

# Effect of Ardox-X Active Oxygen-Containing Toothpaste on Periodontal Parameters in Dentate and Implant-Wearing Patients

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## ABSTRACT

**Background and Aim:** Reducing the number of pathogenic microorganisms can contribute to reducing the incidence and epidemiology of periodontal diseases. This study aimed to evaluate the clinical effects of Ardox-X active oxygen-containing toothpaste on periodontal indices in patients with at least 1 to 2 implants.

**Materials and Methods:** In this crossover randomized clinical trial, 30 subjects were randomly divided into two groups (n=15). Oral hygiene instructions were delivered to all subjects before the study. Scaling and root planing (SRP) were performed for all subjects. The subjects were instructed to brush with Oral-B toothpaste and toothbrush twice daily for at least two minutes. All subjects returned 10 days later, and the plaque index (PI) and gingival bleeding index (GBI) were measured. The first group received Ardox-X, and the second group received Oral-B toothpaste. Both groups presented after 7 days, and GBI and PI were measured. SRP was performed again, and the plaque was zeroed. Both groups spent the wash-out period for 10 days. Next, the indices were measured again. The Ardox-X group received Oral-B toothpaste and vice versa. After 7 days, both groups returned, and the indices were measured again. T-test was used for statistical analysis.

**Results:** No significant difference was observed in the PI changes between the control (0.88±0.22%) and case (0.83±0.22%) groups (P<0.6). The changes in the GBI were significantly different between the control (3.9±3.4%) and case (1.5±2%) groups (P<0.01).

**Conclusion:** The results of this study showed that Ardox-X toothpaste performs better than the control group (Oral-B) in terms of the GBI.

**Keywords:** Active Oxygen, Toothpastes, Dental Implants, Periodontal Indices, Gingival Bleeding on Probing, Dental Plaque Index

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## Introduction:

Sub-and supragingival bacterial plaques cause an inflammatory reaction in the tissues around the tooth and dental implant, leading to loss of soft tissue and alveolar bone attachment. (1-2) A group of microorganisms associated with increased pocket depth in periodontitis and peri-implantitis, called the Red Complex, is one of the

five groups of subgingival microorganisms that include Tannerella forsythia, Treponema denticola, and Porphyromonas gingivalis.<sup>(3-4)</sup>

Clinical and microbiological results have shown that Prevotella intermedia and Fusobacterium may be involved as etiologic factors in periodontitis and peri-implantitis.

Decreasing the rate of pathogenic microorganisms may contribute to the reduction of the prevalence and epidemiology of periodontal diseases.<sup>(4-6)</sup>

The impacts of oral health on the long-term success of dental implant therapy are crucial and challenging. Different methods have been proposed to reduce or remove microbial plaque. The mechanical method, toothbrush, is the most common, although its effectiveness may be limited. Therefore, chemical methods against microbial biofilms, such as mouthwashes or toothpastes, have received much attention.<sup>(7-9)</sup>

The influence of antiplaque chemicals on gingivitis control has been previously investigated. Some of these chemicals have been effective in reducing the prevalence of microbial plaque and gingival bleeding.<sup>(10,11)</sup> Oxygenating agents, such as hydrogen peroxide, sodium perborate, and peroxy carbonate, have been recommended for short-term disinfection. Recently, the Ardox-X mouthwash containing oxygenating agents (peroxoborate) has been introduced to the market, which has been known to selectively inhibit oral bacteria.<sup>(12-14)</sup>

Previous studies have shown that toothpastes containing therapeutic agents, such as propolis, thiocyanate, and carbamide peroxide, can be effective in improving periodontal parameters such as reducing gingival bleeding.<sup>(15-17)</sup> Another substance that can be used as a prophylactic and therapeutic agent for implant hygiene is active oxygen with Ardox-X technology. Ardox-X, as an auxiliary active substance in mouthwashes, has been effective in the treatment and prevention of periodontitis and peri-implantitis.<sup>(11-13)</sup> However, there has been no clinical study of the effect of this substance as an adjunctive substance in toothpastes.

In this study, we investigated the clinical effects of Ardox-X active oxygen-containing toothpaste on periodontal indices in patients with at least 1 to 2 implants.

## Materials and Methods

This crossover randomized clinical trial has been approved by the Ethics Committee of Islam-

ic Azad University of Medical Sciences, Tehran, Iran. Each group of toothpaste was covered by unnamed "A" and "B" labels by an uninformed individual. Thus, the samples remained blind to the clinician.

The inclusion criteria were the absence of systemic disease, pregnancy, and autoimmune disease. Patients who attend regular follow-ups, patients who have not had dental surgery recently, and patients aged 22 to 65 years with at least one implant were entered into the study.

Thirty subjects were randomly divided into two groups of 15 each. Both groups were given oral hygiene instructions before entering the study, and scaling and root planing (SRP) were performed for all subjects.

All subjects were trained to brush their teeth twice daily for at least two minutes with the recommended Oral-B toothpaste and toothbrush (Procter & Gamble, Cincinnati, OH, USA) and to refrain from other oral hygiene methods until further examination. All subjects returned 10 days later, and the plaque index (PI) and gingival bleeding index (GBI) were measured according to previous studies.<sup>(18)</sup> The first group received Ardox-X toothpaste (Dyna Dental Engineering B.V., The Netherlands), and the second group received Oral-B toothpaste. Both groups presented after 7 days, and the PI and GBI were measured again. SRP was again performed, and the plaque was restored to zero. Both groups brushed with their former toothpaste and toothbrush for 10 days (the washout period) and then referred. The Ardox-X group received Oral-B toothpaste and vice versa. After 7 days, both groups returned, and the indices were measured again. The results were analyzed using t-test.

Measurement of the indices:

PI: The dental plaque of the patients was measured using the Turesky PI. First, a disclosing tablet (Svenska Dentorama AB, Stockholm, Sweden) was used. After washing the mouth once, the presence and the amount of plaque at the buccal and lingual surfaces of all teeth were measured according to the criteria proposed by Turesky et al.<sup>(18)</sup>

Each person's plaque score was obtained by summing all the scores and dividing it by the number of surfaces studied, as follows:

0: No plaque,

1: Discontinues plaque less than 1 mm at the cervical margin of the teeth,

2: A thin continuous plaque strip (up to 1 mm) at the cervical margin of the teeth,

3: A plaque strip wider than 1 mm but less than 1/3 of the crown,

4: Plaque coverage of at least 1/3 but less than 2/3 of the crown,

5: plaque covering 2/3 or more of the tooth crown.<sup>(18)</sup>

GBI: The Ainamo and Bay GBI is simply obtained by the observation of bleeding after probing the cervical gingivae, as follows:

A periodontal probe is gently moved through the cervical gingivae and if bleeding occurs after 10-15 seconds, it is indicated by a + sign. The total number of positive signs is divided by the number of teeth tested, and the GBI is obtained and multiplied by 100 to obtain the percentage of the index.<sup>(18)</sup>

### Result:

The study was carried out on 30 subjects and, according to the type of the study, 60 samples were examined including 30 samples of group A (Ardox-X) and 30 samples of group B (Oral-B). Forty-three percent of the subjects were male and 57% were female. They were 41±9 years old (at least 22 years old and up to 65 years old). None of the female subjects was pregnant and none had systemic disease. The number of implants equaled 3±2. Changes in the PI and GBI of the subjects according to the type of toothpaste are shown in Table 1. The PI changes observed in the control (Oral-B) and case (Ardox-X) groups were not significantly different ( $P<0.6$ ). The changes in the GBI were significantly different between the control (Oral-B) and case (Ardox-X) groups ( $P<0.01$ ).

**Table 1: Changes in the Turesky plaque index (PI) and gingival bleeding index (GBI) based on the samples studied**

Indices Groups	PI (%)	GBI (%)
	B (Oral-B) N=30	0.88±0.22
A (Ardox-X) N=30	0.83±0.22	1.5±2
P-value	$P<0.6$	$P<0.01$

### Discussion:

The purpose of this study was to investigate the effect of Ardox-X toothpaste containing active oxygenated substance compared to Oral-B toothpaste on two periodontal indices, namely PI and GBI. The results showed that the toothpaste containing activated oxygen (Ardox-X) had no effect on plaque levels compared to Oral-B toothpaste but it decreased gingival bleeding.

In the present study, the reduction of GBI after the use of Ardox-X toothpaste can be due to the active oxygen in the toothpaste, which reduces the pathogens causing periodontal disease and bleeding.<sup>(12,13)</sup> The PI is more related to the way a person brushes and has less to do with toothpaste.<sup>(19,20)</sup> Therefore, in the present study, no significant difference was found in the PI.

In the present study, the confounding effect of the toothbrush was eliminated by giving a common toothbrush to all participants. Also, the effect of the manner of tooth brushing on the level of dental plaque was eliminated considering the crossover design of the study.

Antimicrobial agents such as chlorhexidine mouthwash,<sup>(21)</sup> toothpaste containing thiocyanate and carbamide peroxide,<sup>(17)</sup> and toothpaste containing propolis,<sup>(15,16)</sup> can influence periodontal disease parameters, such as gingivitis and gingival bleeding, and oral hygiene, which is in line with the results of the present study, indicating that Ardox-X active oxygen can reduce gingival bleeding. Fernandez Y Mostajo et al investigated the antimicrobial potential of Ardox-X active oxygen in the form of mouthwash on oral bacteria and dental plaque.<sup>(12,13)</sup> They showed that Ardox-X changes the composition and metabolism of bacteria. The most susceptible are gram-negative anaerobic bacteria such as Prevotella, Fusobacterium, and Veillonella.

Because pathogenic bacteria increase vascular permeability and increased vascular permeability in the gingivae can lead to increased gingival bleeding, reducing the effect of these bacteria and other pathogens in the tissue can decrease GBI,<sup>(21)</sup> which is consistent with the results of the present study.

The present study is one of the strongest crossover clinical trials, in which, the confounders have been removed and the effect of toothpaste containing the substance on the amount of PI and GBI has been investigated. We did not consider a specific site for the study of bleeding and all the teeth were considered. The plaque of all subjects was reached to zero, and the toothbrush used was the same for all participants. In this study, the effect of Ardox-X toothpaste after 10 days was investigated; longer-term studies are suggested in this respect.

### Conclusion:

According to the results, Ardox-X toothpaste seems to have better results than the control group (Oral-B) in terms of the GBI. Further longer-term studies are recommended to evaluate the effect of this substance on the treatment of periodontitis and peri-implantitis.

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