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SCOPE OF MAXILLOFACIAL PROSTHESIS MATERIALS: FROM PAST TO FUTURE- A LITERATURE REVIEW

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ABSTRACT

Reason behind the facial defect can be trauma, tumor, surgery and congenital/developmental anomaly. Aim of maxillofacial prosthesis is to restore the lost structure, normal function as well as esthetics. Surgical reconstruction may not be possible owing to size or location of the defect. Materials used for fabrication maxillofacial prosthesis, which include full range of chemical structures, with physical properties ranging from hard, stiff alloys, ceramics and polymers.

KEYWORDS: Maxillofacial, Polymers, Tumor.

INTRODUCTION

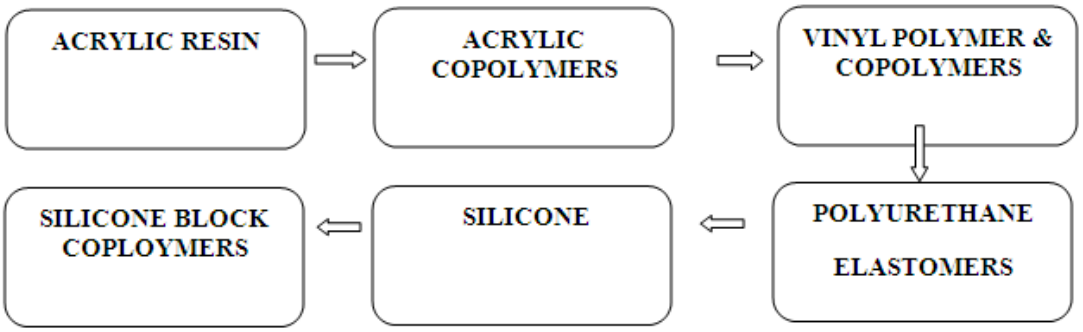
Facial esthetics, expression and appearance play an important role social and personal life of one individual. Unwanted facial abnormalities resulting from trauma, cancer or congenital defect can decrease ones self-esteem and self-confidence. Maxillo-facial prosthesis is one of the treatment option for such patients.[1]

Maxillofacial prosthetics is defined as that branch of prosthodontics concerned with restoration and replacement of both of stomatognathic and associated facial structures by artificial substitutes that may or may not be removed". –GPT.[2]

Maxillofacial prosthesis is defined as any prosthesis, used to replace part or all of any stomatognathic and/or craniofacial structures. –GPT.

Different materials are available now a days, that are used for fabrication of the maxillofacial prosthesis, ranging from acrylic resin, polyvinylchloride and copolymer, chlorinated polyethylene, polyurethane elastomer, thermoset elastomer and silicone elastomers.[3]

HISTORY

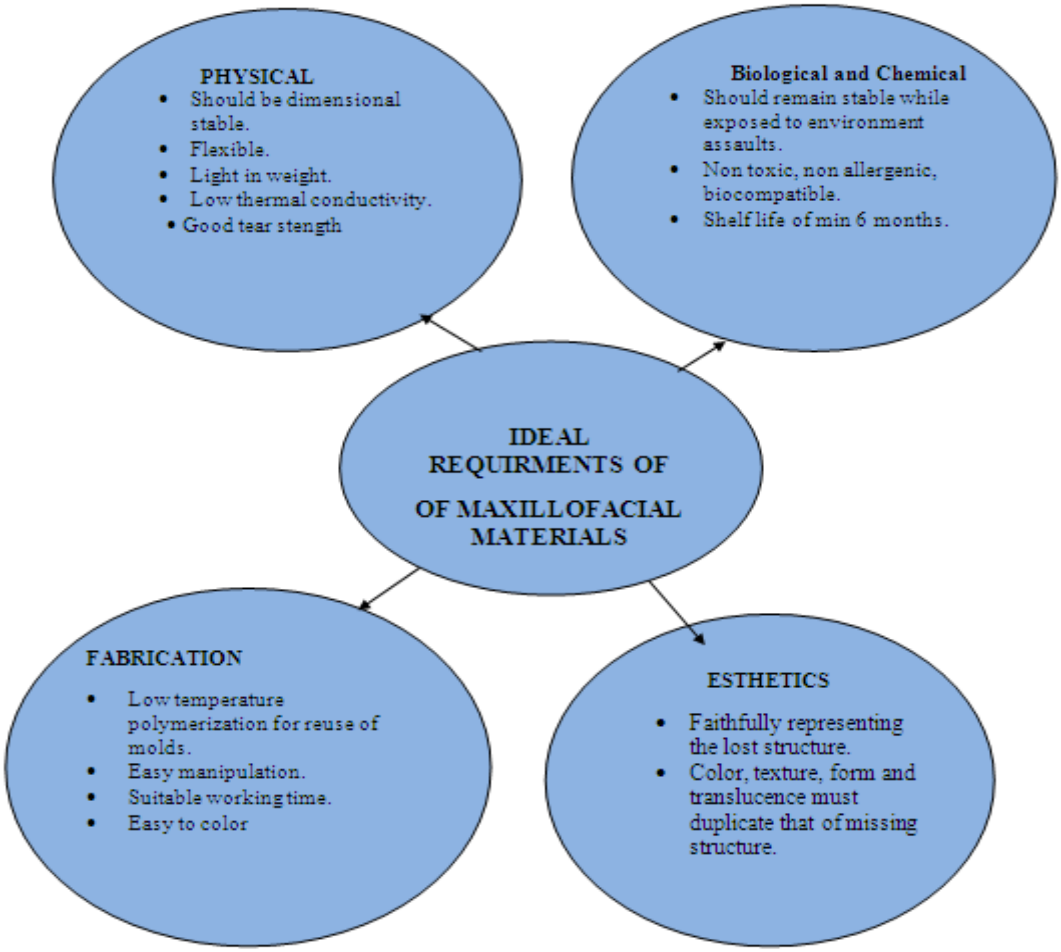


CLASSIFICATION

According to Beumer[4]

- Acyrlic resin
- Acrylic copolymers
- Polyvinyl chloride & copolymers.
- Chlorinated polyethylene.
- Polyurethane elastomers.
- Silicone elastomers. (H.T.V)(R.T.V), Foaming silicones.
- New materials-Silicone block coplymers, Polyphosphazenes.

IDEAL REQUIRMENT



ACRYLIC RESIN

Acrylic resins are used in particularly those cases in which little movement of the tissue bed takes place during function such as ocular and orbital defects. It contains Polymethyl methacrylate as powder and Methyl methacrylate as liquid. Drawback is rigid, cause discomfort and duplication is not possible as processing mold is destructed.[5]

ACRYLIC CO-POLYMERS

These are not widely accepted now a days due to its poor edge strength, poor durability, degradation when exposed to sunlight.

POLYURETHANE ELASTOMERS

Polyurethane elastomers can be synthesized with wide range of physical properties. They contain urethane linkage. Main advantage of this material is they exhibit elasticity without compromise their edge strength, flexible and ease of coloration.[6]

SILICONE

Silicones are a combination of organic and inorganic compounds. It was first used for the external prosthesis by **Barnhart in 1960**.[7] Cross-linking the polymers are referred to as vulcanization. It occurs both with and without heat and depends on the catalytic or cross-linking agents utilized.

CLASSIFICATION

Depending upon the vulcanizing process

• Heat vulcanized (HTV).
• Room temperature vulcanized (RTV).

Depending on their applications[8]

• **Class I**: Implant grade, which requires the material to undergo extensive testing and must meet "food and drug administration" requirements. These materials are used in breast implantation.
• **Class II**: Medical grade, which is approved for external use. This material is used for fabrication of maxillofacial prosthesis. Some studies tested the cytotoxicity of this material; however, none has reported any negative side effects.
• **Class III**: Clean grade, this material is applied to use in food coverage and packaging.
• **Class IV**: Industrial grade, commonly used for industrial applications.

HTV Silicones

HTV Silicones are used for higher tear resistance. Its polymer requires more intense mechanical milling compared with the soft putty RTV silicone.[9]

After milling, the prosthetic device is cured at an elevated temperature in a heat transferring metal mold with added catalyst and cosmetic coloring pigments. Milling procedure represents a significant advances, that outcomes the problem of hand mixing pigments.

Silastic 370, 372, 373, 4-4514, 4-4515
Represents a white opaque material viscous and putty like in consistency. Catalyst / vulcanizing agent of HTV is Dichlorobenzyl peroxide/ platinum salt.

Fillers are added depending on the degree of hardness, strength and elongation. Silica filler size is 30µ. Polydimethyl siloxane may be added to reduce the stiffness and hardness of the prosthesis.[10]

PDM Siloxane
It was developed by the Veterans Administration and reported by Lontz and Schweiger and Lontz. Main drawback of this material is opaqueness, difficulty in intrinsic coloration, it has high superficial surface hardness, difficulty in processing and does not readily accept extrinsic coloration.[11]

Q7-4635, Q7-4650, Q7-4735, SE-45250
It is a new generation of HTV silicones evaluated first by Bell and it has shown improve physical and mechanical properties compared to MDX4-4210 and MDX 4-4514. It has single component system and thus fabrication process is easier.[11]

RTV Silicones
RTV silicones are easy to process and allow intrinsic coloration. Tear resistance of RTV grades is generally inadequate to maintain edge resistance. They set by condensation polymerization. It includes a filler – Diatomaceous earth particles, a catalyst - stannous octate and a cross linking agent - Ortho alkyl silicate.[12]

Silastic 382, 399
Silastic 382, 399 are similar to the HTV types. They are color stable, biologically inert, and retain their physical and chemical properties at elevated temperature. RTVs are much easier to process than the heat cured forms. RTV have poor edge strength and are difficult to color.[13]

MDX 4-4210
It has a chloroplatinic acid catalyst and hydromethylsiloxane as a cross-linking agent. Moore reported that it exhibits improved qualities relative to coloration and edge strength. Accelerated aging tests have shown that the elastomer is very color stable.[14]

Silastic 891
The use of this material was first reported by **Udagama and Drane**, also known as Silastic Medical Adhesive Silicone Type A. It is translucent, polymerizes in air and is compatible with wide range of colorants.[15]

Foaming Silicones
Silastic 386
This is a form of RTV silicone with foam forming variety. It includes an additive agents, so that a gas is released when the catalyst, stannous octoate, is introduced. After the silicone is processed, the gas is eventually released, leaving a spongy material. Aim of the foam forming silicone is to reduce the weight of the prosthesis. However, the foamed material has reduced strength and is susceptible to tearing. This weakness can be partially overcome by coating the foam with another silicone.[16]

Recent advances
Silicone block copolymers
Silicone bock copolymers are new material which are introduce to improve the weaknesses of silicone elastomers, such as low tear strength, low recent elongation. It has been found that silicone block copolymers are more tear resistant than are conventional cross-linked silicone polymers.[17]

Cosmesil
It is a RTV silicone showing a high degree of tear resistance. Woofaardat described that this material can be processed to varying degree of hardness.[18]

A-2186
A-2186 is a widely used maxillofacial prosthetic material. Consists of two-component silicone rubber cured by a platinum catalyst.A-2186 has short working time and because of its hydrophobic nature, poor adhesion to non-silicone based adhesives. It showed better physical and mechanical properties when compared to MDX 4-4210.[19]

Siphenylenes
Siphenylenes are siloxane copolymers that contain methyl and phenyl groups. It represents good biocompatibility and resistance to degradation on exposure to ultraviolet light and heat. In addition, they exhibit improved edge strength, low modulus of elasticity, and color ability over the more conventional polydimethylsiloxanes.[20]

CONCLUSION
Currently available maxillofacial materials do not full fill al the need for prosthesis. Certain advantages and disadvantages makes the clinician difficult to choose the correct materials for prosthesis fabrication. Clinician are still in research purposes of a material comprising all the ideal properties so as to best restore of form and function of a maxillofacial defect.

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