

**USE OF MODERN GLASS IONOMER CEMENTS IN PEDIATRIC DENTISTRY****Barotova Shakhnoza Oripovna.**

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<https://doi.org/10.5281/zenodo.20349031>**Abstract**

Modern pediatric dentistry aims to preserve dental tissues, prevent complications, and ensure comfortable treatment for children. Among restorative materials, glass ionomer cements (GICs) occupy an important place due to their biological compatibility, fluoride release, chemical adhesion to tooth tissues, and ease of application. In recent years, significant progress has been achieved in the development of modern glass ionomer materials, including resin-modified glass ionomer cements and high-viscosity glass ionomers. These materials demonstrate improved mechanical strength, aesthetics, and clinical durability. The purpose of this article is to analyze the characteristics, advantages, disadvantages, and clinical applications of modern glass ionomer cements in pediatric dentistry. The article also discusses their role in preventive and minimally invasive dentistry. Modern GICs are widely used for restorations of primary teeth, atraumatic restorative treatment, fissure sealing, cavity lining, and orthodontic procedures. Their fluoride-releasing ability contributes to secondary caries prevention, which is especially important in children with high caries activity. Despite some limitations related to wear resistance and esthetics compared with composite materials, modern glass ionomer cements remain indispensable materials in pediatric dental practice.

**Keywords:** pediatric dentistry, glass ionomer cement, fluoride release, atraumatic restorative treatment, minimally invasive dentistry, primary teeth.

**Introduction**

Dental caries remains one of the most common chronic diseases among children worldwide. The high prevalence of carious lesions in primary teeth negatively affects nutrition, speech development, general health, and quality of life. Pediatric dentistry therefore focuses not only on treatment but also on prevention and minimally invasive management of dental diseases.

Modern restorative dentistry has introduced a wide variety of materials for the treatment of dental caries in children. Among these materials, glass ionomer cements have gained special significance because of their unique physical, chemical, and biological properties. Since their introduction in the 1970s, glass ionomer cements have undergone continuous modifications aimed at improving their clinical performance.

The main advantage of glass ionomer cements is their ability to chemically bond to enamel and dentin without the need for complicated adhesive systems. In addition, these materials continuously release fluoride ions, contributing to enamel remineralization and inhibition of cariogenic microorganisms. Such properties make them particularly suitable for pediatric patients, where prevention of recurrent caries is essential.

Children often present difficulties related to cooperation during dental procedures. Modern GICs simplify restorative treatment because they require less chair time, are moisture tolerant, and can be applied with relatively simple clinical techniques. These characteristics are highly valuable in young children and patients with special healthcare needs.

Today, different types of modern glass ionomer cements are available, including conventional GICs, resin-modified GICs, and high-viscosity GICs. Each type has specific indications in pediatric dentistry and contributes to minimally invasive restorative approaches.

### **Main Characteristics of Modern Glass Ionomer Cements**

Glass ionomer cements are composed mainly of fluoroaluminosilicate glass powder and polyacrylic acid. The setting reaction occurs through an acid-base mechanism, resulting in the formation of a rigid matrix capable of adhering chemically to tooth tissues.

One of the most important characteristics of modern GICs is fluoride release. Fluoride ions are gradually released over time and can be recharged from external fluoride sources such as toothpaste or fluoride varnishes. This continuous fluoride availability reduces the risk of secondary caries and promotes remineralization of demineralized enamel.

Another important property is biocompatibility. Glass ionomer cements are generally well tolerated by pulp and periodontal tissues. They produce minimal irritation and are suitable for deep cavities in primary teeth when appropriate liners are used.

Modern high-viscosity glass ionomers demonstrate improved compressive strength and wear resistance compared with earlier generations of GICs. Resin-modified glass ionomer cements contain additional resin components, usually hydroxyethyl methacrylate (HEMA), which improve handling properties, esthetics, and setting characteristics through light polymerization.

Moisture tolerance is another valuable feature in pediatric dentistry. Isolation in children can be difficult, especially in partially erupted teeth or uncooperative patients. Unlike composite resins, glass ionomer cements are less sensitive to moisture contamination during placement.

The thermal expansion coefficient of GICs is similar to that of natural tooth tissues, reducing the risk of marginal leakage and microcracks. Furthermore, their chemical adhesion decreases the need for extensive cavity preparation, preserving healthy tooth structure.

### **Clinical Applications in Pediatric Dentistry**

#### **Restoration of Primary Teeth**

Modern glass ionomer cements are widely used for restorations in primary teeth. Their chemical adhesion and fluoride release are highly beneficial in children with high caries risk. Small and medium-sized cavities in primary molars can be effectively restored using high-viscosity GICs.

Resin-modified glass ionomer cements are particularly useful in cervical lesions and Class III or Class V restorations because they provide better esthetics and improved surface smoothness. The reduced treatment time also helps improve cooperation in pediatric patients.

#### **Atraumatic Restorative Treatment (ART)**

Atraumatic restorative treatment is a minimally invasive approach developed for communities with limited access to dental equipment. In ART, softened carious dentin is removed using hand instruments, and the cavity is restored with high-viscosity glass ionomer cement.

Modern GICs play a central role in ART procedures because they bond chemically to the tooth surface and release fluoride. ART is especially valuable in young children, anxious patients, and community-based preventive programs.

Clinical studies have demonstrated good survival rates of ART restorations in primary teeth, particularly in single-surface cavities. This technique also reduces fear and anxiety associated with conventional rotary instruments.

#### **Fissure Sealants**

Glass ionomer-based sealants are frequently used in newly erupted permanent molars when moisture control is difficult. Although resin sealants generally have better retention, GIC sealants provide fluoride release and preventive effects even after partial loss of material.

The use of glass ionomer sealants is recommended in children with high caries susceptibility or inadequate oral hygiene. These sealants help reduce occlusal caries development during the eruption period.

#### **Cavity Liners and Bases**

Glass ionomer cements are often used as liners or bases under composite restorations because of their fluoride release and dentin adhesion. They provide thermal insulation and decrease postoperative sensitivity.

The “sandwich technique,” combining GICs with composite resins, is commonly used in pediatric restorative dentistry. In this approach, the GIC acts as a dentin substitute while the composite provides improved esthetics and wear resistance.

#### **Orthodontic Applications**

Modern GICs are also used for cementation of orthodontic bands and brackets in children and adolescents. Their fluoride-releasing ability reduces the risk of white spot lesions around orthodontic appliances.

Resin-modified glass ionomer cements are especially popular in orthodontics due to their stronger bond strength and improved mechanical properties.

#### **Advantages and Limitations**

Modern glass ionomer cements offer numerous advantages in pediatric dentistry. Their fluoride release significantly contributes to caries prevention and enamel remineralization. Chemical adhesion reduces the need for aggressive cavity preparation and preserves healthy tissues. Easy handling, reduced treatment time, and moisture tolerance are particularly beneficial in children.

In addition, modern GICs demonstrate satisfactory biocompatibility and acceptable esthetic outcomes for many clinical situations. Their ability to function in minimally invasive dentistry supports contemporary preventive approaches.

However, certain limitations still exist. Conventional GICs generally have lower fracture toughness and wear resistance compared with composite resins. They may also exhibit inferior esthetics due to limited translucency and surface polishability. In areas exposed to high occlusal stress, long-term durability may be reduced.

Resin-modified glass ionomer cements partially overcome these disadvantages but may introduce concerns related to polymerization shrinkage and resin components. Despite these limitations, careful case selection and proper clinical technique significantly improve the success of GIC restorations.

#### **Conclusion**

Modern glass ionomer cements occupy an essential place in contemporary pediatric dentistry. Their fluoride release, chemical adhesion, biocompatibility, and ease of use make them highly suitable for restorative and preventive procedures in children.

The development of high-viscosity and resin-modified glass ionomer cements has expanded their clinical indications and improved their mechanical properties. These materials are particularly valuable in minimally invasive dentistry, atraumatic restorative treatment, and management of high-caries-risk pediatric patients.

Although glass ionomer cements may not completely replace composite materials in all clinical situations, they remain highly effective and versatile restorative materials in pediatric dental practice. Future improvements in material science are expected to further enhance their durability, esthetics, and therapeutic properties.

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