast 3 months were included. There was no restriction on the amount or percentage of the mouthwashes. The plaque levels in all the included study were taken with one of the following indices: Plaque Index by Silness & Loe (1964)<sup>6</sup>, Plaque-Index by Quigley & Hein (1970)<sup>7</sup> and its modification by Ture sky S, Gilmore N D & Glickman (1970)<sup>8</sup>.

The search was done from the pub med central listed studies from 2003 to 2017 with the use key words with Boolean operators during the month of May 2017 (chlorhexidine, essential oil, mouth wash, randomized control trials). 17 unique articles were obtained from electronic database search (pub med central). Only 11 studies were pooled in for the Meta analysis (table 1).

Table 1: Various studies included for analysis

Sn.	Author name	Chlorhexidine extracts			Herbal extracts			Weight	Mean Difference IV Fixed 95%CI
		Mean	SD	Total No of study subjects	Mean	SD	Total No of study subjects		
1	Anirban Chatterjee et al (2011) <sup>12</sup>	0.9	0.66	15	1.1	0.48	15	0.30%	-0.20 (-0.61, 0.21)
2	Bathini Chandra has et al (2012) <sup>13</sup>	2.1	0.3	40	2.3	0.3	40	2.90%	-0.20 (-0.33, -0.07)
3	Betul Rahman et al (2014) <sup>14</sup>	2.33	0.66	20	2.74	0.78	20	0.20%	-0.41 (-0.86, 0.04)
4	Devanand Gupta et al (2014) <sup>15</sup>	2.1	0.57	36	2.49	0.46	36	0.90%	-0.39 (-0.63, -0.15)
5	Harjit Kaur et al	2.9	0.34	30	2.86	0.34	30	1.70%	0.04 (-0.13, 0.21)

The other studies were not included as they were either in vitro experiment, experiments done on laboratory animals, and a few studies had used microbial techniques with gingival parameters. The fixed effects model was used for analysis when compared to the random effects model as the data was more heterogeneous. Chi square was used to compute heterogeneity based on the standard deviation and confidence levels of all the selected studies.

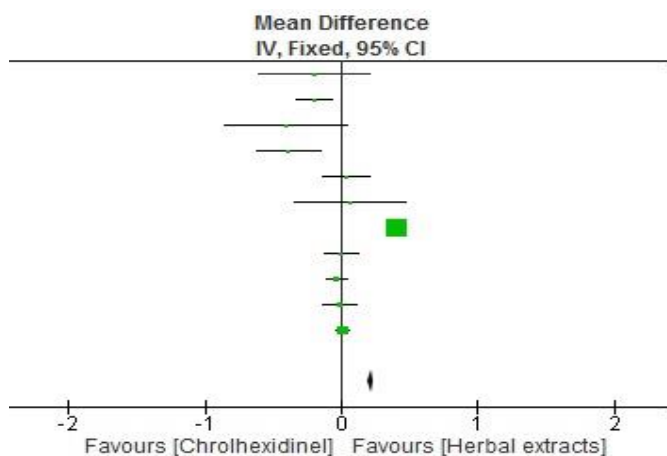
**Results**

The meta-analysis done by the random effect models showed that out of eleven studies (table 1) that were analyzed, eight studies favour the use of essential oil mouth wash <sup>9,11,14-19</sup> in-comparison with only one study <sup>13</sup> that favour the effect of chlorhexidine extract. Table 1 shows the various studies taken into account for our analysis in which the mean, standard deviation and mean difference was calculated.

	(2014) <sup>16</sup>								
6	Manasa Hosamane et al (2014) <sup>17</sup>	1.69	0.6	10	1.63	0.27	10	0.30%	0.06 (-0.35, 0.47)
7	Mayur Sudhakar at all (2013) <sup>18</sup>	1.65	0.13	120	1.25	0.1	120	57.40%	0.40 (0.37, 0.43)
8	Prashant R Shetty et al (2003) <sup>19</sup>	2.09	0.15	10	2.09	0.14	10	3.10%	0.00 (-0.13,0.13)
9	Gupta RK et al (2014) <sup>20</sup>	3.1	0.25	100	3.14	0.29	100	8.80%	-0.04 (-0.12, 0.04)
10	Ratika Sharma et al (2014) <sup>21</sup>	1.29	0.26	32	1.3	0.25	33	3.20%	-0.01 (-0.13, 0.11)
11	Shivika Mehta et al (2013) <sup>22</sup>	1.06	0.1	20	1.05	0.06	35	21.30%	0.01(-0.04, 0.06)
	Total			433			449	100%	0.22[ 0.20,0.24]
Heterogeneity: Chi <sup>2</sup> = 369.01, df=10 (p<0.00001); I <sup>2</sup> =97%									
Test for overall effect Z = 19.22 (p<0.00001)									

Only two studies <sup>10,12</sup> remain neutral agreeing to the null hypothesis that there is no difference in the effect of both the mouth washes (fig 1).

Figure 1



**Discussion**

The prevention treatment of bio film on the surface of the tooth has been herculean task for dentist. The removal of the biofilm can be achieved both at the patient and at the professional level. At the patient level this process of removal is furthermore complicated by

the complex dexterity required during mechanical tooth cleaning process<sup>20</sup>. The efficiency of cleaning is both time and technique bound. Hence in order to ease this process, mouth washes are frequently prescribed prophylactically by the dentist. Chlorhexidine has enjoyed being the dentist favourite prescription for a greater period of time. The effectiveness of chlorhexidine has been well documented. The mechanism of action of chlorhexidine has been thoroughly researched with substantivity remaining undoubtedly the indisputable mechanism of action. Substantivity is defined as the ability of a substance to bind to tissue surfaces and be released over time, thus providing sustained anti-bacterial activity<sup>21</sup>.With the increase in the usage antibiotic resistance is now emerging phenomena that has gained popularity and attention. Antibiotic resistance is a serious concern that is now challenging the prophylactic usage in practically all fields. Studies done by S. M. Clark et al<sup>22</sup> and Carolyne Horner et al<sup>23</sup> has reported significant

antibiotic resistance. It has also come to light that increased staining of teeth associated with long term chlorhexidine use is now a frequent patient aftermath complaint. Furthermore, the usage is now been scrutinized with sufficient studies supporting the fact that prolonged chlorhexidine usage is directly proportional with levels of calculus formation. Studies done by Over holder et al,<sup>24</sup> Grossman et al,<sup>25</sup> Charles CH et al<sup>10</sup> have shown levels of calculus deposition and extrinsic tooth stain were significantly higher in the chlorhexidine group than in the essential oil mouth rinse group. Moreover, the interaction of chlorhexidine with sodium lauryl sulfate an active ingredient in dentifrice is also now documented. Studies done by Barkvoll et al<sup>26</sup> suggest that the activity of chlorhexidine is compromised with the long-standing sodium lauryl sulfate containing dentifrice usage. Listerine though being the primary formed antiseptic was not used so frequently as in comparison with chlorhexidine. The effectiveness of Listerine was always comparatively lesser when compared to chlorhexidine is the yesteryears. This could be attributing to the fact that the trials were not done on a longitudinal basis<sup>10,27,28,29,30</sup>. Trials done in the year 1995 by Triratana T et al<sup>27</sup> seems to be the fairly accepted trial for essential oils and formed the basis for in vivo studies. Newer studies done by Charles CH<sup>10</sup> have now warranted the prolonged prophylactic usage of chlorhexidine. The present Meta analysis has included clinical trials that have been done for greater than three months.

The prevalence of gingivitis in the young adult population is on the rise with the global periodontitis prevalence as noticed by the WHO is 10 to 15% in an adult population.<sup>31</sup> The developed and developing nations have their citizens remove plaque one third times more effectively than the underdeveloped nations<sup>32</sup>. In

India the prevalence of gingivitis affecting about 87.3% of the population<sup>33</sup> and 57%, 67.7%, 89.6% and 79.9% in the age groups 12, 15, 35-44 and 65-74 years of the population respectively suffers from periodontal disease<sup>34</sup>. With chemotherapeutic methods accepted as a measure to remove plaque, the trend of increased usage of over-the-counter mouth washes are now widely used<sup>35, 36, 37, 38</sup>. Inadequate control of bacterial plaque is considered one of the primary causative factors in periodontal disease progression<sup>30,39</sup>. The gaining popularity of prophylactic mouth washes are commonly noticed among geriatrics, differently abled and handicapped populations<sup>40</sup>. Though the usage has been prescribed it should be noted that long-term compliance is yet to be firmly established<sup>41</sup>. It was reported by White D<sup>42</sup> that 50% of the population use mouth washes and most of it that are used are not therapeutic preparations. The certification or endorsement of their continued usage will be further complicated by the fact the most of the individuals will fail to follow or adhere the instructions as furnished by the manufacturer<sup>42</sup>.

### **Recommendations**

The debatable issues regarding the usage of chlorhexidine and essential oil mouth washes can now be suggested based on the inference drawn from the present study that:

1. Prophylactic use of chlorhexidine should now be prescribed with caution. Their usage should be encouraged only for therapeutic purpose.
2. Further essential oil mouth washes can be used for a prolonged interval for prophylactic regime.
3. Essential oil mouth washes can be used to cater the needs of the population that require extra care and dexterity that included handicapped, differently abled and geriatric population.

4. Longitudinal studies are now required to endorse the fact that chlorhexidine causes increased calculus formation and antibiotic resistance with special regard to oral cavity.

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