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Comparative Evaluation of Silver Diamine Fluoride vs Silver Nitrate with Sodium Fluoride Varnish on Mineral Density of Primary Molars

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Abstract: Due to the high prevalence of carious lesions, particularly in children due to the thinner dentin in primary teeth, minimally invasive, non-restorative strategies have become increasingly important in pediatric dentistry, especially the use of silver-based compounds. This study aimed to compare the remineralization capacity of two carious lesion arresting materials, silver diamine fluoride (SDF) and silver nitrate (SN) with sodium fluoride varnish (SFV), by evaluating mineral density using a laser scanning system to measure fluorescence inside each tooth's structure (DIAGNOdentpen). 16 pediatric patients contributing 46 primary molars were assigned the International Caries Detection and Assessment System codes (ICDAS), ranging from 1 to 3 values, and were randomly assigned to either SDF or SN with SFV treatment. Mineral density was assessed at baseline and at 3, 6, and 9 months using the DIAGNOdent pen. Intragroup and intergroup comparisons were performed using one-way and two-way ANOVA. Statistically significant reductions in fluorescence values were observed in the SDF intragroup, indicating an increase in mineral density, whereas no significant changes were observed in the SN with SFV group. No statistically significant differences were found between groups at any time point. Both treatment protocols demonstrated progressive decreases in fluorescence values, consistent with caries arrest, with earlier remineralization observed in the SDF group. These findings suggest that while both treatments are effective non-invasive options for arresting early carious lesions in primary molars, SDF may provide a faster and more pronounced remineralizing effect.

Keywords: Silver diamine fluoride, silver nitrate, remineralization, mineral density.

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1. INTRODUCTION

Carious lesions represent one of the most prevalent chronic diseases affecting children worldwide and constitute a significant public health concern, particularly in early childhood. Compared with permanent teeth, primary teeth are especially susceptible to demineralization due to their thinner enamel and dentin layers, which promotes rapid lesion progression

[1]. Conventional restorative management of cavities in pediatric patients often poses challenges, including limited patient cooperation, cost, and invasiveness of operative procedures. Consequently, non-restorative and less invasive approaches have gained importance in modern pediatric dentistry [2].

The remineralization process in primary teeth is a natural repair mechanism where lost minerals (calcium and phosphate) are restored to the tooth's surface from saliva and

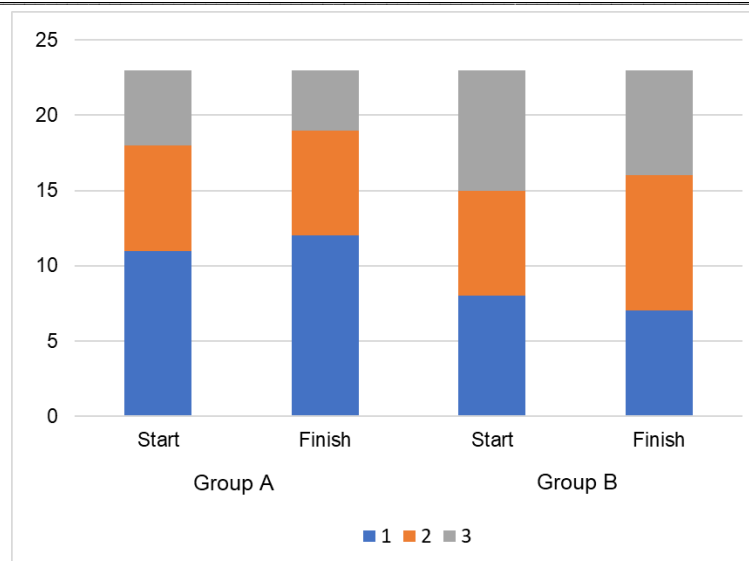


Fig. (1). Changes in ICDAS values (1,2, and 3) at the beginning of the study (t=0) and at the ending of the study (t=9 months).

crystallizes in the form of hydroxyapatite to restore the enamel [3]. This dynamic process is similar to that in permanent teeth, but primary teeth are more susceptible to demineralization because their enamel is thinner and contains less mineral content [4].

Among these restorative and remineralizing strategies, are silver-based compounds, particularly silver diamine fluoride (SDF) and silver nitrate (SN). They have demonstrated to have strong cariostatic, antimicrobial, and remineralizing effects, especially in pediatric patients [5]. SDF, typically used at 38% concentration, combines the antimicrobial action of silver ions with the remineralizing capacity of fluoride, forming a stable layer of fluorapatite on demineralized enamel and dentin. SN, historically employed as a disinfectant, has re-emerged as a potential carious lesion arresting agent, especially when used in conjunction with fluoride varnish, creating a dual-action protocol that enhances remineralization while maintaining antimicrobial activity [6].

Despite increasing evidence supporting both compounds for carious lesion arresting and remineralization capacities, direct comparative clinical data assessing their performance on primary molars under clinical conditions remain limited. The present study aimed to evaluate and compare the changes in mineral density of carious primary molars treated with SDF (38% w/v) vs SN (25% w/v) followed by sodium fluoride varnish (5% w/v) (SFV), using quantitative light-induced fluorescence as an objective assessment tool.

2. METHODOLOGY

This experimental, longitudinal clinical study was carried out at the pediatric dental clinic of the Autonomous University of Baja California (UABC). Parents or legal guardians were informed of the study's objectives, risks, and benefits, provided written informed consent. The International Caries Detection and Assessment System (ICDAS) was applied to diagnose carious lesions. Inclusion criteria included primary

molars exhibiting ICDAS codes 1 to 3, excluding codes 4 to 6, indicating initial to moderate enamel lesions without cavitation extending to dentin. A total of 16 pediatric patients (9 females and 7 males) were included, which contributed 46 primary molars, which were randomly distributed into two equal groups (n = 23 per group): group A treated with SDF and group B with SN and SFV.

Follow-up evaluations were scheduled at 3, 6, and 9 months. At each visit, dental prophylaxis was repeated, and mineral density was reassessed using the DIAGNOdent pen under identical calibration settings, classifying the values from 0-13 to indicate a healthy tooth, and from 14-29 enamel caries [7] these last values have a correlation with the ICDAS codes 1 to 3.

All data were compiled in Microsoft Excel and analyzed with GraphPad Prism 9. Inter- and intragroup comparisons were performed *via* one-way and two-way ANOVA, with significance established at $p \leq 0.05$.

3. RESULTS

The final sample consisted of 46 primary molars from 16 children: group A included 11 upper and 12 lower molars; group B included 13 upper and 10 lower molars. The baseline and final ICDAS values are depicted in Fig. (1). In Group A, the baseline ICDAS distribution was 8 molars (Code 1), 7 molars (Code 2), and 8 molars (Code 3). After nine months, the corresponding values were 7, 9, and 7 molars, respectively, reflecting some lesion stabilization. In Group B, the initial codes were 11 (Code 1), 7 (Code 2), and 5 (Code 3); by nine months, they were 12, 7, and 4 molars, showing a similar trend of arrested lesions.

The results of the evaluation of mineral density using the fluorescent measuring device are shown in Table 1. Statistical analysis of intragroup results showed significant differences in group A between baseline and 3-month ($p < 0.0048$) and

Table 1. Mineral Density Analysis.

-	Baseline	3 months	6 months	9 months
Group A	33.26 ± 16.74	21.65 ± 11.50	23.52 ± 12.17	21.04 ± 9.80
Group B	38.65 ± 22.96	29.56 ± 22.27	28.65 ± 21.19	28.39 ± 20.45

baseline and 9-month ($p < 0.0083$) readings, indicating mineral gain, but no statistically significant differences were found in group B between any of the time points.

In the intergroup comparison, no statistically significant differences were found between group A and group B at any time interval (3 months $p = 0.1063$; 6 months $p = 0.6026$; 9 months $p = 0.1648$). However, both groups demonstrated a progressive decline in fluorescence values, suggesting of remineralization or caries arrest, but the SDF group exhibited greater early improvement.

4. DISCUSSION

The results confirm that both SDF and SN combined with SFV are effective non-restorative interventions for halting carious lesion progression in primary molars. However, the statistically significant reduction in fluorescence values observed in the SDF group indicates enhanced remineralization and mineral stabilization compared with the SN and SFV protocol, although the overall difference between both groups was not statistically significant at any given time point.

The superior performance of SDF can be attributed to its high silver ion concentration and the presence of ammonia, which stabilizes silver ions, enhances penetration into demineralized dentin, and promotes favorable pH conditions for mineral formation [8]. Additionally, fluoride promotes the formation of fluorapatite, improving resistance to future acid challenges. On the other hand, although the dual-step SN with SFV protocol is effective in carious lesion arresting and prevention, it may exhibit slower mineral integration, due to the absence of stabilizing factors present in SDF [9]. Despite both treatments are effective in arresting carious lesions, the faster remineralization potential of the SDF needs to be taken into consideration, as well as the fact that SDF is a more expensive treatment than SN, making the SN with SFV protocol particularly valuable in lower-income communities or countries with limited access to extensive dental infrastructure, due to its low cost and simple application makes it an accessible way to manage caries and alleviate pain, especially in pediatric patients [10].

CONCLUSION

Both SDF and SN combined with SFV demonstrated clinical efficacy in arresting carious lesions in primary molars over a 9-month follow-up period. However, SDF produced statistically significant improvements in mineral density at

specific intervals, suggesting a more pronounced remineralizing effect. Given its simplicity, low cost, and non-invasive nature compared conventional restorative treatments like fillings, the topical use of SDF remains a highly valuable therapeutic alternative for the management of early childhood caries and promoting remineralization, particularly in patients with limited access to conventional restorative treatments. Future studies with larger sample sizes and extended followups are recommended to confirm longterm stability and an assessment of esthetic outcomes of both treatment modalities.

REFERENCES

- [1] Skeie, M. S.; Raadal, M.; Strand, G. V.; Espelid, I., The relationship between caries in the primary dentition at 5 years of age and permanent dentition at 10 years of age – a longitudinal study. *International Journal of Paediatric Dentistry* **2006**, *16*, 152-160.
- [2] Lo, E. C. M.; Duangthip, D., Non-restorative Approaches for Managing Cavitated Dentin Carious Lesions. In *Pediatric Restorative Dentistry*, Coelho Leal, S.; Takeshita, E. M., Eds. Springer International Publishing: Cham, **2019**; 141-160.
- [3] Enax, J.; Fandrich, P.; Schulze zur Wiesche, E.; Eppe, M. The Remineralization of Enamel from Saliva: A Chemical Perspective *Dentistry Journal* [Online], **2024**, 339.
- [4] Montaser, M. M.; Youssef, H.; Mahmoud, G. M., Comparison of the remineralization effectiveness of three remineralizing agents on artificial enamel lesions: an in vitro study. *BDJ Open* **2025**, *11*, 44.
- [5] Betsabé DeLaCruz-Coronaa, L. R., Arzamendi-Cepedab, Lizzett López-Yeea, Karla Vanessa García-Delgadilloa, Julio César GarcíaBrionesa, Fernanda Araiza-Verduzco, Comparative trial between silver nitrate and silver diamine fluoride in Tijuana's pediatric patients: effectiveness evaluation. *Journal of Dentistry and Oral Research* **2024**, *2025*.
- [6] Juárez-López, M. L.; Marín-Miranda, M.; Palma-Pardines, R.; Retana-Ugalde, R. The Effectiveness of Remineralization with Compound Silver Nanoparticles and Fluoride Varnish in Carious Lesions in Primary Teeth: A Randomized Split-Mouth Clinical Trial *Dentistry Journal* [Online], **2024**, 318.
- [7] Kassab, R.; Elsaad, N.; Badr, S., Comparison of Laser Fluorescence and Digital Radiograph with International Caries Detection and Assessment System in Primary Teeth (In-vivo study). *European Scientific Journal ESJ* **2021**, *17*.
- [8] Jamal, D.; AlMushayt, A.; Abujamel, T.; Bamashmous, S.; Bamashmous, N.; Alamoudi, N., Silver diamine fluoride: the science behind the action - a narrative review. *BMC Oral Health* **2025**, *25*, 1195.
- [9] Srisomboon, S.; Kettratad, M.; Stray, A.; Pakawanit, P.; Rojviriyi, C.; Patnirapong, S.; Panpisut, P., Effects of Silver Diamine Nitrate and Silver Diamine Fluoride on Dentin Remineralization and Cytotoxicity to Dental Pulp Cells: An In Vitro Study. *J Funct Biomater* **2022**, *13*, 16.
- [10] Trieu, A.; Mohamed, A.; Lynch, E., Silver diamine fluoride versus sodium fluoride for arresting dentine caries in children: a systematic review and meta-analysis. *Sci Rep* **2019**, *9*, 2115.