

Acrylic allergies information



Allergies and denture intolerance

Intolerance to dentures as a result of allergy is very rare. In such cases the allergy is triggered not by the acrylic itself but the unpolymerised precursors and lead substances. Epicutaneous test data indicate that reactions are primarily due to the benzoyl peroxide initiator and the hydroquinone inhibitor. In contrast, the monomers MMA and TEGDMA are allergens that are primarily relevant for dental technicians in their jobs.

It must be noted here that latex and vinyl gloves are not adequate barriers for monomers. This is still generally unknown, because technicians are still working with doughy acrylic mixtures without adequate precautions. However, the low residual monomer content in completed dentures is considered to present a low risk for the patient. Although a genuine contact allergy to the acrylics in dentures cannot be completely discounted, it can be stated that when a denture is manufactured in accordance with the specifications it is chemically and allergenically inert.

A diagnosis based on an epicutaneous test alone is made more difficult because even if the test is positive (skin surface), a clinical compatibility with the oral mucosa is possible.

Diagnosis of an "allergy" includes not only a positive test but also the presence of clinical symptoms.

In general, a suspected diagnosis should always be considered very carefully, because the significantly more common causes of denture intolerance are mechanical, microbial, endogenous and also psychological in nature. In most cases patients present to the dentist with inflamed mucosa. These inflammatory changes are generally classified as monomer allergies. However, if the base of the denture is stained with initiators, it can often be seen that the visible bacterial colonies on the base are identical to the allergies in the mouth. Such inflammations can generally be significantly improved by very thorough cleaning.

Another reason for inflammation could be rough surfaces on the acrylic material. Particularly in the case of cold-cured polymers the polymer is left to cure for only a short time, which results in microscopic roughness that can cause stomatitis.

If an allergy is confirmed by diagnosis, acrylics that do not contain the relevant allergen should be selected.

Residual monomer content

There is no indication in the literature of an increased occurrence of allergic-toxic reactions resulting from the use of cold-curing acrylic resins. It is important in this context to note that the residual monomer content rapidly decreases on storage in water. The risk of a chemical-toxic effect from the release of residual monomer from acrylic denture materials is therefore minimized.

Interesting information on residual monomer

Monomer is the standard term for a molecule that can be polymerized.

MMA (methyl methacrylate) is not the only monomer (other monomers include TEGDMA, UDMA, etc.)

Every polymerizing system contains residual monomer.

Acrylics in removable dentures

There have been no significant new developments in acrylics used for denture bases in the area of partial and full dentures. However, the development of more impact-resistant materials is worth noting.

Polyamides and polyurethanes

They are practically unbreakable acrylics, but their excessively high elasticity and the low stiffness can cause serious damage to the denture base and the remaining dentition even under normal functional loads. These acrylic materials have a strong tendency to swelling and becoming discolored. This is why these acrylics are no longer in use as material for denture bases.

Polycarbonates

This group of acrylics includes glass-fiber reinforced materials, which have a number of advantages over methyl methacrylates because of their greater impact resistance. However, in everyday use these materials tend to have clinically inadequate dimensional consistency and high sensitivity to water vapor in the melting interval range, resulting in shading and structural inhomogeneity. Compared to MMA these materials are also more sensitive to alkaline substances, such as those that are constituents of denture cleaners. This results in faster tension cracking of polycarbonate dentures, i.e. ultimately an increased tendency for the denture to fracture. Processing of polycarbonates with the required special extrusion apparatus also involves significant technical problems. Polycarbonate materials are still used as material for a denture base if the patient has a genuine allergy to polymethyl methacrylate.

PVC-based acrylics

In this group mixed polymers consisting of vinyl chloride, vinyl acetate and methyl methacrylate acid ester are used as denture materials. This denture acrylic group includes luxene and virlene, which show good dimensional consistency, low water absorption and high breaking strength. They require a complex special apparatus for processing using the melt-press process, which means that these materials are little used.

Acrylics based on polyurethane resin and Plexiglas

This is also a mixed polymer of polyurethane and PMMA.

It is a single-component denture material in the form of a paste that does not contain methyl methacrylate monomer and benzoyl peroxide, and the acrylic has a higher proportion of acrylate monomer. The use of high-molecular cross-linkers means that shrinkage is less than that of conventional PMMA base materials and it offers well-balanced elasticity and breaking strength. Acrylic teeth must be fitted with mechanical retention for bonding because of the high degree of cross-linking. Puran HC belongs to this denture acrylic group.

Polymethyl methacrylate

PMMA is still the most commonly used material for denture bases, in spite of many experiments with other materials. These acrylics are noted for high transparency, low density, relatively low brittleness and ease of processing and shaping. When discussing PMMA acrylics a distinction is made between heat-curing and cold-curing acrylic resins. Both have the same basic chemical substances and differ only in the reaction process or the accelerator system.

PMMA – today still the best base material for dentures

Composition of denture materials

Polymer components	Monomer
PMMA homopolymer	Methyl methacrylate
Copolymer	Dimethacrylate (cross-linker)
Colors	Additives (UV stabilizers, inhibitors and possibly accelerators)
Peroxides	
Additives (catalysts, antistatic substances, etc.)	

Composition of monomer	Composition of polymer
a) Mono methyl methacrylate (MMA)	a) Polymethyl methacrylate (PMMA)
b) Stabilizers or inhibitors (generally hydroquinone)	b) Initiators (e.g. benzoyl peroxide)
c) Accelerators (cold-curing acrylic resins only) comonomers and cross-linkers (e.g. isobutylmethacrylate)	c) Mineral colorants

What the monomer mixture does in the denture material?

The monomer allows the denture material to be processed. The monomer is the solvent for the second component, the polymer body.

The monomer transports important additives that only remain stable with the polymer, such as colorants and catalysts, in the liquid mixture that is to be processed.

After the curing phase the monomer itself becomes a polymer material and is primarily there to reinforce the structure of the substance.

After polymerization, the denture material has the desired properties such as hardness and durability in the mouth, and it can be cut, ground, and polished.

What the polymer mixture does in the denture material?

The second component, the solid polymer body, gives the mixture its syrupy, doughy and kneadable consistency.

The polymer enables the monomer to be bonded to a mixture that can be processed.

The viscosity of the mass is increased during the swelling and dissolving process. This is necessary to counteract the expansion of the gas during the curing process.

During the curing phase the polymer reduces the shrinkage of the monomer that is becoming a polymer. This gives the mass its shape and fit.

Like the monomer, the composition of the polymer influences the physical and clinical properties of the denture material (skeleton effect).

Processing tips

We as dental technicians do not observe the following items, but they are very important for processing thermoplastic acrylics:

Fitting accuracy

Cold-curing polymers generally fit more accurately than heat-curing polymers after polymerization. However, this changes after a short time, because the high residual monomer content is decomposed and replaced by water and the curing process of the material continues.

The heat-curing polymer is always subject to the problem of thermal shrinkage.

Even post-injection systems like the SR-Ivocap can only compensate for this material-specific disadvantage to a limited degree. The important factor is always the exact processing by the dental technician as directed by the manufacturer.

Before polymerization

Note the mixing ratios. Free dosage describes a framework of approx. $\pm 10\%$. If more monomer is used, this increases the transparency. If more powder is used, this improves the fitting accuracy. However, if the 10% limit is exceeded, this will generally seriously affect the properties of the materials.

Ensure good isolation (chemical reaction with plaster by steam pressure during boiling).

Remove all wax residues before plugging.

Roughen teeth and fit them with mechanical retention (except with Ivocap).

The use of isolation for the neck of the tooth forms a thermal barrier and prevents monomer from seeping into the plaster during polymerization. Use isolation extremely sparingly, if at all.

After polymerization

Do not allow solvent to come into contact with the acrylic (Sigolin, monomer, etc.).

Protect from overheating (steam, boiling water).

Store polymerized dentures in water or at least in a moist environment.

Technical Data

Aesthetic cold-curing acrylic resin		Aesthetic base material	
Physical values		Physical values	
Bending strength	68 N/mm ²	Bending strength	83 N/mm ²
Bending modulus	2550 N/mm ²	Bending modulus	2600 N/mm ²
Water absorption	21.4 µg/mm ³	Water absorption	21.5 µg/mm ³
Water solubility	2.7 µg/mm ³	Water solubility	0.01 µg/mm ³
Composition		Composition	
Polymer		Polymer	
Polymethyl methacrylate	95%	Polymethyl methacrylate	96%
Softening agent	3%	Softening agent	3%
Benzoyl peroxide	1%	Benzoyl peroxide	1%
Catalyst	1%		
Color pigments	0.1-0.3%	Color pigments	0%
Monomer		Monomer	
Methyl methacrylate	95.90%	Methyl methacrylate	91.90%
Dimethyl methacrylate	4.00%	Dimethyl methacrylate	8.00%
Catalyst	0.10%	Catalyst	0.10%

AutoPlast		BasePlast	
Physical values		Physical values	
Bending strength	67 N/mm ²	Bending strength	84 N/mm ²
Bending modulus	2300 N/mm ²	Bending modulus	2800 N/mm ²
Water absorption	22.7 µg/mm ³	Water absorption	22.9 µg/mm ³
Water solubility	2.2 µg/mm ³	Water solubility	0.07 µg/mm ³
Composition		Composition	
Polymer		Polymer	
Polymethyl methacrylate	97%	Polymethyl methacrylate	99%
Catalyst	1%	Catalyst	1%
Color pigments	1%	Color pigments	1%
Monomer		Monomer	
Methyl methacrylate	91.20%	Methyl methacrylate	92.50%