REVIEW ARTICLE

Maxillofacial Prosthetic Materials - An Overview

Saikat Deb

ABSTRACT

Acquired and congenital defects of the face create an unfortunate condition for an individual. For the individual to lead a comfortable life requires facial rehabilitation, thus a reassessment of materials used in the field of maxillofacial prosthesis seems desirable. The materials have traveled a long way from wood, wax, primitive metal, leather, rubber, etc., to the latest biomedical material such as polymers. While the new materials have exhibited some excellent properties, they have also exhibited some frustrating deficiencies. We still are in search of a material comprising all the ideal properties so as to best restore a maxillofacial defect.

Keywords: Maxillofacial prosthetic material, Resins, Silicones.

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INTRODUCTION

Maxillofacial prosthetics is defined as that branch of prosthodontics concerned with restoration and/or replacement of the stomatognathic and craniofacial structures with prosthesis that may or may not be removed on a regular or elective basis.[1] Maxillofacial prosthesis is defined as any prosthesis used to replace part or all of any stomatognathic and/or craniofacial structures.[2] Facial defects can result from trauma, treatment of neoplasm, or congenital malformation. The prosthodontist is limited by inadequate material available for facial restorations, movable tissue below, difficulty in retaining large prostheses, and the patient's capacity to accept the final result. Materials for maxillofacial prosthetic reconstruction span the full range of chemical structures, with physical properties ranging from hard, stiff alloys, ceramics and polymers to soft, flexible polymers, and their formulation as latex and plastisols. However, as yet, no material has emerged that possesses all the distinct and desirable characteristics.

Reader

Department of Prosthodontics Crown Bridge and Implantology, Awadh Dental College and Hospital, Jamshedpur, Jharkhand, India

Corresponding Author: Saikat Deb, Department of Prosthodontics Crown Bridge and Implantology, Awadh Dental College and Hospital, Jamshedpur, Jharkhand, India. e-mail: debsaikat@gmail.com

DESIRABLE PROPERTIES OF MAXILLOFACIAL PROSTHETIC MATERIAL[3,4]

1. Physical properties: The material should be flexible, dimensionally stable, and light in weight, with low thermal conductivity and good strength.
2. Biological and chemical properties: The material should remain stable when exposed to environmental assaults, adhesives, and their solvents. It should be non-toxic, non-allergenic, and biocompatible. It should exhibit good life of at least 6 months without significant compromise of esthetic and physical properties.
3. Fabrication characteristics: Polymerization should occur at a temperature low enough to permit reusability of molds. Blending of individual components should be easy, allowing some margin of error. It should have suitable working time and be easy to color.
4. Esthetic characteristics: The complete prosthesis should be unnoticeable in public, faithfully representing lost structure in the finest detail. Its color, texture, form, and translucence must duplicate that of missing structure and adjacent skin.

MATERIALS AVAILABLE

Acrylic Resin

Acrylic resin is easily available, easy to stain, and color and has good strength to be fabricated with feather margin and a good life of about 2 years. Its rigidity and high thermal conductivity are a drawback. Visible light-cured resin is also being used, which has an organic filler made of acrylic resin beads of different sizes that become part of the polymer network structure on curing. The matrix is a urethane dimethacrylate with microfine silica and contains a camphoroquinone amine as photoinitiator.[5]

Acrylic Copolymer

Acrylic copolymers are soft and elastic but have not received wide acceptance because of poor edge strength, poor durability, and being subject to degradation when exposed to sunlight. In addition, complete restoration is often tacky predisposing to direct collection and staining.[6,7]

Polyvinylchloride and Copolymer

Earlier these consisted of a combination of polyvinyl chloride and a plasticizer. However these days, 5–20% vinyl acetate is being added. They exhibit many desirable properties such as flexibility, easy coloration, and acceptable initial appearance. The primary deficiency arises from migration of plasticizer, leading to discoloration and hardening of the prosthesis.[8,9]

Chlorinated Polyethylene

Lewis and Castleberry[5] reported chlorinated polyethylene, a material similar to polyvinylchloride in which coloration can be done using oil-soluble dyes.

Polyurethane Elastomers

Polyurethane elastomers contain a urethane linkage. They can be synthesized with a wide range of physical properties by varying the reactants and their amounts. They have excellent properties such as elasticity and ease of coloration but have certain deficiencies like isocyanates and are moisture sensitive, leading to gas bubbles when water contaminated and can also cause local irritation as described by Gonzalez.[10,11]

Silicone Elastomers

Barnhart (1960) was the first to use silicone elastomers for extraoral prostheses. They are a combination of organic and inorganic compounds. Chemically, they are termed as polydimethylsiloxane.[12] They are of two basic types.

1. Room temperature vulcanizing (RTV).
2. Heat vulcanizing.

Foaming Silicones

The purpose of the foam forming silicones is to reduce the weight of the prosthesis.[12] However, the foamed material has reduced strength and is susceptible to training, leading to weakening of the material.

Siphenylenes

Siphenylenes are siloxane copolymers[13] that contain methyl and phenyl groups. These exhibit improved edge strength, low modulus of elasticity, and color ability over the more conventional polydimethylsiloxane.

Silicone Block Copolymers

Silicone block copolymers are new materials under development to improve on some of the weaknesses of silicone elastomers such as a low tear strength, low elongation, and the potential to support bacterial and fungal growth. They are more tear resistant than conventional cross-linked silicone polymers.[14,15]

Polyphosphazenes

Polyphosphazene fluoroelastomers have been developed for use as resilient denture liners and have the potential to be used as maxillofacial prosthetic materials.[11]

Primer

With the introduction of urethane-line silicone prosthesis,[9] there has been an increased interest in primers used for promotion of bonding between silicone and other maxillofacial prosthetic materials.

Adhesives

A variety of adhesive systems have been employed to retain facial prostheses in position. Most cured silicones, because of their low solubility and low surface energy, will not adhere to conventional tissue adhesive. The single component RTV silicones were developed to serve as adhesives for silicon prostheses.[10]

CONCLUSION

It might be a dream, but the possibility of fabricating a high-quality lifelike prosthesis directly on the face would require no more skills than a prosthodontist already has, if the dental material scientist can help us by providing a perfect material with all the ideal properties to rehabilitate the patient with orofacial defect who deserves the best we can offer.

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