

Herbal Extract and White Spot Lesion: A Review

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Abstract One of the most important complications of orthodontic treatment with fixed appliances is the development of white spot lesions (WSL) which represent the first clinical observation of dental caries. Fluoride is an efficient prophylaxis for WSL; however, its excessive use may lead to fluorosis. In addition, other chemicals (e.g., chlorhexidine) that have bactericidal effects may negatively affect the oral microflora. In the last decade, interest has shifted to using natural products that have beneficial effects on health. Using dental products (toothpaste, mouthwash, or oral gel) containing herbal extracts, has been shown to inhibit pathogenesis of cariogenic bacteria and consequently reduces enamel demineralization. Future longitudinal and in vivo studies are needed to explore the advantages and disadvantages of dental products containing herbs.



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1. INTRODUCTION

Dental caries is still one of the most common diseases in humans. *Streptococcus mutans* is considered the main cariogenic pathogen and plays a crucial role in the development of dental caries. White spot lesions (WSL) represent the first clinical observation of dental caries (demineralization in enamel) that can be seen by the naked eye. One of the most important complications of orthodontic treatment with fixed appliances is the development of WSL. Prolonged plaque accumulation around brackets due to poor oral hygiene will cause WSL [1] (Figure 1).

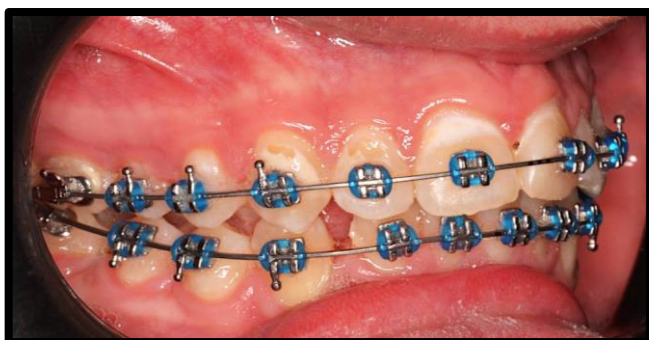


Fig. 1: White spot lesions associated with orthodontic treatment with fixed appliances.

WSL appears as a chalky, opaque, white enamel lesion (due to mineral loss in the surface and subsurface enamel).

Clinically, WSL is rough and porous compared to the non-carious white spots (Figure 2) that are smooth and shiny [2,3].



Fig.2: None-carious white spots.

The buccal surfaces of the maxillary teeth and the gingival region are the most typical locations on which WSLs manifest (Figure 1). When Chapman et al. examined the incidence of WSL in maxillary teeth, they discovered that it was lower on central incisors (17%) and higher on lateral incisors (34%), compared to canines (31%) and premolars (28%). The issues with WSL arise not only during orthodontic treatment with fixed appliances but also afterward, since WSL has detrimental effects on one's appearance, finances, and health [5]. As a result, the orthodontist plays a crucial role in identifying WSL and developing a suitable preventative



strategy [3]. Nevertheless, it might be difficult to prevent WSL while using fixed appliances for orthodontic therapy [6]. There are no specific guidelines for prevention of WSL during orthodontic treatment. Orthodontists usually provide primary preventive dental care during bracket bonding which is based mainly on oral hygiene instructions. In addition, the most accepted method of preventing WSL is the administration of fluoride e.g., mouthwashes containing fluoride [7]. However, extensive use of fluoride is the cause of an increasing incidence of dental fluorosis, especially in preschool children, due to chronic intake of these products. The frequent use of chemicals and synthetic products is unhealthy [8].

In the dental field, herbal extracts are utilized because of the sedative, anti-inflammatory, antimicrobial, and analgesic properties of the plants [9]. Furthermore, in vitro study observed that plant-derived (Herbal extracts) antimicrobials are potential alternatives to chemical compounds used for caries prevention [10-36]. The herbal extracts became popular as they are safe when compared to chemical products [11].

Therefore, the aim of this study is to review the most popular herbal extracts used in dentistry, and primarily their effects on the bacteria that cause WSL (demineralization in enamel). *Salvadora persica* (Miswak)

Salvadora persica is known in the Middle East as a good mechanical teeth cleaner. In addition, *Salvadora persica* showed statistically significant anti-streptococcal and anti-lactobacilli effects [12]. Therefore, *Salvadora persica* has antiplaque [12,13], antibacterial [12,14], and consequently anticariogenic properties. Moreover, the *Salvadora persica* essential oil activates saliva and turns on the buffering mechanism. The *Salvadora persica* contains calcium; thus, after chewing it, the enamel will remineralize [15].

Cinnamon

Cinnamon is one of the many plant-based goods that people utilize regularly. Cinnamon contains cinnamaldehyde and cinnamic acid, which have antibacterial effects against pathogenic gram-positive and gram-negative bacteria [16]. Yaseen et al. found that the adding of 3% Cinnamon Nano particles in orthodontic resin created an antibacterial effect against *Streptococcus mutans* without compromising the shear bond strength [17].

Curcumin

Curcumin (Cur) is an organic and phenolic bioactive substance of the popular Indian spice turmeric (*Curcuma longa*), utilized as a dietary material. Cur has different biological properties; as it has antibacterial, antiviral, and antifungal activity [18]. In addition, Cur acts as a photosensitizer because of its ability to produce reactive oxygen species following the absorption of blue light. Therefore, various studies tested the antimicrobial activity of the Cur by testing the Cur-photodynamic antimicrobial approach activated with proper wavelengths over cariogenic

bacteria [19,20]. Furthermore, observed that the Nano-propolis and curcumin-based photodynamic therapy enhance remineralization of white spot lesions [21].

Grape Seed Extract

Grape seed extract is produced from *Vitis Vinifera* seeds. It is a naturally produced plant metabolite that includes the powerful antioxidant polyphenol; proanthocyanidin. Proanthocyanidin can interact with the organic component of enamel to strengthen and solidify the exposed collagen matrix by enhancing collagen cross-linking [22].

Moreover, Hameed et al, showed that grape Seed extract and Sodium Fluoride are equally effective in remineralizing surface and subsurface artificial enamel lesions [23]. Consequently, grape seed extract is a promising agent for the inhibition and treatment of WSLs [22-24].

Aloe Vera

Aloe vera is a cactus like plant with green leaves that are filled with a clear viscous gel. It is a traditional herbal medicine recorded in different ancient cultures such as Chinese, Egyptian, and Indian. Recently, modern pharmacology studies demonstrated that Aloe vera has a range of therapeutic effects such as anti-microbial, antiviral, anti-cancer, antioxidant and anti-inflammatory [25]. Therefore, Aloe vera has various uses in dental care as it has good antibacterial properties. Studies observed that mouthwash and toothpaste containing Aloe vera resulted in a significant reduction of gingival bleeding and plaque [26,27]. According to research by Lee et al. [28], aloe vera prevents the growth of a variety of oral bacteria, including *Candida albicans*, *Actinomyces viscosus*, *Streptococcus mutans*, and *Streptococcus sanguis*. In a recent study, the impact of fluoride mouthwash and mouthwash containing probiotics and aloe vera on *Streptococcus mutans* in orthodontic patients' plaque was evaluated. According to this investigation, there was no discernible difference in the three mouthwashes' ability to lower the amount of *Streptococcus mutans* in plaque [29].

Ginger

Ginger, or *Zingiber officinale*, is one of the herbs most frequently utilized in traditional Indian medicine. According to studies, *zingiber officinale* significantly reduced *Streptococcus mutans*'s capacity for certain virulence traits. As a result, dental products containing *Zingiber officinale* can help prevent tooth caries [30, 31].

Green Tea

Green tea is an infusion of dried leaves of *Camellia sinensis*, which contains, among other substances, alkaloids, amino acids, carbohydrates, proteins, chlorophyll, fluorine, aluminum, and minerals. It has been shown that green tea extract strongly inhibited *Streptococcus mutans* in the oral cavity [32]. Furthermore, studies indicate that using dental products containing green tea extract reduces plaque formation on the teeth [32-34]. Therefore, it is safe to use mouthwash containing green tea extract to reduce cariogenic bacteria, especially for children and pregnant women [33,34].

Cocoa Beans

Theobromine, a white crystalline powder, is an alkaloid easily available in cocoa beans. Theobromine can be used as a remineralizing agent for enamel, as the microhardness of the enamel is improved after application of theobromine gel[35]. Amaechi et al, explore the caries prevention effect of theobromine by testing its ability to cause remineralization of enamel lesions and improve enamel lesion resistance to further acid attack. In that study, the cariostatic effectiveness of cocoa could be explained by the large crystal formation in the tooth and increased microhardness on the enamel surface in the presence of theobromine [36].

Limitations

Almost all studies done on dental products, containing herbal extracts, have been carried out in the Eastern world. This may be due to the wide availability and use of herbs in this part of the world. However, many of these studies are in vitro studies and mostly published in low impact journals. In addition, there are no studies to date that have studied the possible side effects of dental products containing herbs. Consequently, future longitudinal and in vivo studies are needed to explore

the advantages and disadvantages of dental products containing herbs.

2. CONCLUSION

Using dental products (toothpaste, mouthwash, or oral gel) containing herbal extracts such as *Salvadora persica*, Cinnamon, Curcumin, Grape Seed Extract, Aloe vera, Ginger, Green tea, and Cocoa beans, has been shown to inhibit pathogenesis of cariogenic bacteria and consequently reduces enamel demineralization (WSL).

Conflict of interest

Non.

3. AUTHOR CONTRIBUTIONS

DHO; Original draft manuscript preparation, Data collection, Writing- review. RJH; Reviewing & editing. AFA; Reviewing. AAF; Supervision. MA; Writing - review & editing. Supervision. All authors reviewed the manuscript and approved the final version that to be published.

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