

## FEATURES OF THE USE OF SYNTHETIC DENTAL MATERIALS IN PATIENTS WITH ALLERGIC DERMATOSES

*Tashkent State Medical University*  
**Author: Akhmedov Jamshid Khusanovich**  
**Irsaliev Khusnitdin Ibragimovich**

### **Abstract.**

*The increasing use of synthetic materials in modern dentistry has significantly expanded the possibilities of restorative, prosthetic and orthodontic treatment. However, the widespread application of resin-based materials, acrylic polymers, adhesives and other synthetic compounds raises important questions concerning their biocompatibility, particularly in patients with a history of allergic dermatoses. Such patients may have an increased susceptibility to contact sensitization, although the presence of allergic skin disease does not automatically indicate an allergy to dental materials. Of particular clinical importance are acrylates and methacrylates, including methyl methacrylate (MMA), 2-hydroxyethyl methacrylate (HEMA), ethylene glycol dimethacrylate (EGDMA), triethylene glycol dimethacrylate (TEGDMA), and bisphenol A-glycidyl methacrylate (Bis-GMA). Residual, incompletely polymerized monomers may act as haptens and induce delayed type IV hypersensitivity reactions. Clinical manifestations may include oral burning, erythema, cheilitis, stomatitis, perioral dermatitis and exacerbation of pre-existing eczematous skin lesions. The purpose of this review is to analyze the main features of using synthetic dental materials in patients with allergic dermatoses and to formulate practical recommendations for their safe clinical application. A careful allergy history, individualized selection of materials, adequate polymerization, minimization of direct tissue contact with uncured substances, and collaboration between dentists and dermatologists are essential components of prevention.*

**Keywords:** *allergic dermatoses, dental materials, synthetic materials, acrylates, methacrylates, allergic contact dermatitis, hypersensitivity, dental composites, prosthodontics, biocompatibility.*

### **Introduction**

Modern dentistry relies extensively on synthetic materials. Composite resins, acrylic polymers, bonding agents, impression materials, temporary crowns, denture bases and materials used in digital dentistry have become an integral part of restorative and prosthetic treatment. Their advantages include good mechanical properties, aesthetic characteristics,

ease of processing and the possibility of producing minimally invasive and highly individualized restorations.

At the same time, the biological compatibility of dental materials remains an important clinical issue. Dental materials are placed in prolonged and sometimes permanent contact with oral mucosa, saliva and dental tissues. In some clinical situations, synthetic materials may also come into contact with the skin, especially during prosthetic treatment, impression procedures, orthodontic treatment and the handling of uncured resin materials.

Allergic reactions to dental materials are generally uncommon, but they can have considerable clinical significance. A systematic review of the literature demonstrated that dental materials may cause various allergic manifestations, including contact dermatitis, stomatitis and lichenoid reactions. Acrylates and methacrylates are among the substances of particular concern because they can produce delayed hypersensitivity reactions.

The issue is especially relevant in patients with allergic dermatoses. The term “allergic dermatoses” includes a heterogeneous group of diseases characterized by inflammatory and immunological reactions of the skin. These patients may have a history of eczema, allergic contact dermatitis or other hypersensitivity disorders. Nevertheless, it is important to distinguish between a general predisposition to allergic disease and a confirmed allergy to a particular dental material. Therefore, the diagnosis should be based on clinical history and appropriate allergy testing rather than on the presence of dermatitis alone.

#### Aim of the Study

The aim of this review is to evaluate the specific considerations associated with the use of synthetic dental materials in patients with allergic dermatoses, identify potentially sensitizing components, and describe practical approaches for prevention, diagnosis and management of adverse reactions.

#### Materials and Methods

A narrative analysis of scientific publications concerning allergic reactions to dental materials, acrylate and methacrylate sensitization, allergic contact dermatitis and biocompatibility of resin-based dental materials was performed. Relevant publications indexed in PubMed and available through PubMed Central were reviewed, with particular attention to systematic reviews, multicenter studies and recent literature concerning the allergenic potential of dental monomers.

Recent evidence indicates that (meth)acrylate monomers remain clinically relevant allergens. A 2026 narrative review emphasized that residual monomers can function as haptens and induce type IV delayed hypersensitivity. It also highlighted possible exposure through oral and dermal contact, inhalation of particles generated during grinding and polishing, and occupational exposure during handling of uncured materials.

### Main Synthetic Dental Materials of Clinical Importance

Synthetic materials used in dentistry can be divided into several clinically important groups.

#### 1. Acrylic and methacrylate-based materials

Acrylic polymers are widely used in removable dentures, temporary prostheses, orthodontic appliances and other dental applications. Polymethyl methacrylate (PMMA) is particularly common in prosthodontics.

The main concern is not always the fully polymerized polymer itself, but residual monomers that remain after polymerization. Methyl methacrylate is a well-known sensitizing substance. Inadequate polymerization, improper processing or degradation of the material may increase the amount of residual monomer available for biological interaction.

In addition to MMA, HEMA, EGDMA and TEGDMA are important components of resin-based dental systems. These substances have been associated with contact allergy and allergic contact dermatitis.

#### 2. Composite restorative materials

Dental composites generally consist of an organic resin matrix, inorganic fillers, coupling agents, initiators and other additives. Bis-GMA, UDMA, TEGDMA and related monomers are commonly used components.

The polymerization process substantially reduces the amount of free monomer. However, complete conversion is not always achieved. Consequently, a certain amount of residual monomer can remain in the restoration or may be released into the surrounding environment.

For patients with a known history of contact allergy to dental monomers, the composition of the material should therefore be evaluated before treatment. Simply choosing a product described as "hypoallergenic" is insufficient unless its actual composition and relevant allergens are known.

#### 3. Adhesive systems

Bonding agents contain various monomers and solvents and are frequently applied directly to dental tissues. Their close contact with oral tissues makes appropriate application particularly important.

Accidental contact of uncured adhesive with oral mucosa or skin should be minimized. The use of controlled application techniques, isolation and complete polymerization may reduce unnecessary exposure.

#### 4. Synthetic materials used in digital dentistry

The rapid development of CAD/CAM and 3D-printing technologies has introduced new resin-based materials into clinical practice. These materials can contain reactive monomers and require appropriate post-processing.

Recent literature emphasizes that 3D-printed resins may differ considerably in polymerization quality depending on the printing and post-processing protocols. Therefore, inadequate washing, curing or finishing may potentially increase residual monomer exposure.

#### Allergic Mechanisms and Clinical Manifestations

The majority of allergic reactions to acrylate-based dental materials are associated with delayed, T-cell-mediated hypersensitivity. During the sensitization phase, reactive monomers interact with proteins and form antigenic complexes. Following subsequent exposure, activated T lymphocytes may produce an inflammatory response.

Clinically, patients may present with burning or discomfort of the oral mucosa, erythema, edema, cheilitis, stomatitis, mucosal dryness or perioral dermatitis. In some cases, the symptoms may resemble irritation, infection or a nonspecific inflammatory condition, making diagnosis difficult.

Importantly, contact allergy can be associated with multiple positive reactions because of structural similarities between different acrylates and methacrylates. Cross-reactivity among acrylic monomers has been documented, which complicates the selection of alternative materials in sensitized patients.

A multicenter study published in the British Journal of Dermatology analyzed 2,730 patients evaluated for possible contact allergy associated with dental materials. Among women with confirmed allergic contact stomatitis, sensitization to HEMA was identified in 4.8%, while other relevant allergens included 2-hydroxypropyl methacrylate, MMA, EGDMA and pentaerythritol triacrylate. The study concluded that although allergic contact stomatitis caused by dental materials is rare, diagnostic testing should include not only metals but also relevant (meth)acrylates.

#### Particular Considerations in Patients with Allergic Dermatoses

The presence of allergic dermatoses requires an individualized approach rather than automatic avoidance of all synthetic dental materials.

First, a detailed allergy history should be obtained. The dentist should determine whether the patient has previously experienced reactions to dental prostheses, fillings, orthodontic appliances, adhesives, acrylic nails, cosmetic products, medical devices or industrial materials.

This is important because sensitization to acrylates may occur outside dentistry. For example, exposure to acrylic nail products may precede the development of sensitivity to dental materials. Recent evidence emphasizes that previous non-dental exposure can contribute to sensitization and that cross-sensitization between chemically related monomers may occur.

Second, the clinical condition of the patient's skin should be considered. If allergic dermatitis is active or uncontrolled, unnecessary exposure to potentially sensitizing substances should be avoided. The treatment plan should be coordinated with a dermatologist when the allergy history is significant or when symptoms are difficult to interpret.

Third, material selection should be based on the patient's specific sensitization pattern. It is inappropriate to assume that replacing one acrylate-containing material with another will necessarily eliminate the risk. Because several chemically related monomers may cross-react, the complete material composition should be considered.

#### Diagnostic Approach

When a patient develops oral or perioral symptoms after dental treatment, several possible causes should be considered. These include allergic contact stomatitis, irritant reactions, mechanical trauma, infection, medication-related reactions and reactions to food or oral hygiene products.

A detailed temporal relationship between placement of the dental material and onset of symptoms can provide an important diagnostic clue.

Patch testing is an important method for diagnosing delayed contact hypersensitivity. Depending on the patient's history, testing may include a baseline series as well as an extended dental material and acrylate series. HEMA, MMA, EGDMA and other relevant monomers may be considered.

Evidence from clinical studies demonstrates the usefulness of patch testing in patients with suspected dental-material allergy. In one study, 2-HEMA was able to identify sensitized patients in an acrylate-allergy population, although broader testing may be required in selected cases.

A negative standard screening test does not necessarily exclude allergy. Expanded testing may be necessary when the patient's history strongly suggests exposure to a specific dental material.

#### Prevention and Safe Clinical Application

Prevention is more effective than treating an established allergic reaction. Several practical measures can reduce the risk of sensitization or symptom recurrence.

##### **1. Detailed medical history.**

Before treatment, the dentist should ask specifically about allergic contact dermatitis, eczema, previous reactions to dental materials and sensitivity to acrylic or cosmetic products.

##### **2. Individual material selection.**

Where allergy is confirmed, materials containing the relevant allergen should be avoided. The composition of alternative products should be carefully evaluated.

**3. Adequate polymerization.**

Complete polymerization can reduce the quantity of residual reactive monomers. Manufacturers' recommended curing protocols should be strictly followed.

**4. Minimization of contact with uncured materials.**

Uncured resin should not be allowed to remain unnecessarily on oral mucosa or skin. Appropriate isolation and controlled application techniques should be used.

**5. Proper finishing and polishing.**

After polymerization, restoration surfaces should be appropriately finished and polished to minimize residual surface monomer and improve tissue compatibility.

**6. Appropriate laboratory processing.**

For acrylic prostheses, proper laboratory processing is important because insufficient polymerization can increase residual monomer levels. Some established processing approaches can reduce the amount of leachable monomer before clinical use.

**7. Interdisciplinary cooperation.**

Patients with significant allergic disease should be managed in cooperation with dermatologists or allergologists when necessary. This is particularly important when a previous dental-material allergy has already been documented.

**Discussion**

The main clinical challenge is that allergic reactions to dental materials are relatively uncommon and can resemble other oral diseases. Consequently, excessive avoidance of synthetic materials is not justified for every patient with allergic dermatoses. Instead, treatment should be individualized according to the patient's history and confirmed sensitization.

The available evidence demonstrates that acrylates and methacrylates deserve particular attention. Their extensive use in restorative dentistry, prosthodontics and digital technologies creates numerous potential exposure pathways. A systematic review identified acrylates, latex and formaldehyde among important causes of allergic reactions in dental settings, while PMMA and related materials may produce delayed hypersensitivity reactions.

Another important issue is the distinction between irritant toxicity and true allergy. Not every burning sensation or mucosal irritation after placement of a composite restoration represents an allergic reaction. Dental materials may cause direct irritation, particularly when residual chemicals are present or when the material is improperly processed. True allergic contact reactions require an immunological sensitization mechanism and should ideally be confirmed by appropriate testing.

The increasing use of 3D-printed dental materials makes this issue even more relevant. New resins may contain reactive components, and differences in post-processing can

influence the amount of residual monomer. Therefore, dentists should pay attention not only to the material itself but also to the manufacturing, curing, washing and finishing procedures.

For patients with known acrylate allergy, the safest strategy is not simply to select a different commercial resin without evaluating its composition. Instead, clinicians should identify the specific sensitizing substance and assess whether the proposed material contains that substance or structurally related compounds.

#### Conclusion

The use of synthetic dental materials in patients with allergic dermatoses requires an individualized and evidence-based approach. Most modern dental materials are designed to demonstrate good biocompatibility, but certain components, especially acrylate and methacrylate monomers, can cause allergic contact reactions in susceptible individuals.

Patients with allergic dermatoses should therefore undergo careful history taking before dental treatment. Particular attention should be paid to previous reactions to acrylic materials, dental restorations, cosmetic products, adhesives and other sources of acrylate exposure. When clinical suspicion exists, patch testing and consultation with a dermatologist or allergologist may be indicated.

The principal preventive measures include selecting materials according to the patient's individual sensitization profile, avoiding direct contact with uncured resin, ensuring adequate polymerization and post-processing, and using appropriate clinical and laboratory protocols.

In conclusion, the presence of allergic dermatoses is not an absolute contraindication to the use of synthetic dental materials. Rather, it represents an indication for careful material selection, exposure control and interdisciplinary management. Increasing knowledge about the allergenic potential of modern resin systems, particularly in the context of digital dentistry and 3D printing, will contribute to safer and more predictable dental treatment for patients with allergic disorders.

#### REFERENCES

1. Smidtas L, Johnson J, Rocha Pacheco R, Jauregui C. Allergenic and cytotoxic potential of (meth)acrylate monomers in dental materials: a narrative review. *Frontiers in Dental Medicine*. 2026;7:1846292.
2. Kumar P, et al. Allergic Reactions to Dental Materials—A Systematic Review. *Journal of Clinical and Diagnostic Research*. 2015.
3. Spencer A, Gazzani P, Thompson DA. Acrylate and methacrylate contact allergy and allergic contact disease: a 13-year review. *Contact Dermatitis*. 2016;75:157–164.

4. Aalto-Korte K, et al. Acrylate contact allergy: patient characteristics and evaluation of screening allergens. *Dermatitis*. 2011;22:98–101.
5. Aerts O, et al. Contact allergies to dental materials in patients. *British Journal of Dermatology*. 2023.
6. Sasseville D. Acrylates in contact dermatitis. *Dermatitis*. 2012;23:6–16.
7. Kanerva L. Cross-reactions of multifunctional methacrylates and acrylates. *Acta Odontologica Scandinavica*. 2001;59:320–329.
8. Aerts O, et al. Allergic contact dermatitis to acrylates. *Clinical and Experimental Dermatology*. 2017.