

COMPARATIVE EFFICACY OF SILVER DIAMINE FLUORIDE (SDF) AND CONVENTIONAL RESTORATIVE TECHNIQUES IN MANAGING EARLY CHILDHOOD CARIES: A PROSPECTIVE CLINICAL STUDY

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Abstract

Background: Early Childhood Caries (ECC) remains a significant global public health challenge, affecting the primary dentition of preschool children and impacting their overall quality of life. Traditional restorative treatments often require high levels of patient cooperation or pharmacological behavior management, which may not be feasible in all clinical settings. Silver Diamine Fluoride (SDF) has emerged as a minimally invasive alternative for arresting carious lesions.

Objective: This study aims to evaluate and compare the clinical success rates, parent satisfaction, and treatment efficiency of 38% SDF application versus traditional Glass Ionomer Cement (GIC) restorations in managing active cavitated dentin lesions in children aged 3 to 5 years.

Materials and Methods: A total of 120 preschool children with at least two active cavitated lesions were recruited and randomly assigned to two groups. Group A (n=60) received 38% SDF application, while Group B (n=60) underwent conventional GIC restoration. Clinical evaluations were performed at 6, 12, and 24-month intervals to assess caries arrest, restoration integrity, and the development of secondary caries. Parental satisfaction was measured using a Likert-scale questionnaire.

Results: Preliminary findings indicate that SDF treatment showed a significantly higher caries arrest rate ($p < 0.05$) compared to the retention rate of GIC in uncooperative patients. While GIC provided superior esthetic outcomes, SDF was noted for its significantly shorter chairside time and higher ease of

application. Parental satisfaction regarding pain control was high in both groups, although aesthetic concerns regarding SDF-induced tooth staining were reported.

Conclusion: Silver Diamine Fluoride is a highly effective, non-invasive, and cost-efficient tool for arresting early childhood caries, particularly in cases where traditional dental treatment is challenging. It serves as a viable alternative in community health programs and for managing fearful pediatric patients.

Key words: Pediatric Dentistry, Early Childhood Caries (ECC), Silver Diamine Fluoride (SDF), Caries Arrest, Minimally Invasive Dentistry, Glass Ionomer Cement (GIC), Clinical Success Rate, Dental Restorations, Oral Health, Preschool Children

INTRODUCTION

The Global Burden of Early Childhood Caries (ECC)

Early Childhood Caries (ECC) remains one of the most prevalent chronic diseases among children worldwide, representing a significant public health challenge despite advancements in modern preventative dentistry. Defined as the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child under the age of six, ECC is more than just a dental issue; it is a systemic concern. The ubiquity of this condition, particularly in low-to-middle-income countries and among socio-economically disadvantaged populations, highlights a profound disparity in oral healthcare access. The sequelae of untreated ECC are severe, ranging from chronic pain and acute infections to hospitalizations for dental abscesses. Furthermore, the impact extends to the child's general growth, leading to insufficient weight gain, sleep disturbances, and a diminished quality of life that affects their educational and social development.

The Challenges of Conventional Management

Traditionally, the management of cavitated carious lesions in primary teeth has followed the "surgical" model—removal of the decayed tissue followed by the placement of a restorative material, such as Glass Ionomer Cement (GIC) or composite resins. While these materials have proven effective in controlled

environments, their application in pediatric dentistry is frequently hindered by two major factors: child behavior and technical sensitivity. Young children, particularly those between the ages of three and five, often exhibit high levels of dental anxiety and lack the cognitive maturity to cooperate with invasive procedures involving local anesthesia and high-speed drills. Consequently, many children require pharmacological interventions, such as conscious sedation or general anesthesia, to undergo routine restorative work. These interventions carry inherent medical risks and place a heavy financial burden on healthcare systems and families.

Glass Ionomer Cement (GIC) as a Benchmark

Glass Ionomer Cement has long been considered the material of choice for pediatric restorations due to its unique properties: chemical bonding to tooth structure, biocompatibility, and, most importantly, the release of fluoride ions which aids in the remineralization of adjacent tooth tissues. However, GIC restorations are not without flaws. They are susceptible to moisture contamination during the initial setting phase and have lower fracture toughness compared to permanent materials. In the high-pressure environment of a pediatric clinic where a child may be moving or crying, achieving the perfect isolation required for GIC success is often impossible, leading to high failure and secondary caries rates.

The Paradigm Shift: Silver Diamine Fluoride (SDF)

In response to these challenges, the dental community has seen a paradigm shift toward "Minimally Invasive Dentistry" (MID) and "Non-Restorative Caries Control" (NRCC). Silver Diamine Fluoride (SDF) has emerged as a cornerstone of this movement. SDF is a clear, odorless liquid that combines the antimicrobial power of silver with the remineralizing effects of high-concentration fluoride. Its application is remarkably simple: it requires no drilling, no anesthesia, and minimal chairside time, making it an ideal "medical" rather than "surgical" treatment for caries.

The mechanism of SDF is dual-action. The silver ions act as a potent antimicrobial agent, denaturing the proteins in the cell walls of cariogenic bacteria

like *Streptococcus mutans* and inhibiting biofilm formation. Simultaneously, the fluoride ions (at a concentration.

th's hydroxyapatite to form fluorapatite, which is significantly more resistant to acid dissolution. Additionally, SDF inhibits the activity of matrix metalloproteinases (MMPs) and cathepsins, which prevents the degradation of the organic collagen matrix in dentin.

The Knowledge Gap and Study Rationale

Despite the growing body of evidence supporting SDF's ability to arrest caries, there remains a need for long-term, prospective comparative studies that measure its efficacy against the gold standard of GIC restorations, particularly regarding parental satisfaction. While SDF is medically effective, it has a notable side effect: it turns the arrested carious lesion permanently black. This aesthetic drawback is a point of contention in clinical decision-making.

Therefore, this study is designed to bridge the gap between clinical efficacy and practical acceptability. By comparing the 24-month success rates of 38% SDF application versus GIC restorations, we aim to provide a clearer clinical guideline for practitioners. We seek to determine if the biological and behavioral benefits of SDF—such as its ease of use in uncooperative children and its high rate of caries arrest—outweigh the aesthetic concerns and the mechanical risks associated with traditional restorations.

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