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Cold Atmospheric Plasma in Pediatric Dentistry: Integrating Global Evidence and Maternal Education for Children with Dental Abnormalities

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ABSTRACT

Introduction: Cold atmospheric plasma (CAP) is a novel, non-invasive technology in dentistry with antimicrobial, anti-inflammatory, and regenerative properties. This study reviews international evidence on CAP's applications in pediatric dentistry, focusing on children with dental abnormalities. CAP demonstrates potential in caries removal, gingival inflammation reduction, root canal disinfection, enamel whitening, and post-operative healing. Maternal education is emphasized as a key factor in improving treatment acceptance and preventive oral care. CAP generates reactive oxygen and nitrogen species that eliminate pathogens without damaging healthy tissues. Its painless and minimally invasive nature makes it suitable for pediatric patients, reducing anxiety and discomfort. Studies highlight CAP's ability to complement conventional therapies, offering safer alternatives to chemical disinfectants and invasive procedures. Maternal involvement enhances compliance and supports long-term oral health outcome.

Materials and Methods: This research is based on a narrative review of three international studies published between 2021 and 2023. Sources were selected from peer-reviewed journals focusing on plasma medicine and dentistry. Findings were synthesized to evaluate CAP's clinical applications and its integration into pediatric dental care, with emphasis on parental education.

Results and Discussion: CAP is a non-thermal emerging technology that can reduce microbial load and cariogenic biofilms without damaging healthy tissues, offering potential benefits in managing early caries, disinfecting cavities before restorations and supporting healing of oral lesions in children. Current evidence is mostly laboratory-based; hence, clinical trials in pediatric populations, evaluation of long-term effects on primary and developing enamel, and creation of standardized safety protocols are still needed. In practice, it may help with uncooperative children by reducing the need for drilling or injections, while parents should understand that it is an adjunct—not a replacement—for brushing and fluoride. Future progress depends on developing evidence-based guidelines and designing smaller, affordable devices suitable for pediatric clinics.

Conclusion: Cold atmospheric plasma represents a promising therapeutic tool in pediatric dentistry. By combining scientific innovation with maternal education, CAP can improve care quality, reduce microbial load, accelerate healing, and minimize discomfort. Future research should focus on child-specific devices, clinical trials, and training programs for dental teams.

Keywords: Cold plasma, Dental abnormalities, Dentistry, Maternal education, Pediatric

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