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IMPROVING MINIMALLY INVASIVE TREATMENT APPROACHES FOR PERMANENT TEETH CARIES IN CHILDREN DURING THE LATE MIXED DENTITION PERIOD: A NARRATIVE REVIEW

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Abstract

Dental caries remains one of the most prevalent chronic diseases in children, especially during the late mixed dentition period (6–12 years), when permanent teeth are erupting and undergoing post-eruptive maturation. The aim of this review is to analyze and systematize modern minimally invasive approaches for the management of caries in permanent teeth among children. Emphasis is placed on early diagnosis, remineralization strategies, and non-invasive or micro-invasive interventions such as resin infiltration, atraumatic restorative treatment (ART), fissure sealing, and ozone therapy. These approaches aim to preserve tooth structure, reduce patient discomfort, and improve long-term outcomes. The integration of minimally invasive dentistry into pediatric practice represents a significant advancement in caries management.

Keywords: dental caries, children, minimally invasive dentistry, remineralization, resin infiltration, ART, fissure sealants

1. Introduction

Dental caries is a multifactorial disease characterized by demineralization of the tooth structure due to bacterial activity. Children in the late mixed dentition stage are particularly vulnerable due to incomplete enamel mineralization and increased exposure to cariogenic factors.

Traditional restorative approaches often involve removal of substantial tooth structure, which may compromise the long-term integrity of the tooth. In contrast, Minimal Intervention Dentistry focuses on early detection, prevention, and preservation of healthy dental tissues.

This review aims to evaluate contemporary minimally invasive techniques and their clinical effectiveness in managing caries in permanent teeth during this critical developmental period.

2. Materials and Methods

This narrative review is based on an analysis of peer-reviewed articles indexed in Scopus, PubMed, and Web of Science databases. Relevant literature published between 2000 and 2024 was selected using keywords such as “minimally invasive dentistry,” “pediatric caries management,” and “resin infiltration.”

Inclusion criteria:

- Studies on children aged 6–12 years
- Articles focusing on minimally invasive or non-invasive caries treatment
- Clinical trials, systematic reviews, and meta-analyses

Exclusion criteria:

- Studies on adults
- Invasive restorative techniques only

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3. Early Diagnosis of Dental Caries

Early detection is essential for the success of minimally invasive approaches. Diagnostic tools include:

- Visual-tactile examination
- Laser fluorescence devices (e.g., DIAGNOdent)
- Bitewing radiography
- Caries detection dyes

These methods allow clinicians to identify lesions at the initial stage, where non-invasive treatment is most effective.

4. Minimally Invasive Treatment Methods

4.1 Remineralization Therapy

Remineralization is a cornerstone of non-invasive caries management. It involves restoring lost minerals in enamel through:

- Fluoride varnishes
- Calcium-phosphate agents (CPP-ACP)
- Bioactive materials

Clinical studies show that early enamel lesions can be reversed without mechanical intervention.

4.2 Resin Infiltration Technique

Resin infiltration is a micro-invasive method that uses low-viscosity resin to penetrate and seal porous enamel lesions.

Advantages:

- No drilling required
- High aesthetic outcomes
- Effective in arresting early proximal caries

4.3 Atraumatic Restorative Treatment (ART)

Atraumatic Restorative Treatment involves the removal of softened dentin using hand instruments and restoration with glass ionomer cement.

Advantages:

- Minimal discomfort
- No need for anesthesia
- Fluoride release enhances remineralization

4.4 Fissure Sealants

Fissure sealants are applied to occlusal surfaces of molars to prevent plaque accumulation and caries development.

They are particularly effective immediately after tooth eruption.

4.5 Ozone Therapy

Ozone therapy in dentistry has antimicrobial properties and can reduce bacterial load in early carious lesions.

However, evidence regarding long-term effectiveness remains controversial.

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5. Discussion

Minimally invasive dentistry offers several advantages over traditional methods:

- Preservation of healthy tooth tissue
- Reduced anxiety and pain in pediatric patients
- Improved patient compliance
- Lower risk of restoration failure

However, the success of these approaches depends on accurate diagnosis, patient cooperation, and regular follow-up.

Combining different methods—such as remineralization with sealants or infiltration—can significantly enhance treatment outcomes.

6. Conclusion

The implementation of minimally invasive techniques in managing caries in permanent teeth during the late mixed dentition period is both effective and clinically justified. These approaches not only arrest disease progression but also promote natural remineralization and preserve tooth structure.

Future research should focus on long-term clinical outcomes and the development of more advanced bioactive materials.

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