Case Report

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Combined Fluoride Varnish and CPP-ACP Therapy for MIH-Related Hypersensitivity: A Clinical Case

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Abstract

Molar–incisor hypomineralization (MIH) is a qualitative, systemically induced enamel defect affecting one or more first permanent molars and often the permanent incisors, frequently associated with demarcated opacities, post-eruptive enamel breakdown and marked hypersensitivity, which complicate oral hygiene and dental treatment and negatively affect quality of life. The aim of this case report was to demonstrate the effect of a combined protocol of professional fluoride varnish application and home use of CPP-ACP (Tooth Mousse®) on MIH-related tooth hypersensitivity. A 7-year-old girl with a history of acute lymphoblastic leukaemia in remission presented with hypersensitivity of the first permanent molars. Clinical examination revealed extensive demarcated opacities with creamy-yellow to yellow-brown discoloration and porous, matte enamel surfaces, consistent with MIH, and baseline sensitivity scores of 2–3 on the Schiff Cold Air Sensitivity Scale (SCASS). The patient was treated with four weekly professional applications of 5% sodium fluoride varnish (Clinpro™ White Varnish) combined with daily home use of CPP-ACP cream (GC Tooth Mousse®) for 12 weeks and a 1450-ppm fluoride toothpaste. Reapplication of the fluoride varnish was performed at 3 months following the four-application protocol. Subjective improvement was reported after the first week, while after one month SCASS scores decreased to 1 for all first permanent molars and remained stable at the 6-month follow-up, with almost complete resolution of discomfort. In conclusion, the combined use of professional 5% NaF fluoride varnish and home-applied CPP-ACP resulted in a clinically meaningful and sustained reduction of MIH-related hypersensitivity, supporting this minimally invasive, biologically based approach as an effective strategy for managing sensitivity and improving enamel stability in children affected by MIH.

Keywords: MIH, tooth hypersensitivity, fluoride varnish, Tooth Mousse

Background

Molar–incisor hypomineralization (MIH) is defined as a qualitative, systemically induced enamel defect affecting one or more first permanent molars and often accompanied by disturbances in the enamel of the permanent incisors (1, 2, 3). The lesion represents a demarcated structural defect of

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enamel that is clearly distinguishable from the surrounding sound enamel in terms of color and translucency (1, 4). The clinical features of MIH include (4, 5):

- Demarcated opacities – oval or irregularly shaped areas of defective enamel with clearly defined margins relative to the surrounding sound enamel. Their color ranges from white/creamy to yellow-brown, with yellow-brown lesions generally being more porous and clinically more severe;
- Post-eruptive enamel breakdown;
- Atypical restorations – the clinical presentation often includes restorations in first permanent molars whose size and shape do not correspond to typical predilection sites for caries development and are not consistent with the child's age (e.g. large occluso-buccal/lingual restorations in recently erupted teeth). In MIH-affected teeth, restoration margins are frequently located in clinically visible hypomineralized enamel, and secondary defects and fractures around restorations are a common finding;
- MIH-related extractions – first permanent molars that are extracted at an early age due to severe post-eruptive breakdown may be retrospectively classified as MIH-affected if supported by anamnestic and clinical data (6, 7).
- Tooth hypersensitivity and functional complaints – patients with MIH frequently report pain in response to thermal, chemical and mechanical stimuli (cold drinks, toothbrushing, chewing), which may impair oral hygiene (2, 8).

Hypersensitivity, together with difficulties in achieving adequate local anesthesia of affected teeth, contributes to increased stress and treatment difficulties and negatively affects patients' quality of life. Studies in this field indicate that the application of fluoride varnishes may reduce this sensitivity (9). The standard material of choice is a 5% sodium fluoride (NaF) varnish containing 22,600 ppm fluoride (e.g. Duraphat®, Fluor Protector S®, Enamel Pro Varnish®) (10). The recommended protocol consists of four applications within one month (one application per week), followed by applications every three months (9).

A combination of fluoride applications with CPP-ACP / CPP-ACFP pastes or creams is recommended, with parental application 1–2 times daily on MIH-affected teeth (11).

Aim

The aim of this article is to demonstrate the effect of fluoride varnish application in combination with Tooth Mousse in a patient with MIH-related tooth hypersensitivity.

Case description

A 7-year-old girl was admitted to the dental office for consultation and treatment. She had been diagnosed at the age of 2 years with acute lymphoblastic leukemia (pre-B phenotype) with eosinophilia and was in remission at the time of the dental visit. The child was born at term and had suffered from prolonged neonatal jaundice (icterus neonatorum) after birth. The mother denied medication use or complications during pregnancy. Treatment of the systemic disease had included induction therapy with gradually increasing doses of corticosteroids, tumor lysis syndrome prophylaxis, and intravenous rehydration. Chemotherapy consisted of vincristine (Vcr)

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and farmarubicin, as well as L-asparaginase administered intramuscularly. As a consequence of chemotherapy combined with broad-spectrum antibiotic prophylaxis and frequent use of antipyretics (paracetamol), the patient developed a complication in the form of subacute hepatic failure due to toxic liver injury, requiring treatment with glucose–electrolyte solutions, Hexalgin, vitamin K, Urbason, calcium gluconate, propranolol, Furantril, spironolactone, Tigacil, Amikin, Fungostatin, Mepressor, Aminoplasmal Hepa, and transfusions of erythrocyte mass and plasma.

The reason for the dental visit was persistent tooth hypersensitivity. Both the patient and her mother reported sensitivity triggered by the intake of sweet foods and juices as well as by drinking cold water. The sensation lasted for several seconds and then subsided. It was localized to the first permanent molars in both the maxilla and mandible, predominantly in the third quadrant. The symptoms had been present for several months. The patient was using a fluoride-free homeopathic toothpaste intended for adults.

Clinical examination revealed extensive demarcated enamel opacities with irregular shape, involving the occlusal surfaces and cusps of the first permanent molars. The discoloration ranged from creamy-yellow to yellow-brown, with a loss of normal surface gloss and translucency. The border between affected and sound enamel was clearly distinguishable. The enamel surface appeared porous and matte, with signs of incipient enamel cavitation. The permanent incisors were also affected by similar lesions; however, their full extent could not be assessed because they were still erupting at the time of examination.

Objective sensitivity to cold stimuli was assessed using the Schiff Cold Air Sensitivity Scale (SCASS; 0–3) after application of an air stimulus from a three-way syringe (1 second, approximately 1 cm distance). Scores were defined as follows: 0 = no response; 1 = mild response without interruption of the procedure; 2 = response with interruption of the procedure; and 3 = strong response with refusal to continue. Scores of 2 and 3 were recorded for the molars at the initial visit.

The medical history, including prolonged neonatal jaundice and chemotherapy during early childhood, may have contributed to disturbances in enamel maturation and could be considered potential contributing factors to the development of MIH in this patient.

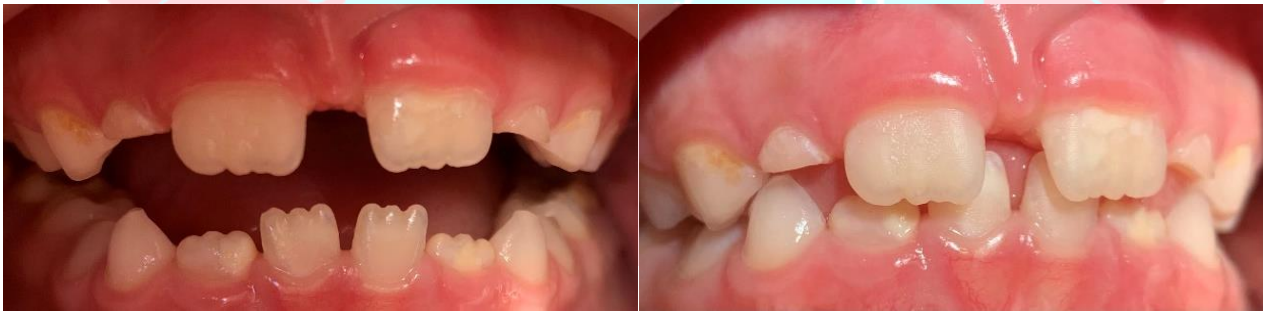

Figure 1. Clinical appearance of incisors affected by MIH

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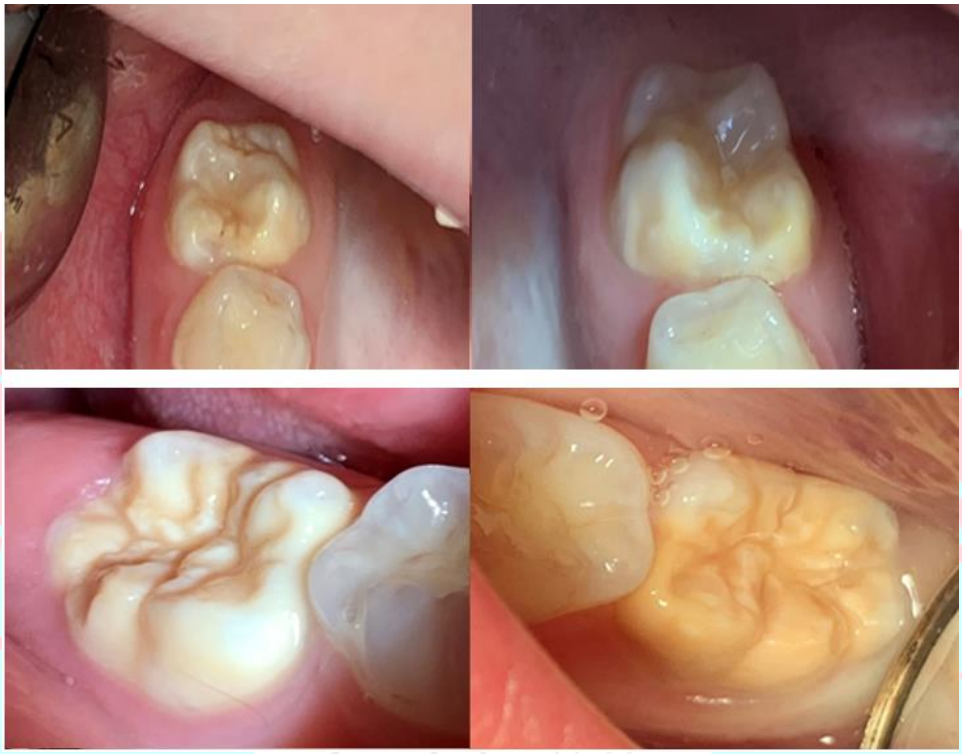

Figure 2. Clinical appearance of the first permanent molars affected by MIH

Combined protocol aimed at controlling hypersensitivity and increasing the mineral resistance of MIH-affected teeth was applied. Over four consecutive weeks, one application per week of 3M ESPE Clinpro™ 5% NaF White Varnish was performed after cleaning and gentle drying of the teeth. Reapplication of the fluoride varnish was carried out at three months following the four-application protocol. Fluoride varnish applications are recommended at three-month intervals. The protocol included:

1. Tooth preparation:

– cleaning with a toothbrush and a non-abrasive paste;
– brief rinsing;
– gentle drying;
– tooth isolation;

2. Application of the varnish to the affected teeth – a thin, even layer applied from the gingival margin toward the occlusal/incisal surface;

3. Post-operative instructions: no food or drinks for the first 30 minutes; avoidance of hard, sticky or "chewy" foods (chewing gum, caramel, nuts) during the first 4–6 hours; and no toothbrushing during this period (6).

The in-office treatment was combined with long-term daily use of a fluoride toothpaste (1450 ppm F) and home application of CPP-ACP cream (GC Tooth Mousse®) for 12 weeks, according to the manufacturer's instructions. In the evening, after brushing with a fluoride toothpaste (1450 ppm F), a small amount of Tooth Mousse was dispensed onto a clean, dry finger and applied to all teeth, using the tongue to distribute it evenly. The product was left on the teeth for at least 3 minutes

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while avoiding spitting and swallowing, after which the excess was expectorated. The remaining material was allowed to dissolve gradually on the tooth surfaces. Rinsing, eating, and drinking were avoided for 30 minutes after application.

Already after the first week of treatment, the patient reported subjective reduction of hypersensitivity, although no objective change was detected using the Schiff Cold Air Sensitivity Scale (SCASS; 0–3). After one month, the scores recorded for the four first permanent molars were 1 on the SCASS. At the six-month follow-up, these values were maintained, and the patient's subjective complaints had almost completely resolved.

Discussion

Empirical clinical evidence specifically addressing the effect of fluoride varnish alone on MIH-related hypersensitivity remains limited. Some studies indicate that remineralizing agents, including sodium fluoride varnish, may reduce sensitivity in MIH-affected teeth; however, large, long-term randomized clinical trials providing high-level evidence are still lacking, and therefore the available data are considered preliminary (9). Systematic reviews also suggest that, although some studies include fluoride varnish application, its effect on hypersensitivity alone is rather moderate, and greater effects are often observed when fluoride is combined with other desensitizing agents or techniques (12).

In the management of hypersensitivity associated with molar–incisor hypomineralization (MIH), both professional and home-based remineralizing strategies have been investigated to reduce enamel porosity and dentinal stimulation. In the present case, a combined protocol of four professional applications of 5% sodium fluoride varnish over one month, followed by daily home use of CPP-ACP (GC Tooth Mousse) for two months, resulted in a clinically meaningful reduction in sensitivity as assessed by the Schiff Cold Air Sensitivity Scale, alongside marked improvement in the patient's subjective comfort. Although randomized controlled trials directly evaluating this exact combination in MIH are scarce, existing evidence supports the individual components of the protocol. Clinical data indicate that home use of CPP-ACP significantly diminishes hypersensitivity in MIH-affected teeth, with reported reductions in thermal and mechanical sensitivity following extended application periods (e.g., 120 days) compared to controls using only fluoride toothpaste (13). In vitro investigations further demonstrate that CPP-ACP applications over several weeks enhance the mineral content and surface organization of hypomineralized enamel, providing a mechanistic basis for sustained desensitizing effects (14). Additionally, contemporary narrative reviews suggest a potential synergism between fluoride and CPP-ACP, whereby fluoride promotes surface fluorapatite formation and tubule occlusion, while CPP-ACP maintains a reservoir of bioavailable calcium and phosphate that facilitates deeper remineralization (15). The use of fluoride varnish as a professional intervention in MIH is supported by evidence that topical fluoride can occlude enamel porosities and promote surface mineralization, thereby reducing dentinal fluid flow and hypersensitivity. While most fluoride varnish studies have focused on caries prevention and remineralization rather than sensitivity per se, the European Academy of Pediatric Dentistry (EAPD) endorses the use of frequent fluoride varnish applications in MIH management to enhance mineral resistance and mitigate post-eruptive breakdown, given the compromised mineral content of hypomineralized enamel (6). Professional fluoride varnishes like 5% NaF deliver high

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concentrations of fluoride (22,600 ppm), which favor the formation of calcium fluoride-like reservoirs and fluorapatite that can reduce enamel solubility and contribute to tubule occlusion. Systematic reviews indicate that fluoride varnish alone is not among the most potent desensitizing agents for MIH when compared with other strategies; such reviews report that protocols using desensitizing pastes and mousses often result in a more pronounced short-term reduction in hypersensitivity (11). Nevertheless, fluoride varnishes remain among the preferred interventions in clinical practice, especially in children with MIH, due to their ability to deliver high concentrations of fluoride to the enamel surface, to prolong fluoride contact with the tooth, and to support enamel remineralization and resistance. In the context of the present case, the combination of four weekly applications of 5% sodium fluoride varnish with home application of CPP-ACP (GC Tooth Mousse®) likely contributed to a more stable and sustained reduction in hypersensitivity than would be expected from fluoride varnish alone. This approach reflects recommendations from major reviews suggesting that combined strategies (fluoride plus desensitizing agents) may have a synergistic effect in MIH and that fluoride varnishes often achieve better outcomes when applied repeatedly and as part of a multimodal protocol (12).

Conclusion

The combined use of professional 5% sodium fluoride varnish and home-applied CPP-ACP (Tooth Mousse®) resulted in a clinically meaningful and sustained reduction of hypersensitivity in MIH-affected teeth. This minimally invasive, biologically based approach may represent an effective strategy for improving comfort and enamel stability in children with molar–incisor hypomineralization.

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