Low-Level Laser Therapy for Management of Hypersensitivity in Molar-Incisor Hypomineralization and Oral Health-Related Quality of Life: Case Report

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The aim was to report the use low-level laser therapy (LLLT) in the management of hypersensitivity in an adolescent with molar incisor hypomineralization (MIH) and the impact of LLLT on his oral health-related quality of life (OHRQoL). Clinical examination revealed severe MIH with hypersensitivity, in all first permanent molars and incisors. The treatment proposed was desensitization with fluoride and esthetic rehabilitation of the affected teeth. Then, LLLT was applied perpendicularly in a continuous mode (wavelength of 808 nm, power of 100 mW, dose of 1 J, and fluence of 35 J/cm^2). The visual analogue scale was applied each session of LLLT. The child perceptions questionnaire (CPQ_{11-14}) was administered at the beginning and the end of the treatment. It was concluded that LLLT can be indicated in the management of hypersensitivity in an adolescent with severe MIH to control pain and to improve his OHRQoL.

Keywords*: Hypomineralization, Dentin Sensitivity, Laser Therapy, Adolescent*

INTRODUCTION

Molar incisor hypomineralization (MIH) is a qualitative defect of the enamel that asymmetrically affects one to four permanent molars and may also affect incisors[1], with a worldwide prevalence of 14.2%[2]. Clinically, MIH presents as a demarcated opacity with chromatic changes that vary from white/cream to yellow/brown, and post-eruptive breakdown (PEB) may occur owing to masticatory efforts. MIH may also be associated with carious lesions in the molars and the incisors[1]. In addition, according to severity, it may present with hypersensitivity[3]. These clinical characteristics of MIH have aesthetic, social, and functional effects, impacting the oral health-related quality of life (OHRQoL) of children and adolescents[4,5].

Hypersensitivity can be considered as one of the biggest challenges in the treatment of MIH. A recent study reported a prevalence of 34.7% of hypersensitivity in the molars of children affected by MIH, through stimulation with an air blast using an air syringe by tactile examination[3]. The high porosity of the affected enamel favors the penetration of bacteria in the dentinal tubules, promoting chronic inflammation of the pulp tissue[6].

Although a defined protocol for the management of hypersensitivity in patients with MIH is lacking, some therapies with promising results have been proposed to promote analgesia. These include the administration of non-steroidal anti-inflammatory drugs before and after the dental visit[7], the use of fluoride varnishes[8], pit and fissure sealants, restorations with chemically activated glass ionomer cement[8], the use of desensitizing toothpaste containing arginine[9], other desensitizing agents, and photobiomodulation (PBM) therapy with low-level lasers[10]and high intensity laser therapy[11].

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Controlling symptoms such as pain in the teeth affected by MIH is essential to improve the health and quality of life of these patients. Thus, the aim of this study was to report the use of PBM with low-level laser therapy (LLLT) in the management of hypersensitivity in an adolescent diagnosed with MIH and the impact of LLLT on his oral health-related quality of life (OHRQoL).

Case report

Accompanied by his mother, an 11-year-old male adolescent visited the Pediatric Dentistry Dental Clinic at COESP, João Pessoa, PB, Brazil, with a complaint of tooth sensitivity and discomfort in relation to dental aesthetics. Prior to the treatment of the patient, his parents signed an informed consent form.

In the anamnesis, his mother reported of no complications during her pregnancy with a full term-delivery. At the age of two years, the patient was hospitalized for an infection in the gastrointestinal tract and antibiotics were administered. Dental changes were noticed when the molars and the incisors began to erupt. At that time, the patient did not report previous history of tooth sensitivity/painful symptoms of high intensity.

Clinically, demarcated opacities were observed in the tooth enamel, varying from white/cream in permanent maxillary incisors and permanent mandibular left central incisor, to yellow/brown in all permanent first molars and permanent mandibular right incisors and mandibular left lateral incisor. Permanent maxillary first molars and permanent mandibular right first molar also had PEB, which on radiographic examination were found to be associated with carious lesions in the molars and the incisors, without the involvement of pulp tissue (Figure 1). Thus, the patient was diagnosed with MIH. During a tactile examination, it was observed that he had severe hypersensitivity in all the affected teeth and also complained of discomfort while performing daily activities, chewing, and practicing oral hygiene. Therefore, due to severe hypersensitivity, compressed air stimulation was not feasible.

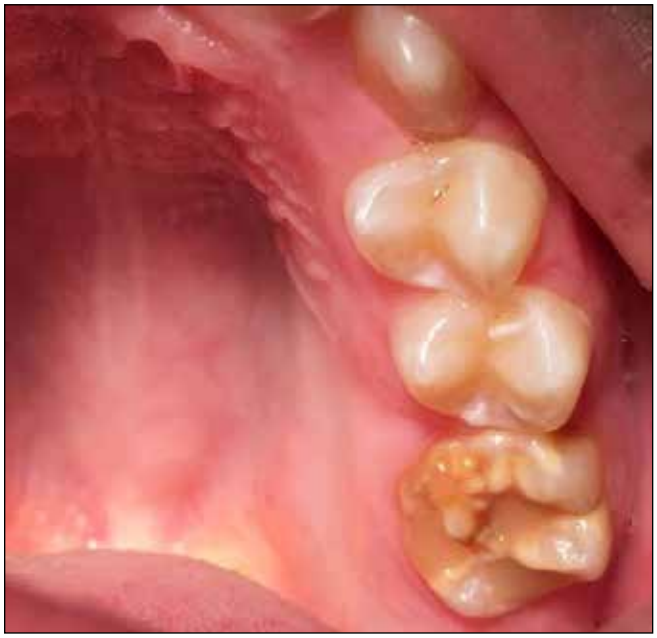

Figure 1. Permanent maxillary left first molar with severe molar incisor hypomineralization (MIH) showing post-eruptive breakdown (PEB) and unsatisfactory restoration.

The proposed treatment was based on desensitization with fluoride varnish and aesthetic and functional rehabilitation of the affected teeth. Initially, selective removal of the decayed tissues and sealing of cavities were performed using resin-modified glass ionomer cement (Riva Light Cure®, SDI, Victoria, Australia) on the permanent maxillary first molars and mandibular right first molar. Following this, fluoride varnish (Duraphat®, Colgate, New York, USA) was applied on teeth affected by MIH (four dental visits).

During the first dental visit, the restorative procedure was performed under local anesthesia using 2% lidocaine with 1:100,000 epinephrine (Alphacaine®, DFL, Rio de Janeiro, Brazil). However, due to the complaint of severe hypersensitivity, 100 mg/mL ibuprofen was prescribed (Alivium®, Mantecorp, São Paulo) 24 h before the dental visit and 1 h before the anesthetic procedure, which was performed using 4% articaine with 1:100,000 epinephrine (Articaine®, DFL, Rio de Janeiro, Brazil).

Next, esthetic rehabilitation of the permanent maxillary left central incisor and all permanent mandibular incisors was performed using the macro abrasion and composite resin technique (Opallis®, FGM, Joinville, Brazil). At the end of the procedure, the patient still had severe hypersensitivity in the teeth affected by MIH. Thus, a regular use of a toothpaste containing sodium fluoride (0.32%) and potassium nitrate (5%) (Sensi Kin®, KIN, Spain) was recommended for two months.

Figure 2. Low-level laser therapy (LLLT) was applied perpendicularly to the cervical region of the permanent maxillary left first molar affected by molar incisor hypomineralization (MIH).

At the end of this period, the patient still experienced pain, especially while cleaning his teeth that were treated. Therefore, LLLT was used for hypersensitivity management. Five applications were performed, once a week, with an infrared laser (Whitening Lase II®, DMC Equipamentos Ltda., São Carlos, Brazil) in a continuous mode, using a wavelength of 808 nm, power of 100 mW, dose of 1 J, and fluence of 35 J/cm^2 following the manufacturer's instructions (DMC protocol for DH) (Figure 2). The laser was applied perpendicularly to the cervical region of the teeth affected by MIH (Figure 3). To measure pain intensity, the visual analogue scale (VAS) was applied before and after each session of LLLT. Table 1 shows the pain assessment results reported by the patient during treatment.

The Child Perceptions Questionnaire (CPQ_{11-14}) for children aged 11 to 14 years was provided to the patient for OHRQoL assessment at two points, and the total scores were as follows: before the beginning of LLLT (total score: 34) and after LLLT (total score: 31). It was noteworthy that the patient reported an improvement in his daily activities of "eating an ice cream" and "blowing air."

Currently, the patient has been followed-up for three years with periodic control for oral health assessment, with no complaints of severe hypersensitivity. The patient was also referred for orthodontic treatment.

Figure 3. Use of low-level laser therapy (LLLT) to control hypersensitivity on permanent mandibular incisors.

Table 1. Pain assessment with the visual analogue scale (VAS), before and after treatment with low-level laser therapy (LLLT)

LLLT Session	VAS Before LLLT	VAS After LLLT
First	9	6
Second	9	6
Third	7	5
Fourth	7	5
Fifth	5	3

DISCUSSION

Hypersensitivity is a common complication found in patients with MIH and is considered one of the biggest challenges for the management of these cases[8]. Patients with MIH and associated hypersensitivity experience severe pain, often with limitations in performing day-to-day activities[3,12]. In this case report, the patient had severe MIH in several teeth with a complaint of severe hypersensitivity during oral hygiene practices and eating. It is important to note that in cases of severe MIH, hypersensitivity cannot be considered a symptom caused exclusively by the disturbance found in the dental tissue. In such cases, associated carious lesions and enamel fractures with dentin exposure are common, also influencing symptoms such as pain[3,13-16]. In the present case report, the patient sought dental care at late stages, only at age 11. The patient did not report previous history of tooth sensitivity/painful symptoms of high intensity. We believe that the MIH demarcated opacities had suffered enamel breakdown at a later time and not soon after tooth eruption, which probably postponed the demand for dental treatment.

The etiology of MIH is not well defined. It is believed to be a multifactorial condition associated with genetic factors[17] and early childhood illness, in particular fever, asthma and pneumonia[18,19]. Some studies have shown that MIH can occur in permanent second molars, suggesting that changes occur in relation to the development of opacities[19,20]. Thus, it is not possible to state that the use of antibiotics to treat an infection of the gastrointestinal tract at 2 years of age are the exclusive etiological factors in this patient. It can be speculated that this episode can be considered as an aggravating factor that can alter the functions of the ameloblast. It is noteworthy that first permanent molars and incisors begin amelogenesis at birth, but finish their crown formation at 3 years of age[21].

The treatment approaches for MIH are related to its severity, which can be noninvasive, microinvasive, and invasive[8-11]. However, there is no defined protocol. In the present case, due to the severity of MIH and hypersensitivity, different approaches were used for better patient management. Applications of fluoride varnish, restorations with resin-modified glass ionomer cement, macro abrasion, and composite resin were carried out using desensitizing dentifrice. Even after using established procedures, the patient complained of great discomfort, probably owing to porosity of the enamel and chronic inflammation of the pulp tissue[6] affecting his OHRQoL[4,5]. Thus, PBM with LLLT was proposed for the management of hypersensitivity to stimulate tooth analgesia[10,12]. It should be mentioned that there is no defined protocol for pain control using LLLT in patients diagnosed with MIH[10,22].

The mechanism of action of LLLT in analgesia has not been defined in the literature. Studies suggest that LLLT promotes a reversible blockade of the central and peripheral sensory nerve fibers, in addition to promoting the release of beta endorphin, a neurotransmitter with analgesic properties[23-25]. In the present case, after each application of LLLT, the patient reported a decrease in pain intensity measured by VAS. In addition, the patient reported improvement when performing his daily activities, especially after the last session. According to Muniz et al.[10], LLLT shows immediate results in patients with MIH when compared to fluoride varnish applications alone or combined with LLLT.

Although the total OHRQoL score showed a small decrease, according to the patient's perception, there were different answers to the specific issues related to the health of his teeth, ingestion of hot and cold foods that previously impacted "frequently," after the LLLT started to impact "sometimes." Considering that the Child Perceptions Questionnaire (CPQ11-14) assesses several oral health factors and not only the patient's perception in relation to hypersensitivity and pain control, it can be assumed that dissatisfaction of the patient with other MIH factors may have influenced the results obtained through the questionnaire. Thus, it should be encouraged to combine different techniques to assess the effect of pain control of dentin hypersensitivity in patients diagnosed with MIH.

A recent study, observed that sealing of hypersensitive MIH-affected molars revealed a significant improvement of OHRQoL immediately and throughout a 12-week follow-up using the German version of the CPQ8-10[26]. Thus, longitudinal clinical studies are recommended to understand the effect of LLLT on hypersensitivity, to reduce the impact of hypersensitivity on OHRQoL in patients with MIH. In addition, protocols for the use of LLLT in MIH need to be developed and validated, since there is no specific pattern for the management of hypersensitivity associated with MIH. In this case report, the protocol based on 5 LLLT applications was performed according to previous positive results for the control of dentin hypersensitivity[12,27] and the manufacturer's recommendations. It can be concluded that LLLT is a therapy that can be indicated in the management of hypersensitivity in an adolescent with severe MIH to control pain and discomfort and to improve his OHRQoL.

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