Journal of Advances in Drug Research

ISSN: 2230-7761
www.jadr.co.in

Volume 17, Issue 05 | Received 31.10.2026 | Accepted 5.11.2026 | Online 10.11.2026

MULTIMODAL MINIMALLY INVASIVE MANAGEMENT OF MILD-TO-MODERATE DENTAL FLUOROSIS IN CHILDREN: INTEGRATING RESIN INFILTRATION WITH FLUORIDE-FREE REMINERALIZATION

Muxamedova Nigina
Asia International University, Bukhara, Uzbekistan
ORCID: https://orcid.org/0009-0006-1470-9346 | Correspondence: muxamedovanigina15@gmail.com

ABSTRACT

Background: Mild-to-moderate dental fluorosis in children presents as diffuse enamel opacities that may affect facial esthetics and psychosocial well-being. Resin infiltration provides optical masking of porous enamel, while fluoride-free remineralizing agents may support mineral balance and noninvasive maintenance; however, their combined effectiveness has not been established by direct pediatric comparative trials. Objective: To evaluate existing evidence for resin infiltration in fluorosis and the adjunctive rationale for fluoride-free hydroxyapatite or casein phosphopeptide–amorphous calcium phosphate (CPP–ACP), and to propose a clinically testable multimodal pathway. Materials and Methods: A targeted narrative synthesis of published randomized trials, systematic reviews, and mechanistic studies available through 14 November 2026 was undertaken. Evidence for fluorosis masking was distinguished from evidence for early caries control and enamel remineralization. Results: A 2025 meta-analysis of six randomized trials reported greater color change with resin infiltration than alternative minimally invasive therapies (pooled mean difference 5.41 ΔE units, 95% CI 3.70–7.12). A 2026 network meta-analysis involving seven controlled studies and 555 participants found strong single-modality performance for resin infiltration, while combined abrasion–bleaching approaches ranked highest for esthetic masking. Evidence supporting fluoride-free hydroxyapatite pertains mainly to caries prevention rather than improvement of fluorotic opacity. A staged assessment and follow-up framework is proposed, but its effectiveness has not been clinically validated. Conclusion: Resin infiltration is an evidence-supported option for selected nonpitted fluorosis lesions. Combining it with fluoride-free remineralization is biologically plausible as an individualized supportive strategy but requires prospective pediatric safety and comparative effectiveness testing.

Keywords: dental fluorosis; children; resin infiltration; minimally invasive dentistry; fluoride-free remineralization; hydroxyapatite; CPP–ACP; enamel opacity; esthetic masking.

Journal of Advances in Drug Research

ISSN: 2230-7761
www.jadr.co.in

Volume 17, Issue 05 | Received 31.10.2026 | Accepted 5.11.2026 | Online 10.11.2026

INTRODUCTION

Dental fluorosis is a developmental disturbance of enamel produced by excessive systemic fluoride exposure during amelogenesis. Altered matrix-protein processing and maturation contribute to persistent subsurface porosity and altered light scattering, yielding diffuse white opacities and, in more pronounced cases, discoloration or pitting [1,2]. Its treatment differs from the management of active enamel caries: fluorosis is a developmental structural phenotype, whereas early caries reflects ongoing biofilm-driven demineralization. Distinguishing these entities is fundamental because the same "white spot" appearance can arise from clinically different mechanisms requiring distinct interventions. In pediatric practice, facial appearance, sensitivity, severity of tissue involvement, stage of dental eruption, oral hygiene, and the preferences of children and caregivers all influence the proportionality of treatment.

Conventional esthetic techniques for fluorotic enamel include observation, polishing, microabrasion, bleaching, resin infiltration, and restorative masking. Resin infiltration has particular relevance to nonpitted lesions because a low-viscosity resin can penetrate porous subsurface enamel and partially reduce the mismatch in refractive index between affected and sound regions. Clinical randomized studies and recent quantitative reviews support a meaningful esthetic effect, although the comparative benefit depends on lesion characteristics, protocol, and assessment interval [3–12]. The clinical motivation for multimodal treatment is to address two separate goals: immediate optical masking and ongoing preservation of tooth surface integrity. The proposed addition of a fluoride-free remineralization component should therefore be justified separately and must not be conflated with proven esthetic synergy.

The present study aims to critically synthesize evidence on resin infiltration and non-fluoride mineral-support strategies for mild-to-moderate fluorosis in children, to identify evidentiary gaps, and to develop a transparent research-ready framework for individualized conservative care. The article is a literature-based analytical contribution, not a report of a newly recruited pediatric cohort or a randomized trial performed by the author.

LITERATURE REVIEW

The optical basis of resin infiltration is supported by enamel porosity and refractive-index modification. In fluorosis, increased scattering from microscopic porous structures makes affected areas appear opaque; resin penetration can improve the visual continuity of the surface without the tissue removal required for conventional restorations. In a randomized trial of 72 patients aged 6–12 years with nonpitted anterior fluorosis, single and double applications of infiltrant yielded sustained esthetic improvement over six months compared with microabrasion or high-concentration bleaching [6]. A second trial evaluated 120 maxillary central incisors with Dean grade 3 fluorosis and found that microabrasion followed by resin infiltration achieved better fluorescence gain and color masking than microabrasion followed by remineralization, particularly for unstained lesions [5]. These observations support resin infiltration as a plausible pediatric treatment, while also demonstrating that pretreatment surface characteristics determine apparent outcomes.

Journal of Advances in Drug Research
ISSN: 2230-7761
www.jadr.co.in
Volume 17, Issue 05 Received 31.10.2026 Accepted 5.11.2026 Online 10.11.2026

Evidence syntheses strengthen the assessment without removing methodological heterogeneity. Han and colleagues combined six randomized trials in a 2025 meta-analysis and found higher visual masking scores and greater reported color-change effects for resin infiltration than several minimally invasive alternatives [8]. A separate 2026 network meta-analysis of seven controlled trials, 13 interventions, and 555 participants ranked microabrasion plus in-office bleaching highest for esthetic masking, whereas resin infiltration performed most consistently among single modalities [10]. These rankings are not a mandate to use bleaching in young children; adult evidence, bleaching concentrations, exposure protocols, age-specific safety considerations, and the possibility of avoiding unnecessary intervention must be assessed separately. Comparative reviews also acknowledge differences in fluorosis grading, the color metric used, intervention combinations, and follow-up duration [9].

The strongest evidence supporting hydroxyapatite-based fluoride-free oral care concerns prevention of caries and initial enamel demineralization, not treatment of developmental fluorotic opacities. A randomized pediatric trial involving 207 children in the intention-to-treat analysis found non-inferior one-year caries progression for fluoride-free hydroxyapatite toothpaste compared with a fluoride-containing comparator within its prespecified margin [14]. A 2025 systematic review and meta-analysis including four eligible studies likewise found no significant between-group differences in the main risk-ratio and odds-ratio estimates for initial lesion progression [13]. Additional syntheses suggest potential enamel mineral-support effects, but differences in study methods, formulations, populations, and conflicts of interest require measured interpretation [15–17]. In particular, a 2026 pediatric scoping review highlighted the predominance of laboratory or surrogate outcomes and cautioned that evidence for long-term caries protection by fluoride-free formulations remains less mature than that for conventional fluoride toothpaste [16].

CPP–ACP constitutes another possible fluoride-free calcium-phosphate delivery approach, although its performance cannot be assumed identical to hydroxyapatite. A randomized study of postorthodontic white spot lesions reported lesion regression in both CPP–ACP and fluoride toothpaste groups without a statistically demonstrable between-group advantage on the central comparison [18]. Such postorthodontic lesions are not fluorosis, and CPP–ACP also requires assessment of milk-protein allergy and the formulation's actual fluoride content. The difference between biologically plausible surface remineralization and proven improvement of fluorotic translucency is the central research gap motivating the present integrative proposal.

MATERIALS AND METHODS

The manuscript was developed as a targeted narrative evidence synthesis and methodological framework rather than a systematic review, meta-analysis, or primary clinical experiment. Searches and reference verification focused on PubMed-indexed literature and publisher sources available through 14 November 2026. Search concepts included "dental fluorosis", "children", "resin infiltration", "microabrasion", "enamel masking", "fluoride-free hydroxyapatite", "CPP-ACP", "remineralization" and

Journal of Advances in Drug Research

ISSN: 2230-7761
www.jadr.co.in

Volume 17, Issue 05 | Received 31.10.2026 | Accepted 5.11.2026 | Online 10.11.2026

"randomized trial". The materials were screened for direct relevance to pediatric fluorosis management or, when no direct evidence was available, for mechanistic support and oral-care safety considerations. Eighteen unique peer-reviewed sources with identifiers were retained: mechanistic descriptions, comparative clinical trials, systematic reviews and supporting clinical studies [1–18].

The extracted elements included diagnostic phenotype, participant age, number of patients or teeth when reported, intervention and comparator, follow-up duration, esthetic outcomes (ΔE, visual rating or fluorescence), caries-related outcomes, and limitations of inference. Evidence was stratified into three domains: direct fluorosis studies, indirect hydroxyapatite or CPP–ACP evidence from other enamel conditions, and conceptual clinical-integration proposals. Published estimates were reproduced with their original metric and direction of improvement; no pooled estimate was calculated by the present author, and no effect size from one disease or age group was attributed to another. Figures 1 and 2 illustrate independent published findings using different outcome definitions; comparisons across these figures are therefore inappropriate. The proposed management pathway in Figure 3 has not undergone validation.

No children were enrolled in the present work; no interventions were performed and no identifiable patient-level data were collected. Ethics approval and informed consent are not applicable to the preparation of this literature review. A future prospective study would require ethics approval, parental or guardian consent, age-appropriate assent, prespecified outcomes and follow-up, and compliance with applicable pediatric dental standards. The literature search was targeted rather than exhaustive: there was no registered protocol, dual independent screening, formal cross-study risk-of-bias synthesis, or new meta-analysis.

RESULTS

The reviewed clinical literature supports three main findings. First, infiltrant treatment can reduce the visible opacity of suitable nonpitted fluorotic enamel and may provide meaningful esthetic benefits in selected children. Second, the published studies differ substantially in comparator procedures, intervention combinations, optical outcomes and follow-up intervals. Third, the proposed fluoride-free mineral-support component has a separate evidence base focused largely on enamel demineralization and caries outcomes; direct evidence of additional fluorosis masking when such products are applied alongside resin infiltration is presently insufficient. Table 1 separates the most informative direct trials and synthesis studies from the adjacent but non-equivalent evidence.

Journal of Advances in Drug Research
ISSN: 2230-7761
www.jadr.co.in
Volume 17, Issue 05 Received 31.10.2026 Accepted 5.11.2026 Online 10.11.2026

Table 1. Selected direct fluorosis evidence and interpretation

Study / design	Participants / intervention	Reported finding	Interpretive limitation
Garg et al., 2022 [6]	72 children (6–12 years); RI, double RI, microabrasion, bleaching	RI protocols improved appearance through 6 months	Different treatment protocols; no RI + fluoride-free maintenance arm
Singhania et al., 2021 [5]	120 maxillary incisors; microabrasion + RI vs microabrasion + remineralization	RI showed better masking and fluorescence in specified comparisons	Tooth-level allocation and grade-specific analysis
Asthana et al., 2023 [7]	66 teeth with very mild/mild fluorosis; RI vs microabrasion	Quantified masking and color outcomes after treatment	Lesion and tooth-level outcomes; limited sample
Han et al., 2025 [8]	Meta-analysis: 6 RCTs; 11 pairwise comparisons	ΔE change MD +5.41 (95% CI 3.70–7.12) favoring RI	Not specific to RI followed by fluoride-free care
Chaple Gil et al., 2026 [10]	Network meta-analysis: 7 studies, 555 participants	RI strongest standalone approach; some combined protocols ranked higher	Indirect comparisons, varied age and procedures

The quantitative result in Figure 1 is drawn from the 2025 randomized-trial meta-analysis: the pooled mean difference in reported color change was 5.41 ΔE units (95% confidence interval 3.70–7.12), favoring resin infiltration under the included study definitions [8]. This is not a predicted gain in any specific child, and it does not represent the incremental benefit of adding a fluoride-free remineralizer. Optical color metrics require attention to direction: the amount of treatment-induced change can increase while residual mismatch between affected and adjacent sound enamel decreases. For this reason, the two published summary measures should not be merged into one pooled ranking.

Journal of Advances in Drug Research
ISSN: 2230-7761
www.jadr.co.in
Volume 17, Issue 05 | Received 31.10.2026 | Accepted 5.11.2026 | Online 10.11.2026

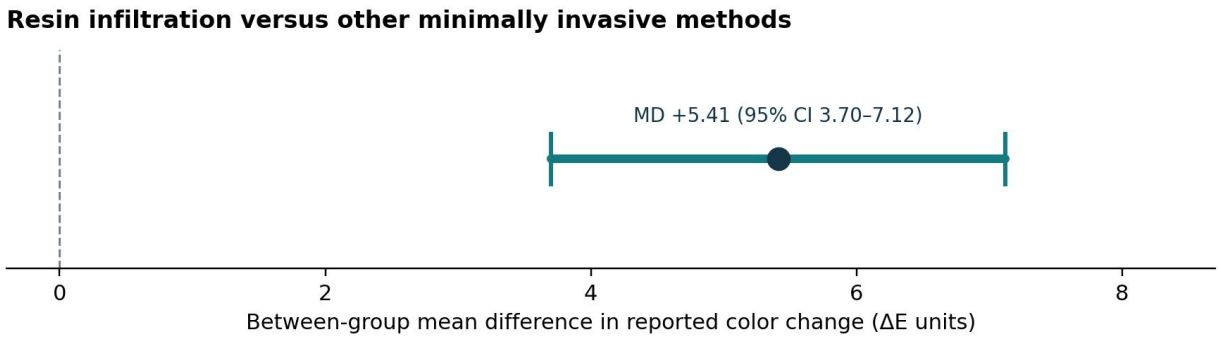


Figure 1. Literature-derived pooled color-change estimate for resin infiltration compared with alternative minimally invasive treatments in six randomized trials [8]. The diagram reproduces the published estimate and its 95% confidence interval; it is not a new meta-analysis.

A separate adult randomized trial provides a useful illustration of the metric distinction. In Schoppmeier et al. [4], 27 adults with 410 fluorotic teeth were randomized to bleaching or placebo bleaching before resin infiltration. At six months, residual color mismatch between fluorotic and unaffected enamel was reported as ΔE 1.41 in the prior-bleaching group and 4.33 without prior bleaching ($p = 0.024$). Because lower residual mismatch represents better masking, those values describe a different direction of clinical improvement from a change-from-baseline plot. The study included adults, used peroxide bleaching, and did not test a fluoride-free remineralizing add-on; therefore its results are not transferable as efficacy estimates for the proposed pediatric combination.

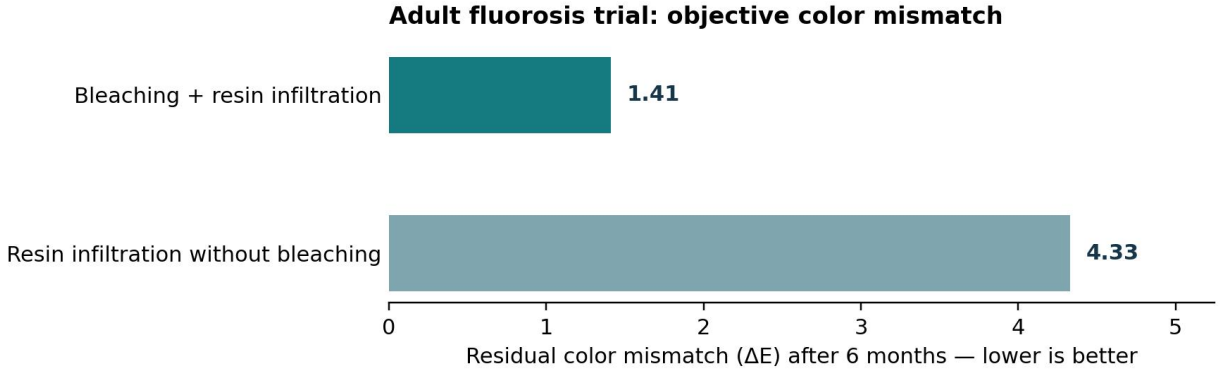


Figure 2. Six-month residual color mismatch (ΔE) after resin infiltration in an adult randomized trial, with and without prior in-office bleaching [4]. Lower values indicate less remaining color difference; these results are contextual, not evidence for the proposed child-specific fluoride-free combination.

Journal of Advances in Drug Research
ISSN: 2230-7761
www.jadr.co.in
Volume 17, Issue 05 Received 31.10.2026 Accepted 5.11.2026 Online 10.11.2026

Table 2. Mechanistic rationale and evidence boundaries for the proposed components

Component	Principal intended action	Direct evidence in fluorosis	Safety / interpretation point
Resin infiltration	Optical masking via penetration of porous enamel	Supported by pediatric trials and syntheses [3–10]	Clinical isolation, precise application, gingival protection; avoid assuming deep pitting is maskable
Fluoride-free hydroxyapatite	Support surface mineral balance / caries control	No established added masking effect after RI [13–17]	Verify actual fluoride-free formulation; long-term child evidence remains limited
CPP–ACP without added fluoride	Calcium/phosphate delivery to enamel	Indirect evidence from nonfluorotic white spots [18]	Milk-protein allergy contraindication; label review essential
Microabrasion or bleaching	Remove superficial stains / modify color	Fluorosis evidence exists [4–12]	Enamel removal or peroxide exposure requires pediatric risk–benefit review
Oral hygiene and dietary counseling	Control cariogenic exposures and protect restorations	Standard preventive rationale; not fluorosis-specific masking	Must not be omitted when aesthetic treatment is chosen

The original integration proposal is organized around a diagnostic separation between diffuse developmental fluorosis and active white-spot caries, followed by severity assessment and choice of the least invasive acceptable treatment. Mild nonpitted opacity with limited psychosocial burden may be managed by documentation, counseling and follow-up. Resin infiltration can be considered for persistent esthetic concern after clinical evaluation and informed discussion with caregivers, whereas significant pitting, cavitation, atypical asymmetric changes, or suspected molar–incisor hypomineralization warrant diagnostic reassessment. Fluoride-free calcium-phosphate products may be evaluated as a supporting maintenance intervention only when their purpose, composition and expected effects are made explicit. Table 3 summarizes potential decision points without turning the framework into an unvalidated treatment directive.

Journal of Advances in Drug Research
ISSN: 2230-7761
www.jadr.co.in
Volume 17, Issue 05 Received 31.10.2026 Accepted 5.11.2026 Online 10.11.2026

Table 3. Proposed phenotype-adapted pediatric care matrix (not clinically validated)

Presentation	Assessment priority	Proportionate option to consider	Review target
Very mild diffuse, intact opacity	Confirm developmental history, symmetry and no active caries	Counseling, photographs, monitoring	Appearance, caries activity, satisfaction
Mild/moderate nonpitted opacity; meaningful esthetic concern	Document severity, color difference, cooperation and consent	Clinician-selected resin infiltration after shared decision-making	Standardized photos, ΔE, discomfort, patient-rated appearance
Concurrent caries risk or surface changes	Separate fluorosis from active carious white spots	Evidence-based caries control; consider fluoride-free support only when appropriate	Caries activity and mineralization-related outcomes
Deep stain, surface pitting, atypical distribution	Exclude other developmental disorders, evaluate tissue loss	Specialist individualized planning; do not rely on infiltration alone	Structural integrity and functional symptoms
Known milk-protein allergy	Identify CPP–ACP component and excipients	Avoid casein-derived products; consider other approaches	Safety and tolerability

For future comparative testing, the most informative design would not compare a combined protocol against an untreated group alone. It should distinguish the optical effect of resin infiltration from the incremental effect of subsequent fluoride-free care while controlling for oral hygiene, diet, caries activity and baseline lesion grade. A stratified randomized study could compare standard infiltrant treatment with infiltrant treatment plus a predefined fluoride-free product, using identical posttreatment instructions apart from the randomized adjunct. Randomization would preferably occur at patient level to avoid treatment spillover within the same mouth; blinded evaluators should score standardized images and objective color values. Table 4 lists proposed endpoints and limitations for such a design.

Journal of Advances in Drug Research
ISSN: 2230-7761
www.jadr.co.in
Volume 17, Issue 05 Received 31.10.2026 Accepted 5.11.2026 Online 10.11.2026

Table 4. Suggested prospective validation protocol and outcome domains

Domain	Suggested recording or comparator	Scientific purpose
Design	Pediatric controlled trial: RI alone vs RI + defined fluoride-free support; prespecified eligibility	Isolate incremental contribution; avoid confounding by different clinical protocols
Baseline phenotype	Dean or TF grade, tooth surface, pitting, baseline CIELAB / ΔE, caries activity	Ensure severity comparability and account for phenotype heterogeneity
Esthetic outcome	Photographic ΔE to adjacent enamel, blinded VAS rating, child/parent satisfaction	Capture optical and patient-relevant change
Structural / preventive outcome	Standardized sensitivity, new carious lesions, lesion progression where indicated	Do not use caries outcomes as surrogate for fluorosis masking
Follow-up	Immediate, 3, 6 and 12 months with adverse-event documentation	Assess durability, discoloration, tolerability and maintenance
Analysis	Intention-to-treat; child-level clustering; pre-specified clinically important difference	Avoid tooth-level pseudoreplication and post hoc selective reporting

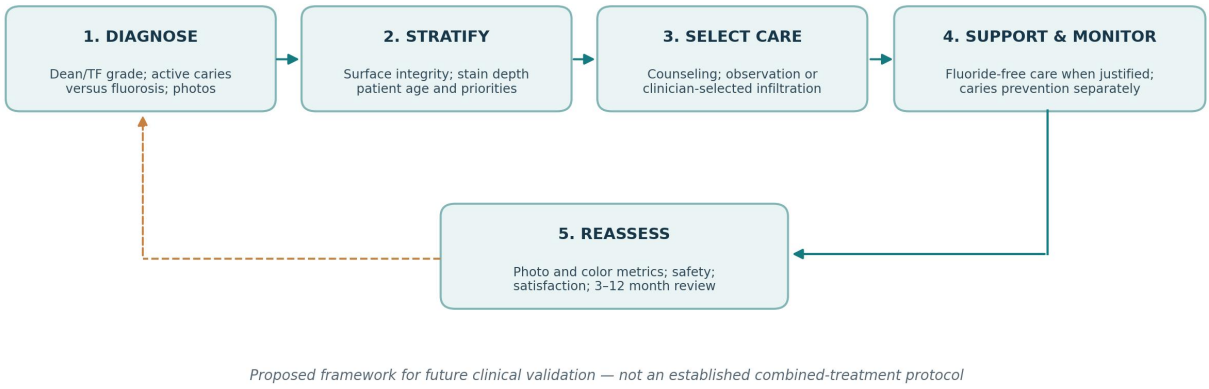


Figure 3. Author-proposed risk-adapted framework for diagnosis, minimally invasive treatment consideration and follow-up. This conceptual algorithm has not been validated as a treatment protocol.

Journal of Advances in Drug Research

ISSN: 2230-7761
www.jadr.co.in

Volume 17, Issue 05 | Received 31.10.2026 | Accepted 5.11.2026 | Online 10.11.2026

5. DISCUSSION

The central finding is that fluorosis management has a relatively mature evidence base for optical resin infiltration, while the particular combination of resin infiltration and fluoride-free remineralization remains an untested clinical claim. This separation is not a minor methodological qualification: a resin-filled subsurface may have different accessibility and optical behavior than untreated demineralized enamel, and a product that reduces caries progression need not reduce persistent developmental opacities. Theoretical synergy should therefore be framed as a testable hypothesis. Existing pediatric and adult trials establish meaningful possibilities for minimally invasive masking, but cannot by themselves establish the efficacy, duration, or safety of the proposed additive regimen [4–12].

The existing direct clinical studies also highlight the need to define patient-level outcomes more carefully. Young patients differ from adults in eruption stage, capacity to cooperate with isolation and application, perceived esthetic burden and susceptibility to new caries. Fluorosis classification and lesion characteristics matter because nonpitted chalky opacities may respond differently from brown staining, surface breakdown, and mixed developmental conditions. Cross-trial ΔE values are difficult to rank without uniform image calibration, follow-up, baseline color and a clear distinction between residual mismatch and absolute change. Consequently, the pooled 2025 result and the 2026 network rankings should be interpreted as supportive research findings, not a fixed hierarchy applicable to every child [8–10].

The rationale for fluoride-free remineralization requires additional nuance. Fluorosis results from excess fluoride during enamel development; a diagnosis of fluorosis does not mean that topical fluoride used appropriately after eruption is categorically contraindicated. Current fluoride caries-prevention benefits should not be discarded solely because the patient has fluorosis. However, families may have exposure-related concerns or clinical circumstances in which a verified fluoride-free hydroxyapatite product is considered. The randomized clinical and systematic evidence for such formulations focuses on prevention of caries or on nonfluorotic enamel lesions, and it is much thinner for durable pediatric effectiveness than the broad literature supporting fluoride toothpaste [13–17]. Any fluoride-free maintenance choice should therefore be individualized, with explicit attention to caries risk, total fluoride exposure, formulation and dental supervision.

CPP–ACP products deserve similarly precise framing. Their calcium-phosphate delivery mechanism differs from resin infiltration and their evidence in postorthodontic lesions does not directly predict improvement in fluorosis-related optical defects. Milk-protein allergy or other product-specific contraindications must be checked. In addition, immediate resin infiltration outcomes could be compromised by inappropriate sequencing, preparation, or post-treatment product use. A trial addressing multimodal therapy should standardize these issues, include adverse-event reporting, and evaluate both esthetic and preventive endpoints independently rather than combining them into an opaque global success score [5,18].

Journal of Advances in Drug Research

ISSN: 2230-7761
www.jadr.co.in

Volume 17, Issue 05 | Received 31.10.2026 | Accepted 5.11.2026 | Online 10.11.2026

This synthesis has several limitations. The search was selective rather than a protocol-driven systematic review, and the article does not provide an independent meta-analysis or risk-of-bias audit. The direct evidence uses heterogeneous lesion definitions, age ranges, comparators and treatment combinations. Fluoride-free hydroxyapatite research has substantial formulation variability, with some systematic reviews including studies supported by industry stakeholders. The proposed clinical framework and trial design are methodological contributions awaiting independent validation. No new pediatric data, changes in enamel mineral density, treatment adherence rates, adverse effects or follow-up success percentages are attributed to the author. These boundaries should be disclosed explicitly whenever this manuscript is submitted for peer review.

6. CONCLUSION

Resin infiltration is a defensible minimally invasive option for selected mild-to-moderate, nonpitted fluorotic enamel defects in children, provided that diagnosis, lesion morphology, oral health status and family preferences support intervention. Current randomized trials and systematic reviews demonstrate esthetic masking effects, although treatment response and durability depend on the population and protocol. Fluoride-free hydroxyapatite and selected calcium-phosphate systems have a rationale for enamel support and, in some circumstances, caries prevention; they have not yet been shown to provide an additional fluorosis-masking benefit when combined with resin infiltration. A carefully controlled pediatric study with separate esthetic, preventive and safety endpoints is needed before the proposed multimodal strategy can be presented as an established or superior treatment.

REFERENCES

1. Aoba T, Fejerskov O. Dental fluorosis: chemistry and biology. Crit Rev Oral Biol Med. 2002;13(2):155–170. doi:10.1177/154411130201300206.
2. DenBesten P, Li W. Chronic fluoride toxicity: dental fluorosis. Monogr Oral Sci. 2011;22:81–96. doi:10.1159/000327028.
3. Gugnani N, Pandit IK, Gupta M, et al. Comparative evaluation of esthetic changes in nonpitted fluorosis stains when treated with resin infiltration, in-office bleaching, and combination therapies. J Esthet Restor Dent. 2017;29(5):317–324. doi:10.1111/jerd.12312.
4. Schoppmeier CM, Derman SHM, Noack MJ, Wicht MJ. Power bleaching enhances resin infiltration masking effect of dental fluorosis: a randomized clinical trial. J Dent. 2018;79:77–84. doi:10.1016/j.jdent.2018.10.005.
5. Singhania S, Nandlal B, Shanbhog R, Veeramani R. Resin infiltration and remineralization interventions in management of moderate dental fluorosis: a quantitative light-induced fluorescence-based randomized controlled trial. Indian J Dent Res. 2021;32(3):362–371. doi:10.4103/ijdr.IJDR_998_20.
6. Garg I, Kumar A, Kumar A. Comparative evaluation of esthetic improvement of resin infiltration, in-office bleaching, enamel microabrasion and double resin infiltration on

Journal of Advances in Drug Research
ISSN: 2230-7761
www.jadr.co.in
Volume 17, Issue 05 Received 31.10.2026 Accepted 5.11.2026 Online 10.11.2026

non-pitted fluorosis stains: a randomized six-month interventional study. Int J Clin Pediatr Dent. 2022;15(1):20–34. doi:10.5005/jp-journals-10005-2140.

7. Asthana G, Patel K, Parmar R. Efficacy of microabrasion and resin infiltration techniques for masking of fluorotic white spot lesions: a randomized clinical study. J Conserv Dent Endod. 2023;26(6):677–681. doi:10.4103/JCDE.JCDE_95_23.
8. Han H, Lan T, Li F, Sun H. Resin infiltration for dental fluorosis: a systematic review and meta-analysis of randomized controlled trials on esthetic masking efficacy. J Esthet Restor Dent. 2025;37(12):2579–2589. doi:10.1111/jerd.70028.
9. Wittich FK, Cebula M, Effenberger S, et al. Masking efficacy of bleaching and/or resin infiltration of fluorotic spots on anterior teeth: a systematic review and meta-analysis. J Dent. 2024;149:105276. doi:10.1016/j.jdent.2024.105276.
10. Chaple Gil AM, Pereda Vázquez L, Santiesteban Velázquez M, Menendez JJ. Minimally invasive treatments for dental fluorosis: a network meta-analysis of esthetic masking efficacy. J Esthet Restor Dent. 2026;38(7):1323–1337. doi:10.1111/jerd.70119.
11. Saxena P, Grewal MS, Agarwal P, et al. Clinical efficacy of resin infiltration technique alone or in combination with micro abrasion and in-office bleaching in adults with mild-to-moderate fluorosis stains. J Pharm Bioallied Sci. 2021;13(Suppl 1):S301–S305. doi:10.4103/jpbs.JPBS_795_20.
12. Mittal N, Baranwal HC, Kharat SM, et al. Comparative evaluation of quantitative color changes in discolored anterior teeth by bleaching, resin infiltration, and microabrasion: a randomized clinical trial. J Conserv Dent Endod. 2025;28(6):537–542. doi:10.4103/JCDE.JCDE_229_25.
13. Chatzidimitriou K, Theodorou K, Seremidi K, et al. The role of hydroxyapatite-based, fluoride-free toothpastes on the prevention and remineralization of initial caries lesions: a systematic review and meta-analysis. J Dent. 2025;156:105691. doi:10.1016/j.jdent.2025.105691.
14. Paszynska E, Pawinska M, Gawriolek M, et al. Impact of a toothpaste with microcrystalline hydroxyapatite on the occurrence of early childhood caries: a 1-year randomized clinical trial. Sci Rep. 2021;11:2650. doi:10.1038/s41598-021-81112-y.
15. Pawinska M, Paszynska E, Amaechi BT, et al. Clinical evidence of caries prevention by hydroxyapatite: an updated systematic review and meta-analysis. J Dent. 2024;151:105429. doi:10.1016/j.jdent.2024.105429.
16. Wong AJ, Donnell CC. Navigating fluoride hesitancy: mapping the evidence base for fluoride-free toothpaste alternatives. Eur J Pediatr. 2026;185(7):507. doi:10.1007/s00431-026-07176-y.
17. Unterbrink P, Schulze Zur Wiesche E, Amaechi BT, Enax J. Fluoride-free toothpastes for caries prevention: a systematic review of clinical evidence on active ingredients. Clin Cosmet Investig Dent. 2026;18:586895. doi:10.2147/CCIDE.S586895.
18. Bröchner A, Christensen C, Kristensen B, et al. Treatment of post-orthodontic white spot lesions with casein phosphopeptide-stabilised amorphous calcium phosphate. Clin Oral Investig. 2011;15:369–373. doi:10.1007/s00784-010-0401-2.