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Restoration of permanent teeth affected by molar-incisor hypomineralisation

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Abstract

Molar-incisor hypomineralization (MIH) is a qualitative disorder of dental enamel, where 10%-20% of children and adolescents are affected due to extensive enamel breakdown.

Aim: To analyze the literature about molar incisor hypomineralization, its etiology and clinical characteristics, as well as its effects on adherence and different treatment plans.

Methods: The search for published articles was carried out using the PubMed and Google Scholar databases. Keywords used for the search include "Molar-incisor hypomineralization", "Him", "Restorative treatment", "Adhesion".

Results: Him is an enamel defect associated with premature births, fever, and infectious diseases in childhood. It presents with demarcated opacities of white, yellow or brown color due to breakdown of the enamel causing hypersensitivity. The microstructural characteristics of hypomineralized enamel generate adhesion problems, for which the most widely used protocol is the total removal of the affected tissue. Among the treatments are from ionomers to ceramics, depending on the degree of condition and cooperation of the patient.

Conclusion: To carry out the restorative treatment in pieces with him, it is necessary to follow protocols with greater care. An early diagnosis and appropriate treatment are ideal to give the affected parts a better prognosis.

Keywords: Hipomineralización, tratamiento restaurador, Adhesión, him

Introduction

Hypomineralization of molar-incisor (Him) is a common dental developmental disorder affecting 10%-20% of children and adolescents. Affected patients report limited functionality due to extensive enamel breakdown, as well as hypersensitivity and hygiene difficulty, ultimately associated with an increased risk of caries (Cavalheiro, 2020) [7]. Early diagnosis is crucial in him to prevent subsequent complications such as hypersensitivity, dental caries, pulp inflammation, and pain. Thus, preventive interventions are advisable and indicated (Bandeira, 2021) [4]. Preventive treatments such as sealants, resins, and glass ionomers may be effective but with limited longevity. The use of an adhesive system to ensure greater restoration longevity allowing for increased retention remains controversial (Al Saffan, 2021) [1]. Weerheijm *et al.* (2001) [45] first introduced the term "Molar Incisor Hypomineralization" to define the developmental defect of the first permanent molars and incisors resulting in insufficient mineralization and maturation of both enamel and dentin. Studies have reported an average prevalence of 14%, labeling it as the "New Disease of the 21st Century" due to its increasing cases (Cook, 2022) [9].

The treatment of teeth affected by him still poses a challenge in clinical practice. Currently, there is no consensus on the best treatment option for severe him defects (Dhareula, 2019) [10]. Given the treatment difficulties, there is a need to evaluate restorative protocols associated with the use of materials with current technologies to restore the lost structure of affected teeth (Rolim, 2021) [38].

Reduced bonding forces of resin cements or composites to hypomineralized enamel increase restoration failure (Lygidakis, 2022) [20].

Although there is a general consensus that the most appropriate method currently for the restoration of hypomineralized molars is adhesive restorations, it is still unclear whether partial or total removal of defective enamel before adhesion would be best for the patient.

Justification

Him is a common enamel defect that can have various clinical implications, ranging from aesthetic and hygiene issues to difficulties in food intake due to hypersensitivity. Analyzing the literature and establishing a protocol for long-term rehabilitation of affected teeth is crucial to improve the patient's quality of life.

Objective

The objective is to analyze the literature on molar-incisor hypomineralization, its etiology, clinical characteristics, effects on adhesion, and different treatment plans.

Methodology

A search for articles published in the last 5 years was conducted using the PubMed and Google Scholar databases. Keywords such as "Molar-incisor hypomineralization," "Him", "Restorative treatment" and "Adhesion" were used for the search.

Results

Etiology

Prenatal Factors

Multiple maternal diseases during pregnancy have been associated with the presence of him, however, none have been significant. Conversely, the intake of drugs, smoking, or alcohol has shown no evidence of being related to Him.

Perinatal Factors

During the perinatal period, parameters such as hypoxia, premature birth, low birth weight, and birth complications have been associated with him.

Postnatal Factors

Many postnatal factors can intervene from birth to 4 years of age, which are considered critical for the development of him. Common associations include antibiotics, childhood illnesses such as measles, urinary tract infections, fever, pneumonia, and asthma.

Genetic Factors

A genetic predisposition to him has been proposed along with one or several other etiological factors. Certain variants in genes related to amelogenesis or genes related to the immune response have been identified in children with him.

Common associations with him include premature births, fever, and recurrent infectious diseases during childhood, as well as genetic factors. However, the exact etiology of him has not been identified.

Characteristics

Structural Characteristics

Dental enamel, in a normal state, has a mineral content of 95%, providing high hardness to withstand occlusal and masticatory forces. The remaining 5% is composed of water and organic content. Enamel affected by him generally shows a reduction in both quantity and quality of mineral content, resulting in reduced hardness and elasticity and increased porosity and protein content, which hinder the growth of

hydroxyapatite crystals. The microstructural characteristics of hypomineralized enamel are clinically manifested as enamel opacities. The porous structure of enamel and its breakdown lead to dentin exposure and the development of carious lesions. Additionally, dentin may also be negatively affected by him, presenting morphological alterations such as increased interglobular dentin, which compared to normal dentin, has lower mineral density.

Clinical Characteristics

Clinically, hypomineralized enamel appears porous and chalky. It presents demarcated opacities of white, yellow, or brown color, usually limited to the incisal third. The degree of opacity of the lesion is directly related to the degree of porosity, so creamy or white lesions are less porous compared to yellow or brown enamel. These lesions can be classified into three categories: mild, with isolated opacity and no symptoms; moderate, affecting the occlusal third, presenting little sensitivity; and severe, characterized by enamel breakdown, caries, and symptomatic presentation. Depending on the severity of the lesion, symptoms may include sensitivity to cold, heat, or mechanical stimuli, difficulty chewing food, carious teeth, among others. Additionally, rapid progression of carious lesions is common due to enamel structure and brushing difficulty caused by hypersensitivity. Early detection, intervention, and appropriate therapy can prevent severe complications and improve both masticatory function and aesthetics.

Enamel affected by him presents a high protein content that limits hydroxyapatite crystal growth, resulting in porous enamel. These characteristics lead to clinical findings ranging from aesthetic concerns to the development of extensive carious lesions and enamel breakdown resulting in hypersensitivity and hygiene complications.

Adhesion

One of the complications within him is the difficulty in adhesion for restorative treatment. Affected enamel exhibits lower mechanical properties, leading to more failures in margin integrity. Additionally, due to the disorganized enamel prisms, when etched with phosphoric acid, an organic layer with a different etching pattern than healthy enamel is exposed. Consequently, restorations may present micro leakage, interfering with sealing and restoration longevity. Various protocols or suggestions have been established to improve adhesion to hypomineralized substrates.

Universal Adhesives

Universal adhesives serve as an alternative to phosphoric acid etching as they contain monomers that allow for structure demineralization and adhesive infiltration. This avoids creating an etching pattern like that of phosphoric acid which may affect future restoration margin integrity.

Deproteinization

Pre-treatment with 5% NaOCl has been found to increase the success of bonding orthodontic brackets to teeth affected by imperfect amelogenesis, suggesting its use in him patients. NaOCl treatment has shown to be effective in preventing significant dental tissue loss. Clinically, higher survival rates in resin restorations have been found with prior 5% NaOCl treatment.

Complete removal of hypomineralized enamel

Regardless of the adhesion protocol used, hypomineralized

enamel presents a porous adhesive-enamel interface with micro fractures. This interface has been associated with increased marginal fractures compromising restoration integrity. Thus, complete removal of hypomineralized enamel to obtain completely healthy enamel has been suggested. However, even apparently unaffected enamel exhibits microstructural changes that compromise restoration survival. Currently, adhesion in him cases is controversial. Strategies have been suggested to improve restoration longevity; however, no protocol has been established to ensure it. Currently, the most accepted adhesion protocol involves complete removal of hypomineralized enamel to ensure restoration on a healthy substrate.

Restorative Treatment

For patients with him-affected teeth, restorative treatment is recommended in case of structural loss, dentin exposure, or carious lesion development in the affected tissue. When establishing a treatment plan, potential complications must be considered, including hypersensitivity, difficulty in administering proper anesthesia, and patient cooperation during treatment. Therefore, non-invasive restoration procedures are necessary to reduce hypersensitivity, protect hypomineralized tissue, ensure patient cooperation, and improve oral health-related quality of life.

Glass Ionomer

When the patient exhibits poor cooperation for more invasive treatment, restoration with glass ionomer cements is suggested. These restorations promote enamel remineralization and reduce caries development and hypersensitivity. However, the effectiveness of these effects remains unclear, so glass ionomer use is considered provisional.

Composite Resin

Composite resin restoration is considered definitive. This material is capable of restoring all severity levels of him. However, resin use requires patient cooperation to achieve absolute isolation. Additionally, different adhesive systems and protocols prior to phosphoric acid etching, such as deproteinization with 5% NaOCl, must be considered.

Ceramic Restorations

Successful use of indirect restorations in him has been reported, mainly utilizing ceramic restorations. Marginal sealing on healthy enamel is suggested in all indirect restorations, resulting in a more invasive treatment. Therefore, this treatment is usually recommended in severe stages of him.

Among the various restorative treatments for him-affected teeth, there are minimally invasive procedures and those requiring the removal of more tissue. It is necessary to understand their applications to evaluate patient conditions and choose the appropriate treatment. Depending on patient cooperation and structural damage, the ideal restoration protocol should be chosen.

Conclusion

Him is an enamel defect currently recognized as a global health problem. Despite significant interest and extensive research, its etiology is not fully understood, and no treatment has been found to prevent its manifestation. Furthermore, due to its microstructural characteristics and negative effects on adhesion, no established protocol exists for its rehabilitation.

However, multiple treatment plans have been recommended that, depending on the case, could prevent its progression and reduce long-term symptoms.

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