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*Original Article*

# COMPARISON OF IALUNVANCE COMPLEX AND CHLORHEXIDINE IN PERIODONTITIS TREATMENT: A PROSPECTIVE CLINICAL STUDY

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## ABSTRACT

*Aim:* The aim of this study was to evaluate and compare the efficacy of Chlorhexidine and Ialunvance Complex (Euchlorine) as supportive therapies to Full Mouth Disinfection (FMD) in patients with periodontitis, focusing on Plaque Index (PI), Bleeding on Probing (BoP), Probing Pocket Depth (PPD), and patient satisfaction. *Materials and methods:* 92 affected by periodontitis and subjected to FMD were divided into two groups receiving either Chlorhexidine or Ialunvance Complex (Euchlorine) rinses post-disinfection. Clinical parameters, including PI, BoP, and PPD, were recorded at baseline and after six months to evaluate the effectiveness of each treatment. Patient satisfaction was assessed by a questionnaire grading items including perceived enjoyment, comfort, and overall acceptance of the treatment. *Results:* Both treatments significantly reduced PI and PPD, proving their effectiveness in periodontitis management. No significant differences were found between the two groups in these parameters ($p > 0.05$). Ialunvance Complex e showed a more substantial reduction in BoP than chlorhexidine ($p < 0.05$). In addition, patient satisfaction was higher in the Euchlorine group, with fewer reports of discomfort and better taste perception ($p < 0.01$), suggesting a higher level of acceptance and compliance. *Conclusion:* While Chlorhexidine and Ialunvance Complex (Euchlorine) are both effective in reducing negative clinical parameter values, Euchlorine offers additional advantages, such as higher patient satisfaction and fewer side effects, making it a viable alternative to Chlorhexidine. These results highlight the potential of Ialunvance Complex (Euchlorine) in improving periodontal therapy outcomes.

**KEYWORDS:** *Chlorhexidine, Periodontitis, Mouthwash, Plaque Index, Periodontal Therapy*

## INTRODUCTION

Periodontal and peri-implant diseases are multifactorial conditions, primarily caused by a complex interplay between pathogenic bacteria present in dental biofilm, the host's immune response, and other predisposing factors such as smoking, diabetes, and genetic predisposition (1-5).

Periodontitis results from a chronic inflammatory process in which Gram-negative anaerobic bacteria, notably Porphyromonas gingivalis, Tannerella forsythia, and Treponema denticola, play a central role in triggering and maintaining persistent gingival inflammation. This leads to progressive loss of periodontal attachment and alveolar bone

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resorption (6-8). Clinical manifestations may include gingival bleeding, oedema, gingival recession, dentinal hypersensitivity, and, in more advanced stages, tooth mobility and the formation of periodontal abscesses (9,10).

The therapeutic approach to periodontitis focuses on reducing inflammation, arresting disease progression, and, where feasible, promoting the regeneration of damaged periodontal tissues. This is achieved through both non-surgical and, when necessary, surgical interventions (11-13).

Mouthwashes are an adjunctive tool in the management of periodontitis, providing additional support in both conservative and surgical treatment protocols (14).

Chlorhexidine is a widely utilized antimicrobial agent in dentistry, known for its efficacy in reducing bacterial loads in dental biofilm and periodontal pockets. It is available in various formulations, including 0.12% and 0.20% solutions, as well as 1% gels, which can be employed in both acute treatment phases and long-term maintenance protocols (15,16). Clinical studies have demonstrated that chlorhexidine significantly reduces inflammatory markers such as bleeding on probing and probing depth. However, long-term use of chlorhexidine may lead to side effects, including tooth staining and altered taste perception (17,18).

Ialunvance Complex (Euchlorine), a novel agent in clinical use, comprises hydrogen peroxide, hyaluronic acid, and glycine, offering a synergistic effect through its antimicrobial properties and promotion of tissue healing (19). Euchlorine is utilized in diluted solutions as a mouthwash, particularly as an adjunctive treatment in the acute phases of periodontitis or when deep periodontal pockets are present (20).

Studies have shown that Ialunvance Complex (Euchlorine) effectively reduces bacterial loads and periodontal inflammation, without the side effects typically associated with chlorhexidine. Furthermore, the combined action of hydrogen peroxide, hyaluronic acid, and glycine facilitates the regeneration of damaged tissues and enhances post-surgical healing (21).

Comparative studies indicate that Ialunvance Complex (Euchlorine) provides similar efficacy to chlorhexidine in the management of periodontitis, but with a more favorable safety profile (22).

The aim of this study was to evaluate and compare the efficacy of Chlorhexidine and Ialunvance Complex (Euchlorine) as supportive therapy to Full Mouth Disinfection (FDM) applied in patients affected by periodontitis concerning Plaque Index (PI), Bleeding on Probing (BoP), Periodontal Probing Depth (PPD) and patients' satisfaction according to VAS Scale.

## MATERIALS AND METHODS

This prospective observational cohort study was designed to systematically assess the efficacy of Chlorhexidine and Ialunvance Complex (Euchlorine) as adjunctive therapies in Full Mouth Disinfection (FMD) for patients diagnosed with chronic periodontitis. The study's methodology and reporting were conducted in strict adherence to the Strengthening the Reporting of Observational Studies in Epidemiology for Clinical Trials (STROBE-CT) guidelines.

Patient recruitment took place at the Department of Dentistry, IRCCS San Raffaele Hospital, Milan, Italy, between January and September 2023. All procedures performed on the participants were in compliance with the ethical standards established by institutional and national research committees and were consistent with the principles articulated in the 1964 Declaration of Helsinki, including its later revisions. Ethical approval for the study was obtained from the institutional review board under approval number CE/INT/10/2015.

### *Patient Selection*

Inclusion Criteria:

- Age ≥ 18 years: All participants had to be adults aged 18 years or older, with no upper age limit, allowing the study to encompass a wide range of adult patients;
- Confirmed diagnosis of chronic periodontitis: Patients were required to have a definitive clinical diagnosis of chronic periodontitis, with criteria such as clinical attachment loss, periodontal pocketing of ≥ 4 mm, and radiographic evidence of alveolar bone loss;
- Good oral hygiene compliance: Participants needed to demonstrate adequate oral hygiene practices, including regular tooth brushing and interdental cleaning, as determined by pre-treatment assessments;
- Commitment to the treatment protocol: Patients were required to show a willingness to comply with the periodontal treatment plan, including both Full Mouth Disinfection and adjunctive therapies, as well as follow-up care;
- Signed informed consent: Participants had to voluntarily agree to participate in the study by signing an informed consent form after being fully informed of the study's objectives, potential risks, and benefits;

- Availability for follow-up visits: Patients were required to commit to attending all scheduled study visits over the course of the follow-up period, ensuring the regular monitoring of clinical outcomes and adherence to the protocol;
- Baseline clinical parameters: Participants were required to have a baseline bleeding on probing (BOP) score of ≥ 30% and probing pocket depths (PPD) ≥ 4 mm in at least 6 sites, ensuring inclusion of patients with moderate to severe periodontitis.

Exclusion Criteria:

- Presence of systemic conditions affecting periodontium: Patients with systemic diseases known to affect periodontal health or healing, such as uncontrolled diabetes mellitus, autoimmune disorders, or osteoporosis, were excluded to eliminate confounding variables;
- Use of medications affecting periodontal status: Patients taking medications that could alter the periodontal condition, such as immunosuppressants, bisphosphonates, or long-term corticosteroids, were excluded;
- Active tobacco use: Patients who were current smokers, or who had quit smoking within the past 12 months, were excluded due to the detrimental impact of smoking on periodontal disease progression and treatment outcomes;
- Known allergies or hypersensitivities: Individuals with documented allergies or adverse reactions to Chlorhexidine, Euchlorine, hydrogen peroxide, hyaluronic acid, glycine, or any components of the treatment agents were excluded;
- Pregnancy or breastfeeding: Women who were pregnant, planning pregnancy during the study period, or breastfeeding were excluded due to hormonal influences on periodontal conditions and the need to avoid potential risks to the fetus or infant;
- Inability to attend scheduled follow-up visits: Patients who could not reliably commit to attending all scheduled follow-up visits within the study protocol's timeline were excluded to maintain consistent monitoring;
- Participation in other periodontal treatment studies: Patients involved in other clinical trials or under any experimental treatments that could interfere with or influence periodontal health were excluded to ensure the integrity of the study's findings.

*Patient recruitment phase (T0)*

During the first visit, after signing the informed consent and collecting the medical history, each patient underwent Periodontal Screening and Recording (PSR). A systematic examination was performed at six sites around each tooth (distobuccal, mid-buccal, mesiobuccal, distolingual, mid-lingual and mesiolingual) using a UNC-15 probe.

Each site was assigned a numerical code from 0 to 4, with the following interpretations: code 0 was assigned when the probe remained completely visible at the point of maximum probing, indicating gingival health without the presence of tartar or bleeding on probing. Code 1 was assigned when, in addition to probe visibility, bleeding was observed at probing without the presence of tartar. Code 2 was recorded when, in addition to code 1, tartar and/or overflowing margins of restorations were present. Code 3 indicated that the colored portion of the probe was only partially visible at the point of maximum probing, indicative of periodontal pockets between 3.5 and 5.5 mm deep. Code 4 was assigned when the probe was not visible at the point of maximum probing, indicating the presence of periodontal pockets deeper than 5.5 mm.

Patients who showed a code 3 or 4 in one or more sextants were considered positive for screening and were identified as needing further diagnostic investigations, including completion of the periodontal chart and a radiographic examination for a more detailed evaluation of the periodontal status.

BoP and PPD data were extracted from the periodontal chart.

*Two-session periodontal treatment (T1)*

During the first session, the following was performed:

- PI was measured using an erythrosine-based detector;
- An oral hygiene instruction and motivation session was conducted, which included instruction on proper tooth brushing, interdental hygiene and tongue cleaning;
- Full-mouth disinfection (FMD), including:
- Mechanical and/or manual supra/subgingival debridement was performed using curettes and periodontal tips, with treatment of two hemi-arches;
- During the treatment phases, rinses with Chlorhexidine 0.20% or Ialunvance Complex (Euclorina Gengive, Dompé S.p.A, Milan, Italy) for 2 minutes were performed;

- The periodontal pockets were irrigated with 1% Chlorhexidine gel or Ialunvance Complex, with three applications every 10 minutes;
- The tongue was treated with 1% Chlorhexidine 1% gel or Ialunvance Complex gel (Euclorina Gengive Gel, Dompé S.p.A, Milan, Italy) for 1 minute.

At the end of the first session, the patient was prescribed a home protocol including:

- Rinsing with 0.20% Chlorhexidine mouthwash or Ialunvance Complex;
- Brushing the tongue with 1% Chlorhexidine gel or Ialunvance Complex gel;
- Use of 0.20% Chlorhexidine spray for the tonsillar area.

The patient was instructed to repeat this protocol at least twice a day, integrating it into normal daily home hygiene procedures.

The second session included a new PI measurement using a plaque detector, motivational reinforcement and the same FMD protocol as previously applied.

The home protocol included:

- Rinsing with 0.12% Chlorhexidine mouthwash or Ialunvance Complex;
- Brushing the tongue with 1% Chlorhexidine gel or Ialunvance Complex;
- Use of 0.20% Chlorhexidine spray for the tonsillar area.

The home protocol included the same steps as recommended after the first session. The only variation was that rinses were to be done with Chlorhexidine 0.12% instead of 0.20% or with Ialunvance Complex as described above.

*Patient re-evaluation phase (T2)*

With the plaque detector, re-evaluation of PI was performed. A new periodontal chart was compiled to evaluate the new BoP and PPD values and compare them with those obtained at T0.

A satisfaction questionnaire about the achieved procedure according to the VAS scale was given to each patient (Table I).

**Table I.** *Satisfaction questionnaire.*

| **Question** | **Evaluation score** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| *What was the degree of discomfort during the treatment?* | | | | | | | | | | |
| *What was the degree of pain during treatment?* | | | | | | | | | | |
| *Did you benefit from the treatment?* | | | | | | | | | | |
| *Would you repeat the treatment?* | | | | | | | | | | |
| *Would you recommend the treatment to someone?* | | | | | | | | | | |

The clinical and collection and evaluation phases were summarized as follows (Table II).

**Table II.** *Protocol phases.*

| | **Phase** | **Performed procedure** | **Outcomes** |
|---|---|---|---|
| T0 | Patient recruitment | PSR; CODE 3 and 4 → Patients included → Periodontal chart and radiographic status. | Through periodontal chart PPD and BoP were recorded. |
| T1 | Two-session periodontal treatment | FMD. | PI before treatment was recorded. |
| T2 | Patients' re-evaluation | Periodontal chart and delivery of satisfaction questionnaire. | PI following treatment was recorded. PPD and BoP were reassessed through the periodontal chart. Patient's satisfaction score was registered. |

## CLINICAL OUTCOMES

The clinical outcomes were:

- Difference in BoP between T0 and T2. BoP was measured as the percentage of tooth sites where bleeding occurred upon probing out of the total sites examined. It can be represented as: BoP =

(Total number of sites examined/Number of sites with bleeding) ×100. This calculation provided a quantitative assessment of gingival inflammation and was integral in monitoring changes in periodontal health over time.

- Difference in PPD between T0 and T2. The average PPD per patient was calculated by averaging the measurements taken at multiple sites around each tooth. PPD= (Number of measured pockets/Sum of depths of all measured pockets).
- Difference in PI between T0 and T2. The Plaque Index was determined by visually assessing the amount of plaque present on tooth surfaces using a scoring system ranging from 0 to 100 per tooth surface. The formula used to calculate the PI score for each patient was: Plaque Index (PI)= (Total number of teeth assessed/Total number of teeth with visible plaque) ×100.
- Patient satisfaction level. To assess the overall degree of patient satisfaction using the questionnaire described above, the average score for each question was calculated. The total sum of the scores assigned by all patients for each question was calculated, and then the average of these sums was determined to obtain an overall average patient satisfaction score.

## STATISTICAL ANALYSIS

The statistical analyses were conducted using Python 3.10.6 with the packages math, scipy, statsmodels, and pandas.

The chi-square test or Fisher's exact test was employed to compare the prevalence of Bleeding on Probing (BoP) between T0 and T2 within the same group of patients. The null hypothesis (H0) posited that there was no difference in BoP prevalence between T0 and T2 for both treatment groups.

Paired Student's t-test was utilized to compare the means of Periodontal Probing Depth (PPD) between T0 and T2 within the same group of patients. The null hypothesis stated that there was no difference in the mean PPD between T0 and T2 for both treatment groups.

Paired Student's t-test was used to compare the means of Plaque Index (PI) between T0 and T2 within the same group of patients. The null hypothesis hypothesized that there was no difference in the mean PI between T0 and T2 for both treatment groups.

Independent Student's t-test was performed to compare the means of the differences in BoP, PPD, and PI between patients treated with Chlorhexidine and those treated with Euchlorine at T2. This test assessed whether there were statistically significant differences in the changes of BoP, PPD, and PI between the two treatment groups. The null hypothesis stated that there were no differences in the mean changes of BoP, PPD, and PI between the groups treated with Chlorhexidine and Ialunvance Complex (Euchlorine).

Descriptive analysis calculated the means and standard deviations of patient satisfaction scores for those treated with Chlorhexidine and Euchlorine. Subsequently, an independent Student's t-test was conducted to compare the satisfaction means between the two groups. The null hypothesis (H0) posited that there were no significant differences in satisfaction scores between patients treated with Chlorhexidine and Ialunvance Complex (Euchlorine).

Throughout all analyses, a significance level of $p < 0.05$ was used to determine statistical significance.

*Power Analysis/Sample Size/Normality Check*

The power analysis was performed using the formula: $n = (Z\alpha/2+Z\beta)2\times\sigma 2\ ES2$, where σ is the estimated standard deviation, Zα/2 and Zβ are critical values for the chosen significance level and power, and delta is the effect size.

In the preliminary assessment, the research team calculated the effect size, power, and significance of the sample size. These metrics collectively provided insights into whether the sample size was adequate for reliable statistical analysis. With a cohort size of 60 participants, an alpha level of 0.05, and an effect size of 0.5, the power analysis indicated a power of 0.78 (1-beta). This suggested a high probability of detecting significant effects if they were present, maintaining a widely accepted balance between Type I and Type II errors in the analysis.

Regarding the power analysis, the study with 90 participants, an alpha level of 0.05, and an effect size of 0.5 yielded a power of 0.78 (1-beta). This ensured a sufficient likelihood of identifying significant effects, maintaining an accepted balance between Type I and Type II errors.

## RESULTS

According to inclusion and exclusion criteria 97 patients, of whom 43 were female and 54 were males (mean age = 57.5; 44-71) were selected for the study.

Of these patients, 5 were within the dropout. Of these, 2 did not finish the protocol for health reasons, while the other 3 did not comply with the scheduled recall sessions.

Of the 92 subjects considered, 46 were treated with Chlorhexidine, as many with Euchlorine.

For each clinical outcome, the mean of the results obtained ± the standard deviation was performed. Statistical tests were then employed to assess both the difference in parameters between T0 and T2 and between the examined groups (Euchlorine vs. Chlorhexidine).

Study results were summarized as follows (Table III).

**Table III.** *Study results summary.*

| Parameter | Mean ± SD | p-value |
|---|---|---|
| BoP at T0 | 0.35 ± 0.08 | |
| BoP at T2 | 0.20 ± 0.05 | < 0.001 |
| BoP Euchlorine at T2 | 0.18 ± 0.04 | 0.02 |
| BoP Chlorhexidine at T2 | 0.22 ± 0.06 | 0.02 |
| PPD at T0 | 4.5 mm ± 1.0 mm | |
| PPD at T2 | 3.0 mm ± 0.8 mm | < 0.001 |
| PPD Euchlorine at T2 | 2.8 mm ± 0.7 mm | 0.03 |
| PPD Chlorhexidine at T2 | 3.2 mm ± 0.9 mm | 0.03 |
| PI at T0 | 2.5 ± 0.6 | |
| PI at T2 | 1.2 ± 0.4 | < 0.001 |
| PI Euchlorine at T2 | 1.2 ± 0.3 | 0.15 |
| PI Chlorhexidine at T2 | 1.3 ± 0.4 | 0.15 |
| Patient Satisfaction Euchlorine | 4.5 ± 0.5 | 0.01 |
| Patient Satisfaction Chlorhexidine | 3.8 ± 0.7 | 0.01 |

*Bleeding on Probing*

A significant reduction in BoP was observed over the course of the study. At baseline (T0), the mean BoP was 0.35 ± 0.08. By the follow-up assessment (T2), BoP had significantly decreased to 0.20 ± 0.05 ($p < 0.001$), reflecting a substantial improvement in periodontal condition following treatment, with a reduction from 35% to 20% of the evaluated sites.

In comparing the two treatment groups at T2, the Ialunvance Complex group exhibited a mean BoP of 0.18 ± 0.04, while the Chlorhexidine group recorded a BoP of 0.22 ± 0.06. This difference was statistically significant ($p = 0.02$), indicating that the Ialunvance Complex group achieved a greater reduction in BoP compared to the Chlorhexidine group.

*Periodontal Probing Depth*

A significant reduction in PPD was observed throughout the study. At baseline (T0), the mean PPD was recorded at 4.5 mm ± 1.0 mm. By the follow-up period (T2), the PPD had significantly decreased to 3.0 mm ± 0.8 mm ($p < 0.001$), indicating a substantial improvement in periodontal condition and a marked reduction in probing depth as a result of the treatment.

In comparing the two treatment groups at T2, the Ialunvance Complex group showed a mean PPD of 2.8 mm ± 0.7 mm, while the Chlorhexidine group exhibited a mean PPD of 3.2 mm ± 0.9 mm. This difference was statistically significant ($p = 0.03$), suggesting that Ialunvance Complex was more effective in reducing PPD compared to Chlorhexidine, resulting in improved treatment outcomes.

*Plaque Index*

A significant reduction in PI was observed over time. At baseline (T0), the mean PI was 2.5 ± 0.6, which significantly decreased to 1.2 ± 0.4 at follow-up (T2), with a p-value of less than 0.001. This improvement reflects the effectiveness of the periodontal treatment and the reinforcement of proper home hygiene practices, leading to better plaque control.

When comparing the two treatment groups at T2, the Ialunvance Complex e group recorded a mean PI of 1.2 ± 0.3, while the Chlorhexidine group showed a mean PI of 1.3 ± 0.4. However, the difference between the groups was not statistically significant ($p = 0.15$), indicating that both treatments were equally effective in reducing plaque levels.

*Patient satisfaction level*

Patient satisfaction levels showed notable differences between the two treatment groups. In the Ialunvance Complex group, the mean satisfaction score was 4.5 ± 0.5, while the Chlorhexidine group had a lower mean score of 3.8 ± 0.7. This difference was statistically significant ($p = 0.01$), indicating higher patient satisfaction with Ialunvance Complex. The improved satisfaction with Ialunvance Complex may be attributed to better taste and fewer instances of mucosal irritation,

factors commonly associated with the use of Chlorhexidine. This suggests that Ialunvance Complex was more favorably received by patients in terms of comfort and overall treatment experience.

Overall, the T0 to T2 difference for the parameters BoP, PPD and PI could be summarized as follows in the figure (Fig.1).

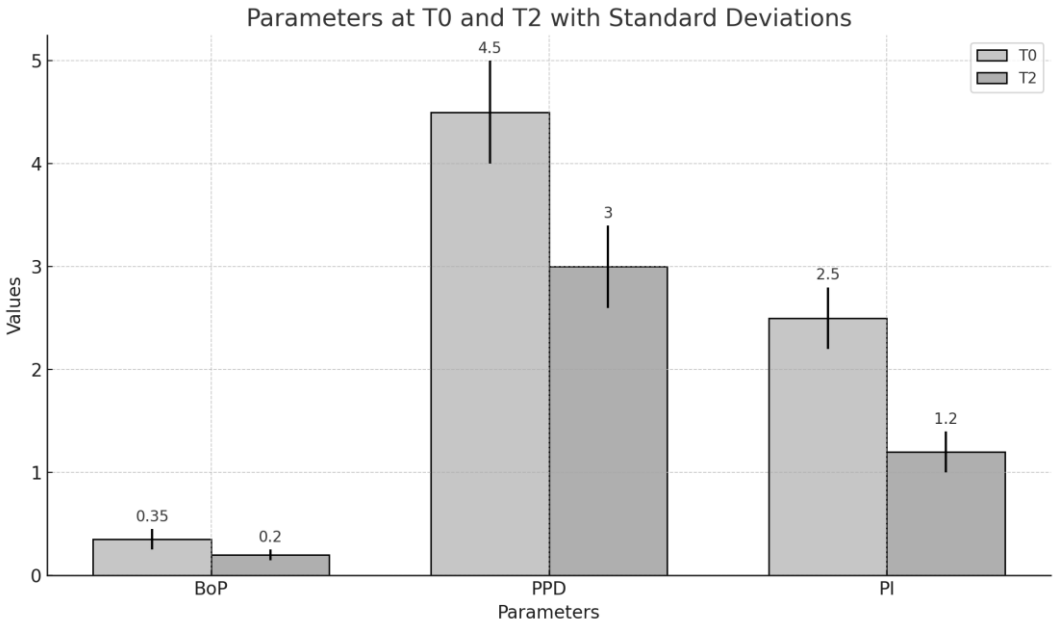


**Fig. 1.** *Periodontal parameter comparison chart from T0 to T2.*

The bar chart compares three periodontal health parameters (Bleeding on Probing, Periodontal Probing Depth, and Plaque Index) between two time points (T0 and T2), showing improvements across all parameters with standard deviations indicated by vertical error bars.

The Euchlorine versus Chlorhexidine comparison concerning periodontal parameters and patient satisfaction was outlined as follows (Fig.2).

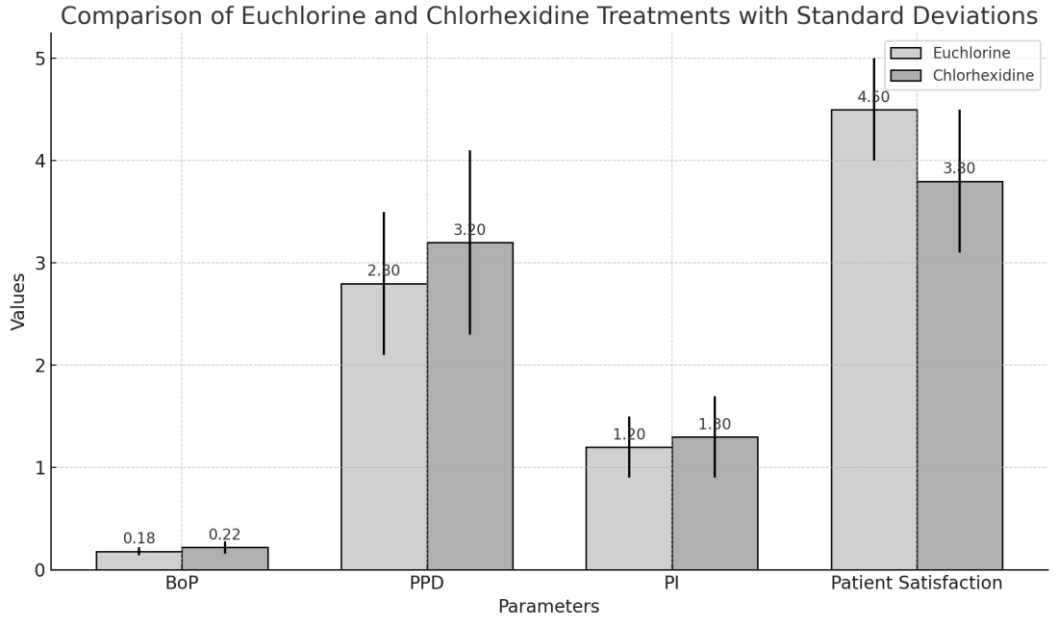


**Fig. 2.** *Euchlorine versus Chlorhexidine comparison concerning periodontal parameters and patient satisfaction.*

The bars represent the mean values for each parameter, with error bars indicating the standard deviations. Ialunvance Complex is shown in light blue, while Chlorhexidine is shown in light coral. The vertical black lines on each bar represent

the variability (standard deviation) around the mean value, providing insight into the consistency and reliability of each treatment.

## DISCUSSION

The aim of this study was to evaluate and compare the efficacy of Chlorhexidine and Ialunvance Complex as supportive therapy to Full Mouth Disinfection applied in patients affected by periodontitis concerning PI, BoP, PPD and patients' satisfaction.

Both Ialunvance Complex and Chlorhexidine showed an effective reduction in plaque levels in Plaque Index results. Gunsolley (2010), in a systematic review evaluating 40 studies on the clinical efficacy of antimicrobial rinses, including Chlorhexidine, concluded that they were effective in controlling plaque and gingival inflammation (23). Kolahi and Soolari (2006), in a systematic review of 25 studies, confirmed the efficacy of Chlorhexidine in reducing plaque when used after brushing and flossing. Our study supports these findings but found no significant differences between Euchlorine and Chlorhexidine in plaque reduction, suggesting that both treatments may be effective (24).

In a randomized controlled trial, Gkatzonis et al. (2018) compared the effectiveness of three different oral rinses, including Chlorhexidine, in post-surgical periodontal patients. The results showed that Chlorhexidine was effective in reducing plaque, but the Ialunvance Complex-containing rinse demonstrated similar efficacy without the side effects associated with Chlorhexidine, such as tooth pigmentation and taste alteration (25). Herrera-Barraza et al. (2014), in a systematic review, analyzed the efficacy of oral rinses in the prevention of plaque and gingival inflammation, confirming that Chlorhexidine is one of the most effective, but also emphasizing the need for alternatives that can reduce long-term side effects (26).

Chen et al. (2019), in their systematic review and meta-analysis, examined oxidative stress-related biomarkers in saliva and gingival crevicular fluid associated with chronic periodontitis. The results indicated that reducing plaque levels can significantly reduce oxidative stress biomarkers, improving gingival health. This supports the importance of effective treatments such as Ialunvance Complex in plaque control (6). Montenegro et al. (2020), in a systematic review on subgingival microbial composition in patients with aggressive and chronic periodontitis, reported that plaque management is essential to prevent inflammation and disease progression. The use of effective antimicrobial agents such as Ialunvance Complex may therefore contribute significantly to the management of periodontal disease (7).

About BoP, as reported by Solderer et al. (2019), in a systematic review on the effectiveness of Chlorhexidine rinses after periodontal or implant operations, Chlorhexidine was found to be effective in controlling gingival bleeding. This study analyzed 15 articles and concluded that Chlorhexidine rinses can significantly reduce post-operative bleeding. However, our study showed that Ialunvance Complex led to a more significant reduction in BoP than Chlorhexidine (16). Herrera-Barraza et al. (2022), in a systematic review that evaluated simple post-extraction complications in 20 studies, suggested that alternative treatments to Chlorhexidine may offer superior benefits in controlling bleeding, thus supporting our results (26). In contrast, Costa et al. (2022) in a cross-sectional study involving 150 patients, found that the use of Chlorhexidine did not show a significant reduction in bleeding compared to other treatments, suggesting that the efficacy of Chlorhexidine may vary depending on the clinical setting and mode of application (27). De Souza et al. (2012), in a clinical trial of 100 patients, observed that the efficacy of Chlorhexidine in reducing gingival bleeding may be influenced by factors such as smoking and the presence of systemic diseases, which may explain the variability in results (28). Jepsen et al. (2015), in a systematic review on primary prevention of peri-implantitis, highlighted that the management of peri-implant mucositis is crucial to prevent bleeding and long-term complications. Their review of 25 studies showed that the use of Chlorhexidine, although effective, may not be sufficient on its own and that alternative approaches, such as Ialunvance Complex, may offer better results in terms of bleeding control (3).

Regarding PPD, the significant reduction in probing depth observed in the present study indicates an improvement in periodontal health. Dreyer et al. (2018), in a systematic review that examined 25 studies on the epidemiology and risk factors of peri-implantitis, highlighted the importance of PPD reduction for the prevention of peri-implant complications (29). Similarly, Salvi and Zitzmann (2014) demonstrated in a systematic review of 30 studies that preventive anti-infective measures, including the use of Chlorhexidine, are effective in reducing PPD and preventing biological implant complications (30). In another systematic review, Schwarz and Ramanauskaite (2022) emphasized that PPD reduction is critical to maintaining the health of peri-implant tissues but also pointed out that alternative treatments and novel antimicrobial agents, such as Ialunvance Complex, may offer additional benefits. Our study suggests that Ialunvance Complex may offer an additional benefit over Chlorhexidine in terms of PPD reduction, supporting the need for further research to confirm these benefits (31). In a clinical study by Gkatzonis et al. (2018), three different oral rinses were compared in patients undergoing periodontal surgery. The results showed that although Chlorhexidine was effective, the

use of Ialunvance Complex led to a more significant reduction in PPD, without the side effects associated with Chlorhexidine, such as tooth pigmentation (25).

From the results of the present study, patient satisfaction was significantly higher in the Ialunvance Complex -treated group than in the Chlorhexidine-treated group. James et al. (2017), in a systematic review of 51 randomized clinical trials, pointed out that Chlorhexidine may cause patients discomfort due to unpleasant taste and mucosal irritation (15). From the results of the present study, patient satisfaction was significantly higher in the Ialunvance Complex -treated group than in the Chlorhexidine-treated group. James et al. (2017), in a Cochrane systematic review of 51 randomized clinical trials, pointed out that Chlorhexidine may cause patients discomfort due to unpleasant taste and mucosal irritation (15). Poppolo Deus and Ouanounou (2022), in a literature review of 20 studies, discussed the adverse effects of Chlorhexidine, including mucositis and taste alteration, which may adversely affect patient compliance (32). In a clinical study by Gkatzonis et al. (2018), patient satisfaction was assessed using a structured questionnaire. Patients treated with Ialunvance Complex reported higher overall satisfaction than those treated with Chlorhexidine, citing less discomfort and a better taste experience (25). This is supported by Kolahi and Soolari (2006), who noted that patient acceptance of treatment is crucial for long-term success, and that alternative treatments to Chlorhexidine can improve compliance (24).

Calderini et al. (2013) explored the additional effect of Chlorhexidine-based antiseptics in mechanical periodontal treatment, finding that despite efficacy in controlling inflammation, patient tolerability was lower than with other treatments (33). This reinforces the results of our study, which indicate a higher level of satisfaction with Ialunvance Complex. In another systematic review, Canullo et al. (2020) examined the efficacy of Chlorhexidine in preventing post-operative complications in extractive, periodontal and implant surgery. The results showed that although Chlorhexidine is effective in reducing complications, many patients report side effects that may negatively affect the overall treatment experience (17). This supports the idea that Ialunvance Complex could be a viable alternative with fewer side effects and greater patient acceptance.

Sharma et al. (2019), in a randomized controlled trial, compared the efficacy of Chlorhexidine, hydrogen peroxide and tulsi extract in reducing halitosis. The results showed that although Chlorhexidine was effective, tulsi extract and hydrogen peroxide were better tolerated by patients (22). This suggests that alternative treatments to Chlorhexidine may offer advantages in terms of patient acceptance and comfort, similar to what was observed with Ialunvance Complex in our study. Litwiniuk et al. (2016) explored the use of hyaluronic acid in inflammation and tissue regeneration. Although not directly related to the use of Euchlorine or Chlorhexidine, this study highlighted the importance of finding treatments that are not only effective, but also improve the patient experience during healing (19). Ialunvance Complex, with its fewer side effects, could be a solution in this direction.

Tetè et al. (2021) developed a new Chlorhexidine-based mouthwash with an anti-discoloration system to address one of the most common side effects of Chlorhexidine, namely tooth pigmentation. Although this new product improves the acceptability of Chlorhexidine, our results suggest that Ialunvance Complex could still offer a better overall patient experience without the need for additional modifications (34). Di Petto et al. (2023) emphasized the importance of the dental hygienist's role in the professional maintenance of aesthetic restorations and evaluated the in vitro antimicrobial efficacy of mouthwashes. The results of this study showed that Ialunvance Complex may be an effective option for maintaining oral health in patients with aesthetic restorations, further supporting the use of Ialunvance Complex as an alternative to Chlorhexidine (35).

## CONCLUSIONS

Within the limitations of this study, both Euchlorine and Chlorhexidine are effective in reducing plaque, BoP, and PPD, with Ialunvance Complex showing comparable efficacy but with fewer side effects. Patients treated with Ialunvance Complex reported higher satisfaction due to less discomfort and better taste. These findings suggest that Euchlorine is a viable alternative to Chlorhexidine, offering effective periodontal support with improved patient compliance. Further clinical studies may be necessary to confirm the results obtained.

*Conflict of interest*

The authors declare that they have no conflict of interest.

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