

# IMPROVING THE EFFECTIVENESS OF COMPLEX PERIODONTITIS TREATMENT USING THE VECTOR SYSTEM AND PHOTODYNAMIC THERAPY

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## **Introduction**

Periodontal diseases are a widespread problem affecting individuals of all ages. Statistics indicate that they are diagnosed in 64% to 98% of adults and 30% to 80% of children. If left untreated, progressive periodontitis leads to tooth loss, negatively impacts systemic health, and ultimately diminishes the patient's quality of life. The high prevalence of periodontal infections, their systemic influence, and significant tooth loss emphasize the clinical and socio-economic importance of this issue. Developing effective methods for treating inflammatory and destructive periodontal diseases remains a priority in modern dentistry. This necessity is driven by the persistence of these conditions and the complexities involved in treating chronic lesions, which require a comprehensive and highly effective therapeutic strategy.

The microbial environment in the periodontium plays a key role in the development of inflammation; therefore, eliminating periodontopathogenic microorganisms with antimicrobial agents remains a cornerstone of treatment. However, clinicians face significant challenges [2,3,4], primarily in maintaining adequate drug concentrations at the site of inflammation over an extended period. When choosing oral antibiotics, factors such as tissue penetration, microbial susceptibility, and potential adverse reactions must be considered. Furthermore, antibiotic resistance and the presence of microbial biofilms significantly reduce the efficacy of traditional drug therapy. Without eliminating the

pathogenic microflora within the gingival sulcus, subsequent therapeutic actions remain largely ineffective, often leading to disease recurrence.

### **Photodynamic Therapy (PDT)**

Photodynamic therapy, which utilizes the destructive energy of photochemical processes, offers a promising solution [7]. PDT is based on a photosensitizer—a substance that becomes active upon exposure to light and selectively accumulates in bacterial cells. When light of a specific wavelength (matching the dye's absorption peak) hits the sensitizer, it accumulates energy that is subsequently released, activating surrounding molecular oxygen to form short-lived singlet oxygen species. Singlet oxygen is highly reactive and destroys bacterial cell structures. Consequently, microorganisms die almost instantly, and the development of resistance to such exposure is not observed.

### **The VECTOR System**

A primary goal of conservative periodontitis treatment is the suppression of inflammation through the complete removal of supra- and subgingival biofilm and root surface granulations. Among various methodologies, the "Vector" system (Durr Dental, Germany) holds a special place. It is used for treating and preventing gingivitis, periodontitis, and peri-implant mucositis, as well as for professional cleaning and micro-invasive treatment of hard tissues. The system utilizes ultrasonic energy transmitted through a specialized fluid. Similar to a lithotripter or ultrasonic bath, it effectively cleanses and processes tissues. Periodontal pockets and root surfaces are treated using a gentle ultrasonic method with the *Vector Fluid Polish* suspension (Reg. No. 2004/867). This system creates a biocompatible layer on the tooth root, allowing for tissue-preserving therapy that protects the root cementum and soft tissues essential for rapid healing.

### **Study Objectives and Methods**

The study aimed to optimize comprehensive treatment approaches for patients with moderate chronic generalized periodontitis (CGP).

- **Participants:** 93 patients (aged 35–68) diagnosed with CGP.
- **Groups:**
  - **Main Group (53 patients):** Received complex treatment involving the "Vector" system and the "Helbo" (Austria) antibacterial photodynamic laser system. A diode laser (670–690 nm, power density 75 mW/cm<sup>2</sup>) and "HELBO® Blue Photosensitizer" were used.
  - **Control Group (40 patients):** Treated with standard therapeutic methods.
- **Assessment:** Comprehensive clinical examination including hygiene and periodontal indices (HI, PI, PMA, CPITN), as well as radiological analysis (contact radiography and orthopantomography) at baseline, 6 months, and 12 months. Microbiological analysis studied aerobic (5% blood agar) and anaerobic (thioglycollate medium) microflora.

## Results of the research

Comparative index analysis showed a significant reduction in PI, PMA, and CPITN scores. Differences between groups were statistically significant ( $p < 0.01$ ) at day 14, one month, and six months post-therapy, with the main group showing more pronounced improvement.

The treatment efficiency in the main group reached **93.12% ( $\pm 2.03\%$ )**, based on clinical and radiological parameters and the duration of remission. In contrast, the control group efficiency was significantly lower at **55.54% ( $\pm 5.16\%$ )**.

Microbiological findings indicated that the combined use of the "Vector" system and "Helbo" PDT led to a significant reduction in microorganisms—specifically decreasing populations by **1.5 to 2 orders of magnitude**. The effect was particularly notable in the reduction of anaerobic bacterial strains. While the control group also saw a decrease in microbial count, healthy levels were only achieved toward the end of the course, whereas the main group showed more rapid and sustained microbial suppression.

## Conclusion

The results demonstrate that comprehensive periodontal treatment combining the "Vector" system and the "Helbo" antibacterial photodynamic laser system is significantly more effective than standard methods. This approach effectively eliminates periodontopathogenic microorganisms, minimizes the pharmacological burden on the patient, stabilizes the disease progression, and substantially extends the period of remission.

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