UNLV School of DENTAL MEDICINE

Differential Antimicrobial Effects of Endodontic Irrigant Endocyn on Oral Bacteria

Michael Pearson, Samuel Stewart, Linda Ma, Karl Kingsley and Victoria Sullivan

University of Nevada Las Vegas School of Dental Medicine

Introduction

Need for Effective Antimicrobials:

In pediatric dentistry, infection control for vital and non-vital pulp therapy is critical. These procedures often involve the risk of bacterial contamination, necessitating robust antimicrobial agents to ensure successful outcomes and patient safety.

Endocyn:

This novel endodontic irrigant is formulated with hypochlorous acid (HOCl), known for its potent antimicrobial properties and a neutral pH, making it safer for use in delicate oral environments. Its potential to replace more toxic agents like sodium hypochlorite (NaOCl) is of significant interest.

Research Gap:

Despite its promising formulation, the specific effects of Endocyn on diverse oral bacterial strains remain under-explored. This study aims to investigate its efficacy across a spectrum of oral pathogens, focusing on both Gram-positive and Gram-negative bacteria that are prevalent in dental infections.

Materials and Methods

Bacterial Strains:

- Gram-positive: Includes strains such as Actinomyces naeslundii, Lactobacillus acidophilus, Streptococcus gordonii, and Streptococcus mutans. These bacteria are commonly associated with dental caries and endodontic infections.
- Gram-negative: Includes Porphyromonas gingivalis, Fusobacterium nucleatum, and Veillonella parvula, which are often involved in periodontal diseases and are more resistant to treatment.

Experimental Setup:

- Each bacterial strain was cultured under optimal conditions to ensure viability and accurate assessment of antimicrobial effects.
- Endocyn was tested at dilutions of 1:100, 10:100, and 50:100 to evaluate dose-dependent effects.
- Controls included phosphate-buffered saline (PBS) as a negative control and 5% sodium hypochlorite (NaOCl) as a positive control for comparative purposes.

Measurements:

- Turbidity measurements and bacterial cell counts were conducted after 24 hours of exposure to assess the degree of bacterial inhibition.
- Statistical analyses were performed using Student's t-tests and ANOVA to determine the significance of the results, ensuring robust and reliable data interpretation.

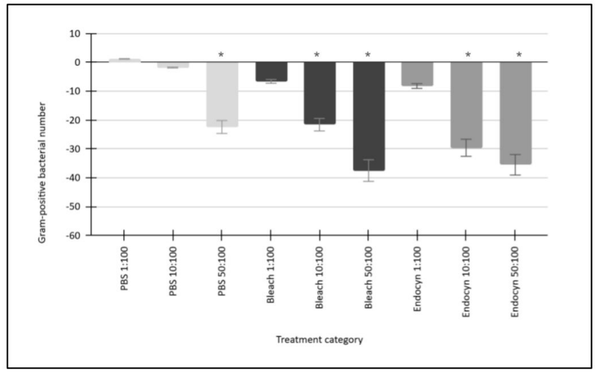

Figure 1. Gram-positive bacterial responses to the administration of Endocyn and experimental controls. The negative control (1x PBS) reduced the turbidity and cell counts of the Gram-positive bacteria by between −1.2% and −22.4% ($p = 0.688$ to $p = 0.022$) on average over the concentration range tested compared with the baseline (0:100). The positive control (5% NaOCl or bleach) led to greater reductions ranging from −6.6% to −37.5% ($p = 0.08$ to $p = 0.001$), while Endocyn induced similar reductions of between −8.2% and −35.5% ($p = 0.14$ to $p = 0.004$) compared with the baseline. * Denotes the statistical significance of p-values less than alpha = 0.05.

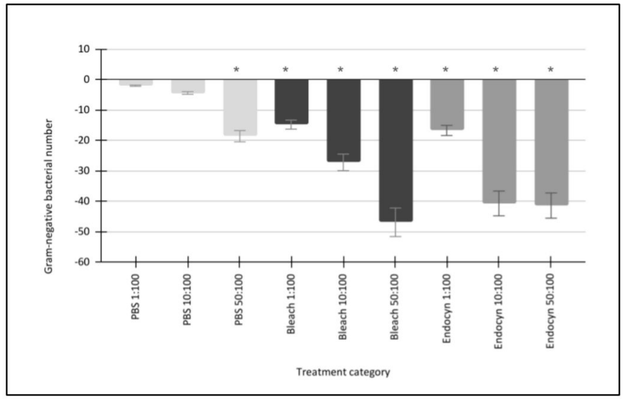

Figure 2. Gram-negative bacterial responses to the administration of Endocyn and experimental controls. The negative control (1x PBS) reduced the turbidity and cell counts of the Gram-negative bacteria by between −2.0% and −18.6% ($p = 0.712$ to $p = 0.024$) on average over the concentration range tested compared with the baseline (0:100). The positive control (5% NaOCl or bleach) led to larger reductions ranging from −14.8% to −46.9% ($p = 0.041$ to $p = 0.001$), while Endocyn elicited similar reductions of between −16.7% and −41.4% ($p = 0.04$ to $p = 0.001$) compared with the baseline * Denotes the statistical significance of p-values less than alpha = 0.05.

Results

Gram-positive Bacteria:

Endocyn demonstrated a significant reduction in bacterial growth, with inhibition rates ranging from 8.2% to 35.5%. These results are comparable to those achieved with NaOCl, highlighting Endocyn's efficacy as an antimicrobial agent.

Gram-negative Bacteria:

The irrigant was particularly effective against Gram-negative bacteria, with inhibition rates between 16.7% and 41.4%. This is noteworthy as Gram-negative bacteria are often more resistant to conventional disinfectants, indicating Endocyn's potential superiority in this regard.

Statistical Correlation:

A strong correlation was observed between turbidity and cell count data ($R^2 = 0.998$), validating the consistency and reliability of the experimental outcomes. The statistical significance of the results was confirmed with p-values indicating meaningful differences from the controls.

Discussion

Efficacy of Endocyn:

The study underscores Endocyn's robust antimicrobial properties, particularly its effectiveness against challenging Gram-negative bacteria. This positions Endocyn as a viable alternative to traditional agents like NaOCl, potentially reducing the risk of chemical burns and other adverse effects associated with more toxic substances.

Clinical Implications:

Given its demonstrated efficacy, Endocyn could be integrated into routine endodontic practices, offering a safer, effective solution for infection control. Its use could enhance patient outcomes by minimizing the risk of post-procedural infections and complications.

Limitations and Future Directions:

While the study provides compelling in vitro evidence, clinical trials are necessary to confirm these findings in vivo. Future research should focus on understanding the long-term effects of Endocyn on oral tissues and its interaction with other dental materials during procedures.

Conclusion

Summary:

The study provides strong evidence of Endocyn's antimicrobial capabilities, suggesting it could significantly enhance endodontic treatment protocols by offering a potent, less toxic alternative to current irrigants.

Clinical Potential:

With further validation through clinical trials, Endocyn has the potential to become a standard component in dental care, improving safety and efficacy in infection management.

References

Available upon request