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Review Article

## Application of Herbal Antioxidants in Dentistry: A Mini Review

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### Abstract

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Periodontitis is one of the common public health problems in the world and is most common reason of tooth loss in peoples. Periodontitis is highly prevalent and can affect up to 90% of the world population. Periodontitis is a gum infection that damages the soft tissues and bones present around tooth for support. Herbs and their extracts have long been used as a therapy for various diseases in the world due to their safety & low cost. Currently herbal medicines are preferred due to their low cost, high safety margin and wider range of medicinal activities. Presence of excess free radicals results in oxidative damage of periodontal tissue. Herbal antioxidant reduces the deleterious action of free radicals and improves the oral health and decrease of inflammatory levels of periodontium. Thus, in this review we described the role of some herbal antioxidants as adjuvants for the management and treatment of Periodontitis.

**Keywords:** Periodontitis, herbal antioxidants, free radicals, periodontium

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## Introduction

Currently herbal medicines are preferred due to their low cost, high safety margin and wider range of medicinal activities. Periodontitis is one of the common public health problems in the world and is most common reason of tooth loss in peoples. Periodontitis is highly prevalent and can affect up to 90% of the world population. Periodontitis is a gum infection that damages the soft tissues and bones present around tooth for support. The etiology is multifactorial with periodontopathogens forming a major crux in the initiation and progression of the disease. Plaque build-up allows the growth of anaerobic bacteria<sup>1</sup> which eventually leads to the recruitment and activation of neutrophils. This further results in the upregulation of pro-inflammatory cytokines and also leads to the release of neutrophilic enzymes and ROS. Prolonged exposure of the connective tissue to these insults results in the degradation and subsequent loss of ligamentous support and alveolar bone, eventually leading to tooth loss.<sup>2</sup>

Presence of excess free radicals results in oxidative damage of periodontal tissue<sup>3</sup>. Herbal antioxidant reduces the deleterious action of free radicals and improves the oral health and decrease of inflammatory

levels of periodontium<sup>4</sup>. Numerous studies have shown that the total antioxidant capacity in periodontitis patients is significantly lower when compared to healthy controls.<sup>4, 5</sup> Thus, in this review we described the role of oxidative stress in periodontitis & role of herbal antioxidants as adjuvants for the management and treatment of Periodontitis.

## Oxidative Stress and Periodontitis

It is well-established that oxidative stress is an important cause of cell damage associated with the initiation and progression of many chronic diseases<sup>6-8</sup>.

The results of the work carried out by Ivan Borges Jr. et al showed an important correlation between oxidative stress biomarkers and periodontal disease<sup>9</sup>.

The exact mechanism of periodontitis development, including the prior agents or mediators involved, is not clear. Periodontitis manifests itself as a multifactor phenomenon, including the generation of reactive oxygen species (ROS)<sup>9, 10</sup>.

When periodontitis occurs, Reactive Oxygen Species (ROS), which are overproduced mostly by hyperactive neutrophils, could not be balanced by antioxidant defence system and cause tissues damage. This is characterized by increased metabolites of lipid

peroxidation, DNA damage and protein damage. Local and systemic activities of antioxidants can also be influenced by periodontitis <sup>11</sup>.

The strong evidence linking reactive oxygen species to the pathological damages the soft tissues during periodontal disease rests on the presence of neutrophils infiltration as the main event in the host's response to bacterial invasion <sup>9,12,13,14</sup>. Furthermore, hydroxyl radical ( $\bullet\text{OH}$ ) is most active in damaging important molecules such as DNA proteins and lipids, while hydrogen peroxide ( $\text{H}_2\text{O}_2$ ), even not being considered a potent ROS, is capable of crossing the nuclear membrane and also damaging the DNA <sup>15</sup>. Quantitatively, the main source of superoxide anion ( $\text{O}_2^{\bullet-}$ ) and other ROS responsible for initiation reactions is the respiratory chain. However, its presence in the periodontal soft tissue results first and foremost from the activation of phagocytes (neutrophils and macrophages), such as antibacterial agents <sup>12, 13, 16</sup>.

## Herbs Used in Periodontitis

### *Rubia cordifolia* (Indian Madder)

*R. cordifolia* contain Mollugin which has shown anti-inflammatory action <sup>23</sup> Results from study of Baek et al showed that mollugin inhibited RANKL-induced osteoclast differentiation and bone resorbing activity of mature osteoclasts. Mollugin reduced the phosphorylation of signaling pathways activated in the early stages of osteoclast differentiation, including the MAPK, Apt, and GSK3 $\beta$  and inhibited the different genes associated with osteoclastogenesis such as Osteoclast-associated receptor, tartrate resistant acid phosphatase, ICAM-1, cathepsin K, DC-STAMP and OC-STAMP. Furthermore mice treated with mollugin showed significant restoration of lipopolysaccharideinduced bone loss as indicated by micro-computed tomography and histological analysis of femurs. <sup>17, 24</sup>

Results from study of Mali et al concluded that Arimedadi oil is equally effective to Chlorhexidine gluconate as an adjunct to mechanical plaque control in prevention of plaque accumulation and gingivitis. Arimedadi oil could be an effective and safe alternative to 2% Chlorhexidine gluconate mouthwash due to its prophylactic and therapeutic benefits.<sup>25</sup>

### *Psidium guajava* (Guava)

Guava is a potential antioxidant owing to it is rich source of Ascorbic acid. Guava also has quercetin, polyphenols and carotenoids, which increase its

antioxidant action and reduces the deleterious action of free radicals and improves the oral health and decrease of inflammatory levels of periodontium. <sup>17, 18, 19</sup> Guava leaf extracts and essential oil from the stem have the ability to scavenge hydrogen peroxide, superoxide anion and inhibit the formation of hydroxyl radical <sup>20, 21</sup>. The seed of guava contains glycosides, carotenoids, phenolic compounds having antimicrobial actions.<sup>22</sup>

### *Azadirachta indica* (Neem)

*Azadirachta indica*, commonly referred to as the Neem plant. Brushing with *Neem stick* after every meal and chewing a *Neem* leaves is recommended treatment for preventing gingivitis.

It has shown several pharmacological action such as and anti-oxidant, antifungal antipyretic, antibacterial, anti-inflammatory, antiviral, anticariogenic, antihelminthic, analgesic and anti-carcinogenic. Several studies have shown that neem is used in the treatment of dental caries, gingivitis and periodontitis.<sup>26, 27</sup>

Regular brushing with *Neem*-containing toothpaste will reduce the deposition of plaque, prevents caries, and enhances the immune response for overall oral health. Frequent usage of mouthwash containing *Neem* extract will lessen gingival problems, and also treats halitosis. <sup>27</sup>

Vennila et al used 10% neem oil as a local drug delivery system to evaluate the efficacy in the periodontal disease management. This study reported that clinical parameters showed statistically improved on the neem chip sites and presence of *P. gingivalis* strains were significantly reduced on the neem chip sites. Hence, 10% neem oil local delivery system delivers desired effects on *P. gingivalis*. <sup>26</sup>

Botelho *et al.*, in their experiments and trials concluded that *Azadirachta indica* is highly efficacious in the treatment of periodontal disease thus exhibiting its biocompatibility with human periodontal fibroblast.<sup>27</sup>

### Triphala

Triphala is an excellent herbal antioxidant that consists of powder of three fruits *Embolica officinalis*, *Terminalia chebula* and *Terminalia bellirica*. Ascorbic acid & Polyphenolic contents in Triphala are responsible for the antioxidant and radioprotective ability and reduce the oxidative stress by converting reactive oxygen free radicals to non-reactive products.<sup>28</sup> *T. chebula* extract also has Anticaries activity because it inhibits the growth and accumulation of *S. mutans* on the tooth surface.

Table 1: Botanical and chemical description of Triphala

	Fruit 1	Fruit 2	Fruit 3
<b>Common Name</b>	Amla, Amalaki	Black myrobalan, haritaki, harada	Belliric myrobalan, bibhitaki, bahera
<b>Botanical Name</b>	<i>Embolica officinalis</i>	<i>Terminalia chebula</i>	<i>Terminalia bellirica</i>
<b>Family</b>	Phyllanthaceae	Combretaceae	Combretaceae
<b>Chemical constituents</b>	Ascorbic acid, Gallic Acid, and Flavones	Ascorbic acid, Gallic Acid and tannic acid	Ascorbic acid, Gallic Acid, tannic acid, Syringic acid and epicatechin

Study by Bajaj and Tandon shown a significant progressive decrease in plaque scores from baseline till the end of 9 months in both triphala and chlorhexidine groups, whereas increase in plaque scores in negative control group.<sup>29</sup> Results from study by Desai *et al.* shown a significant reduction in periodontal indices in chlorhexidine and triphala groups who received scaling and root planing along with mouthwashes compared to a control group that received only scaling and root planing.<sup>30</sup> Pratibha Mangain *et al* carried out the comparative study of Triphala and chlorhexidine in treatment of gingivitis. Results from this study shows that Triphala and Ela decoction has similar efficacy as that of chlorhexidine in reducing dental biofilm build-up, gingivitis, and halitosis. It is easy to prepare, organic, and relatively economical compared with chlorhexidine. Hence it can be used for effective plaque control, gingivitis control, and halitosis<sup>31</sup>

## Conclusion

Presence of excess free radicals results in oxidative damage of periodontal tissue<sup>3</sup>. Herbal antioxidants are preferred because they reduce the deleterious action of free radicals and improve the oral health and decrease of inflammatory levels of periodontium<sup>4</sup>. It is well-established that oxidative stress is an important cause of cell damage associated with the initiation and progression of many chronic diseases.<sup>6, 7, 8</sup> Many scientific papers reported different application of herbal antioxidants in dentistry. In the future; it would be of great interest to conduct clinical trials that would confirm the beneficial effect. Many herbal drugs found suitable for the treatment of periodontal disease but further pharmacological studies are needed to find out and understand the possible toxic effects of Herbal drugs in order to improve their biocompatibility. Hence we can find out safe and effective herbs for the treatment of periodontal disease<sup>35</sup>.

## Conflicts of Interest:

The authors declare that there are no conflicts of interest in this paper.

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