Review Article

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Maxillo-Facial Materials: Update

V.S.L. Sarvani[1*] Sudheer Arunachalam[2] L. Srikanth[3] Sudeepti Soni[4] Kaumudhi Kalla[5] K. Sowmya Sree[6]

[1]PG Student, Department of Prosthodontics & Crown & Bridge, Sree Sai Dental College, and Research Institute, Srikakulam, Andhra Pradesh, India.

[2]Professor and Head, Department of Prosthodontics & Crown & Bridge, Sree Sai Dental College, and Research Institute, Srikakulam, Andhra Pradesh, India.

[3]Senior Lecturer, Department of Prosthodontics & Crown & Bridge, Sree Sai Dental College, and Research Institute, Srikakulam, Andhra Pradesh, India.

[4]Senior Lecturer, Department of Prosthodontics & Crown & Bridge, Sree Sai Dental College, and Research Institute, Srikakulam, Andhra Pradesh, India.

[5]PG Student, Department of Prosthodontics & Crown & Bridge, Sree Sai Dental College, and Research Institute, Srikakulam, Andhra Pradesh, India.

[6]PG Student, Department of Prosthodontics & Crown & Bridge, Sree Sai Dental College, and Research Institute, Srikakulam, Andhra Pradesh, India.

ABSTRACT

Background: Rehabilitation of patients with disabilities of the Head and Neck region due to either congenital or acquired face defect is challenging. Facial prosthesis restores normal anatomy and appearance, which protects tissues of defects, and provides excellent psychological benefit to the patient. Various maxillofacial prosthetic materials have been instrumental in the rehabilitation of these defects created by disease /trauma. Materials used for repair of such defects should fulfill the requirements such as function, longevity & esthetics. Maxillofacial prosthesis restores several types of orofacial defects and improves patient's quality of life. The aim of this article is to provide insight into the currently used maxillofacial prosthetic materials.

Keywords: Facial defects, Silicones, Rehabilitation, Maxillo-facial Prosthesis.

INTRODUCTION

Maxillofacial defects can be emotionally traumatizing, considering the societal emphasis on physical appearance.

Definition: Maxillofacial prosthesis is defined as any prosthesis used to replace part or all of any stomatognathic and craniofacial structures (G.P.T. - 8).

Maxillofacial prosthetics can be defined as that branch of prosthodontics concerned with the restoration or replacement of stomatognathic and craniofacial structures with a prosthesis that may or may not be removed on a regular or elective basis.[1]

II.CLASSIFICATION OF MAXILLOFACIAL MATERIALS

1. Surgical reconstruction (alloplastic implantable material).

2. Prosthetic reconstruction.

Materials for surgical reconstruction are Dimethylsiloxane, polyethylene, polyesters, polyamide, acrylic, metals - stainless steel, vitalliun, titanium, and cyanoacrylate.

Prosthetic reconstruction includes materials for the Impression phase, modeling phase, and fabrication phase.[2]

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***Correspondence Dr. V.S.L. Sarvani.**
Department of Prosthodontics & Crown & Bridge, Sree Sai Dental College, and Research Institute, Srikakulam, Andhra Pradesh, India.
Email: Not Disclosed

According to Beumer:-

1. Acrylic resins.
2. Acrylic copolymers
3. Polyvinyl chloride and copolymers.
4. Chlorinated polyethylene.
5. Polyurethane elastomers.
6. Silicone elastomers- H.T.V., R.T.V., Foaming silicones.
7. New materials- Silicone block copolymers, Poly phosphazenes.[3]

Objectives of maxillofacial prosthetics:-

a) Restoration of aesthetics.
b) Function.
c) Protection of tissues.
d) To act as a psychological therapy
e) To serve a therapeutic purpose.[4]

III. HISTORY

Before 1600 A.D. Archeologists found artificial eyes, nose, and ears constructed from waxes, clay, and wood in the ancient Chinese culture.

1600-1800 A.D.

Tycho Brahe is the first documented person to have a facial prosthesis. He had a silver and golden plate shaped into a nose to cover his defect.

Pierre Fauchard (1678-1761) made a monumental contribution to prosthetic facial reconstruction. He made a silver mask to replace the lost portion of the mandible for a French soldier. The silver prosthesis was painted with oil paints, and the margins of the prosthesis were made inconspicuous by covering them with facial hair.

1800-1900 A.D.

William Morton (1819-1868) was credited with the fabrication of a nasal prosthesis using enameled porcelain to match the patient's complexion. In 1880, Kingsley described a combination nasal-palatal prosthesis in which the obturator portion was an integral part of the nasal-palatal prosthesis. And before the end of the decade, in 1889, Claude Martin described fabricating a nasal prosthesis using ceramic material.

Detamore, in 1894 made an artificial nose made of "very light plastic material" secured by bow spectacles.

1900-1940 A.D.

Towards the end nineteenth century, vulcanite rubber was widely used by the dental profession and adapted for facial prostheses. Upham described the fabrication of the nasal and auricular prostheses made from vulcanite rubber. In 1905, Ottofy, Baird, and Baker reported using black vulcanized rubber as a nasal prosthesis foundation. They processed pink vulcanized rubber onto the foundation and painted it with the artist's paint. But the rigidity of the vulcanized rubber presented a problem when adapted to facial skin.

In 1913, gelatin-glycerin compounds were introduced for facial prostheses to mimic human skin's softness and flexibility. Kazanjian described the use of celluloid paints for coloring vulcanized rubber facial prostheses.

1940-1960 A.D.

With the introduction of latex, which overcomes the rigidity of vulcanized rubber, techniques were described by Bulbulian and Clarke for the use of pre vulcanized latex with water-soluble dyes for facial prostheses.

The acrylic resin was introduced to dental profession in 1937, and it replaced the older vulcanite rubber in both intra and extra-oral prostheses. Its transparency, colorability, and ease of processing was attractive to most clinicians despite its rigidity.

To overcome acrylic resin's rigidity problem, Tylman introduced the use of a resilient vinyl copolymer acrylic resin for facial prostheses. He used acrylic resin polymer stains for intrinsic coloring and watercolor for external tinting.

1960-1970 A.D.

Banhart was the first to use silicone rubber for constructing and coloring facial prostheses by combining a silicone rubber base material with acrylic resin polymer powder for the intrinsic coloring of silicone facial prostheses. Ouelette mixed dry mineral earth pigments in a silicone base material thinned with xylene for external spray coloring of silicone facial prostheses. The final tinting was further protected by spraying a thin layer of catalyst on the prosthesis and then polymerizing it.

Firtell and Barlett used dry mineral earth pigments and silicone base material to produce stock colors from which base shades and surface colors could be formulated.

Schaaf reported using standard artist's oil paint tattooed into silicone facial prostheses' surface to simulate freckles, blood vessels, and general shading.

Fine described the use of colored nylon flockings as a major colorant for both internal and external coloring of facial prostheses. It was claimed that nylon flockings were more color stable and imparted a more natural appearance to prosthesis than dry earth mineral pigments.

A multi-layering technique for shade matching was also introduced for both chairside and laboratory procedures.

1970 to 1990:

Lontz used modified polysiloxane elastomers.

Turner documented the use of isophorone polyurethane.

Udagama and Drane introduced the use of Silastic Medical Adhesive Silicone Type A for the fabrication of facial prostheses.

1990 to present: Advances in polymer chemistry have renewed interest in developing new materials for facial prostheses.

Antonucci and Stansbury are investigating new generations of acrylic resins.

Polyphosphazenes and Silicone block copolymers are also being evaluated.

Advanced technologies like Rapid prototyping, CAD-CAM technology are being introduced and extensively used in maxillofacial prosthetics.[2,5]

IV. SCOPE OF MAXILLO-FACIAL PROSTHETIC MATERIALS

The ultimate challenge to a maxillofacial prosthetic material is its clinical performance.

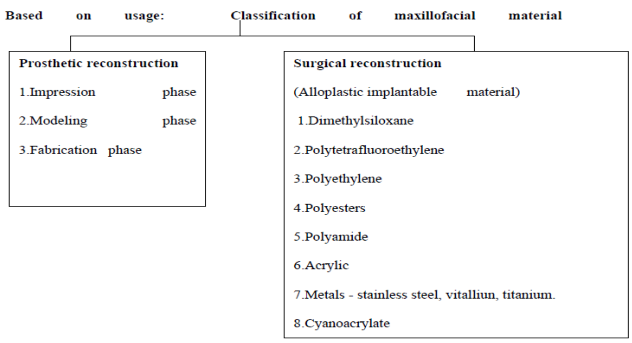
Future research should concentrate on two primary goals.

1. **First:** Improves physical and mechanical properties of material will behave more like human tissue and increase the prosthesis's service life.

2. **Second:** Finding color-stable coloring agents for coloring facial prostheses & developing a scientific method of color matching to human skin.

V. IDEAL REQUIREMENTS OF MAXILLO-FACIAL PROSTHETIC MATERIALS:

1. Materials should be biocompatible.
2. Flexibility: have to be flexible at temperatures from 4.4°C to 60°C.
3. Color and Translucency: Color has to blend with the adjacent skin as close as possible.
4. Chemical and environmental stability.
5. Thermal conductivity: Poor conductors of heat.
6. Ease of processing and duplication.
7. Weight: Light and easily retained in the position and are comfortable to the patient.[5]



Flow Chart 1: Classification of maxillofacial material.

CLASSIFICATION OF MAXILLOFACIAL MATERIALS

PROSTHETIC RECONSTRUCTION MAXILLO-FACIAL MATERIALS

The maxillo-facial materials which are used during prosthetic reconstruction are categorized mainly as –

1. The Impression phase.
2. The Modeling phase.
3. The Fabrication phase.

1. IMPRESSION PHASE MATERIALS:-

Ideal requirements of impression phase materials:

• Should be able to reproduce sufficient detail
• Be inherently strong
• Be easy to manipulate
• Be easy to obtain
• Be comparatively inexpensive

The materials used for the impressions phase:-

a) Reversible Hydrocolloid
b) Irreversible Hydrocolloid
c) Room Temperature Vulcanizing Materials
d) Plaster Of Paris
e) Elastomeric impression material

2.MODELING PHASE MATERIALS

Ideal requirements of modeling material:-

- Should be malleable.
- Should have sufficient body and strength to permit sculpting a feather edge
- Should be possible to sculpt texture.
- Color has to be close to the skin tone

a) Modeling clay.
b) Plaster
c) Plastolene
d) Waxes.
a). Modeling Clay (Sculptor's Clay):
It is a water-based clay which, when allowed to dry, becomes a hard, stone-like substance

Fig 1: Modeling Clay.

b) Plaster: This age-old material gives excellent accuracy of slight facial defects, for example, in moulage.

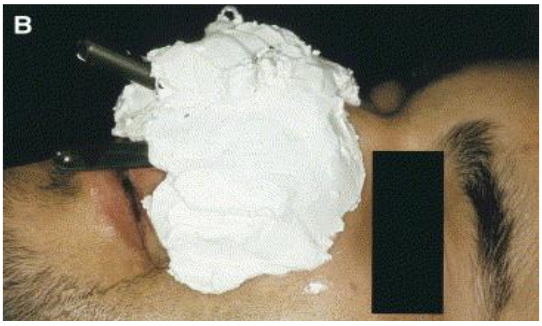


Fig 2: Plaster

C). Pleistocene: This is a type of modeling clay or Fuller's earth with an oil base

D). Waxes: Waxes are generally available in various consistencies

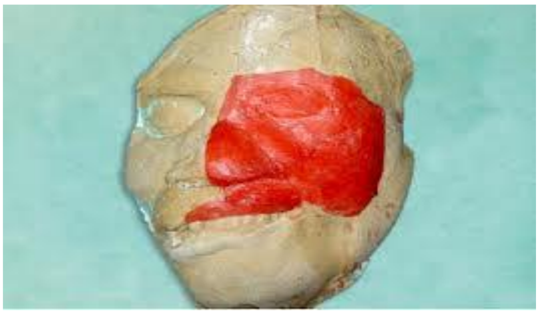


Fig 3: waxes

3.FABRICATION PHASE MATERIALS

1. Acrylic resin.
a. Methyl methacrylate
b. Plasticized methyl methacrylate
c. Polymethyl methacrylate

2. Latex.

a. Natural latex
b. Synthetic latex
c. Silicone foam rubber

3. Vinyl polymers and copolymers.

4. Polyurethane.

5. Silicone

a. Room temperature vulcanizing
b. Heat temperature vulcanizing

6. Recent advancement

1. ACRYLIC RESINS: Polymethyl methacrylate have been used before on facial defects where little movement occurs in tissue bed during the function.

Advantages are compatible with most adhesive systems; the strength of the material enables feather exposed margins.

Fig 4: Acrylic Resin.

B. Plasticized methyl-methacrylate (Palamed)

It is formulated with a foaming agent resulting in heat or an initiating chemical, and a foaming agent releases a gas incorporated into the material as it cures where resulting product is spongy with solid skin wherever the material contacts the surface of mold.

Disadvantage: Tackiness of the finished prostheses' surface, which creates the affinity for the collection of dust, necessitating special cleaning with benzene.

2. LATEX

a. Natural latex.
b. Synthetic latex.
c. Silicone foam rubber.

a) Natural latex: is one of the oldest materials used.

b. Synthetic latex

This is a terpolymer of butyl acrylate, methyl methacrylate, and methacrylamide. Firstly gypsum cast is made identical to the finished prosthesis. Later model dipped in latex. Now the cast is covered with a layer of Plastogum (plaster and corn starch), which prevents the latex from distorting. Latex shrinks considerably as it solidifies because of large volumes of water that evaporates from the mixture

Fig 5: Synthetic latex.

C. Silicone foam rubber

This is Seldom used as a material for a maxillofacial prosthodontics material.

Fig 6: Silicone rubber foam

§ Most consistent (even-sized small pores)
§ Easy to manipulate
§ Its stiffness, strength, and specific gravity can be altered by mixing Silastic 382 with it before the addition of the foaming agent

§ Foaming agent material releases hydrogen gas.

3. Vinyl polymers and copolymers

Commercially available:- polyvinylchloride (Realistic), polyvinyl acetate chloride (Mediplast, Prototype III)

Fig 7: Vinyl copolymer.

Introduced in the mid-1940s as plastisols. These are most widely accepted are realistic (polyvinyl chloride) and mediplas (polyvinyl acetate chloride) and are susceptible to the degradation or destruction by U.V. light, ozone, peroxide, and tetraethyl lead, and they are relatively rigid and are made flexible by the use of a plasticizer

Chlorinated polyethylene

Commercially available:- CPE 726

Described by Lewis and Castleberry. These are processed by involves high heat curing of pigmented sheets of the thermoplastic polymer in metal molds. The Coloration is done by using oil-soluble dyes, and repeated molding is possible

Gettleman reported thermoplastic chlorinated polyethylene (CPE 726/19-15) as a potential maxillofacial material.

The main disadvantage of these is the usage of metal molds.[6]

4. POLYURETHANE

Diisocyanate + Polyol initiator polyurethane.

Commercially available:-Epithane-3 (DARO products, Butler, Wis.)

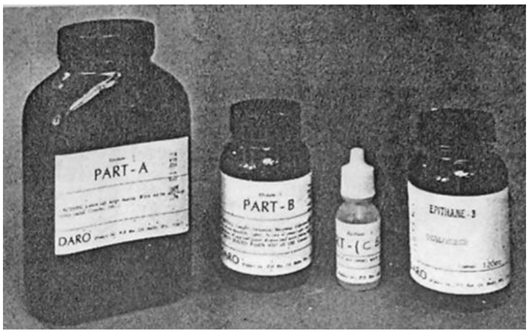


Fig 8: Polyurethane

Three components of Polyurethane:

Part A - Polyol
Part B - Iso-cyanate
Part C - Initiators like dibutyltin dilaurate or stannous octoate.

This is a high technique sensitive material

a) 3 components must be accurately proportioned and carefully mixed to produce a usable product

b) Curing temperature must be controlled

c) Presence of moisture in air leads to the production of carbon dioxide, which results in porous elastomer

d) Linotype metal molds are necessary to prevent moisture contamination.[5,6]

Isophorone polyurethane

Being formulated as a three-component kit comprising an isocyanate-terminated prepolymer, cross-linking agent, and an organotin catalyst. The system's main component, the prepolymer, is prepared by the controlled combination of Isophorone Diisocyanate, butanediol, and a Polyether polyol. These have unusually high strengths when compared to other aliphatic Polyurethane. The exceptional strength of the polyurethane results from the cycloaliphatic Isophorone moiety in the vulcanized network. The system has not yet undergone toxicological evaluation in animals.

Fig 9: Isophorone Polyurethane

5. SILICONE

Long-chain molecules are composed of an alternating chain of silicon and oxygen atoms. So thereby adjusting the length of this silicon-oxygen chain, silicones can be produced in the form of fluids, resins, or elastomers (rubbers). Better physical and chemical properties of all materials. Silicones can only be produced synthetically. The unique properties of silicones are due to the unique characteristics of the silicon-oxygen bonds in their backbone. Because as the silicon-oxygen bond is much stronger than the carbon-carbon bond of organic polymers, silicones make better electric insulators, which are more resistant to oxidation. So the silicon-oxygen chain is easily twisted, and the organic side groups can rotate freely around the bonds

Silicones are classified as

Based on the vulcanizing mechanism as:-

• High-temperature vulcanization silicone (H.T.V.)
• Room temperature vulcanization silicone (R.T.V.).[7]

Based on applications as :

•Implant grade - F.D.A. requirements.
•Medical grade - External use only.
•Clean grade - Packaging silicone.
•Industrial grade - Industrial applications.

Based on chemistry as:-

• Poly dimethyl siloxanes.
• Methyl vinyl/dimethyl siloxanes.
• Phenyl methyl siloxanes.
• Fluoro dimethyl siloxanes.

Based on viscosity as:-

Puttylike
High viscosity - Heavy body
Regular body
Light body

Fig 10: Silicone elastomers

R.T.V. Silicones:-

R.T.V. Silicones set by condensation polymerization. They are easier to process and allow intrinsic Coloration.[8]
 Catalyst -Stannous octoate
 Cross-linking agent -Ortho-alkyl Silicate
 Easier to process and allow intrinsic Coloration.

Commercially available:- Silastic 382, 399

- It includes a filler – Diatomaceous earth particles.
- A stannous octoate - catalyst
- Ortho alkyl silicate – cross-linking agent
- They are available as a clear solution that enables the fabrication of translucent prosthesis
- R.T.V. silicone is blended with suitable earth pigment; to produce the patient primary skin color

HTV Silicones :- Commercially available:- Silastic 370, 372, 373, 4-4514, 4-4515.[9]

- H.T.V. silicone is usually a white, opaque material with viscous, putty-like consistency.
- 1-component or 2-component putty.
- Catalyst / vulcanizing agent of H.T.V. is Dichlorobenzyl peroxide/ platinum salt.
- Various amounts of fillers are added depending on the degree of hardness, strength, and elongation.
- Silica – Filler Size 30
- Co polymerization of silica with a small amount of methyl, vinyl, or methyl phenyl siloxane radicle
- Poly dimethyl siloxane may be added to reduce the stiffness, hardness of the prosthesis.

Various types of H.T.V. Silicones:

- Silastic S-6508, 382, and 399 (Michigan).
- Silastic S-6508 is in the bare stage is similar to sticky modeling clay. It must be vulcanized at 2600F and formed in pressure molds.
- Silastic 382 - an opaque white fluid with a viscosity same like that of thick honey.
- Silastic 399 resembles white vaseline in a raw state. Easily spatulated, but non-flowing.
- Silastic 382, tougher non-flowing, but easier to handle

Fig 11: H.T.V. silicones.

Condensation type polymerization

Commercially available:- MDX 4-4210 (Silastic 4-4210), Silastic 388, 399

It has a chloroplatinic acid catalyst and hydro-methylsiloxane as a cross-linking agent.[10]

Fig 12: MDX4-4210

Silphenylene - Silicone copolymer

Copolymerization with two or more of different monomers results in chains with various properties.

E.g., There are twenty amino acid monomers whose sequence results in different shapes and functions of protein chains are synthesized and formulated as a pourable, viscous, R.T.V. liquid are transparent reinforced with silica fillers.

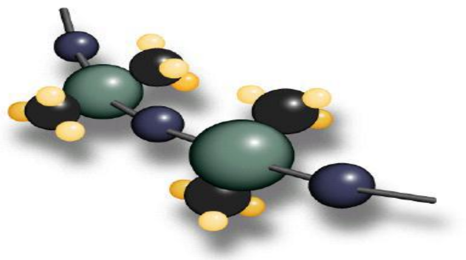
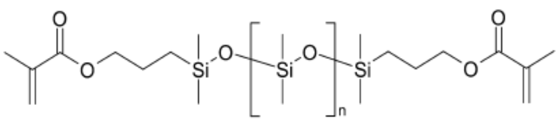


Fig 13: Silphenylene - Silicone copolymer

Three-component kit –

- Base elastomer,
- Tetrapropoxysilane (cross-linking agent) and
- Organotin catalyst. - Improved property

SILICONE BLOCK COPOLYMERS



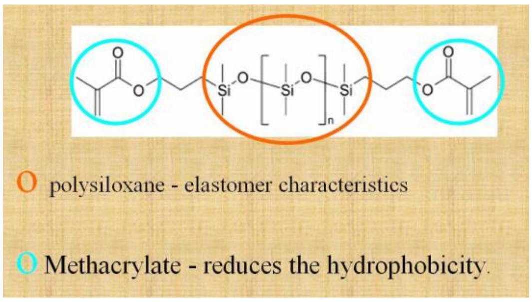


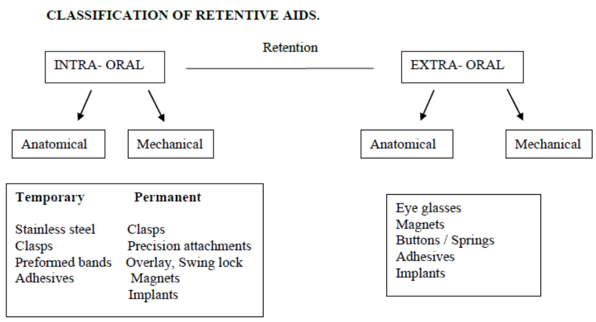
Fig 14: MPDS - Methacryloxypropyl-terminated Polydimethylsiloxane

Methacrylate - (Adheophilic) reduces the hydrophobicity and enhances the adhesive bond strength to non-silicone-based adhesives.[10]

Retentive aids in maxillofacial prosthodontics.

The maxilla-facial prosthesis field aims to restore lost or compromised facial anatomy with the use of artificial substitutes. There are various types and methods for gaining retention, stabilization, and immobilization as required in a maxillofacial prosthesis.

In the past, palatal defects were stuffed with cotton-wool, oakum, and wax. Then suspension devices, spectacles, and other retentive aids were used. The retentive methods have now progressed to the use of cast partial dentures and implants.



Flowchart 2: Classification of retentive aids.

The use of anatomic undercut was one of the first ways employed for retention of the maxillofacial prosthesis.

1. **Eyeglasses & eye patches** are used to retain large facial prostheses.

Fig 15: Eye patches

2. **Magnets - intra-oral and facial prosthesis are mutually retained by attractive forces of magnets**

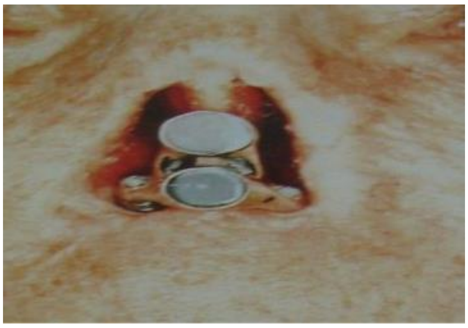


Fig 16: Magnets.

Fig 17: Spring dentures.

3. Springs:- George Washington springs, Pandel springs

Adhesives

Historically, the facial prosthesis has been retained by various mechanical devices; recently, adhesives have been used.

Skin adhesive is a temporary method of retention.

A variety of adhesive systems are employed to retain facial prostheses in position. Adhesives should retain prostheses during ordinary and extreme facial expressions, a build-up of sebaceous secretions and water, and change of weather conditions.

Selection of Adhesives.

It is based on:-

1. Biocompatibility
2. Retentive properties
3. Ease of applicability
4. Removal on a daily basis.
5. Nature of the materials from which prosthesis is fabricated.

Classification of adhesives

•Rubber-based liquid adhesives (natural and latex)
•Pressure-sensitive bifaced tape
•Silicone adhesives
•Acrylic resin emulsions (gum mastics)
•Cyanoacrylates

Pressure-sensitive tape Ex:- double-coated polyethylene and 3M surgical tape.

These materials are backing strips which arcomposed of cloth, paper, film, foil, or laminate coated with a pressure-sensitive adhesive.

It is a rubbery type elastomer combined with a liquid or solid resin tackifier component, plasticizers, fillers, and antioxidants.

The advantages of this type are the ease of application and cleaning after removal.
The bond is weaker than that of rubber adhesives.
The primary indication for biphasic tape is with materials that have low flexibility and non mobile tissue beds.

Fig 18: 3M Adhesive tape.

Fig 19: Silicone adhesive.

Silicone adhesives

Ex. Hollister medical adhesive, Secure medical adhesives

They are a form of R.T.V. silicone dissolved in a solvent. Once applied, the solvent evaporates, and tacky surface forms that can contact bond with other surface.

Despite their low adhesive strength, they have good resistance to moisture and weathering with low water sorption

They are prone to dissolve in organic solvents such as xylene.

Acrylic resin emulsions

Ex:- Epithane-3 adhesive, Prosaide adhesive

Composed of acrylic resin dispersed in a water solvent that, when evaporated, leaves a rubber-like substance.

Other materials within the mixture include synthetic rubber, vinyl acetate, reclaimed rubber, vinyl chloride, styrene, and methacrylic.

Penetration and wetting can be controlled by adding surfactants or altering the particle size of the dispersion.

Increasing the viscosity can prevent penetration into porous surfaces.

Udagama determined the best combinations to be polyvinylchloride with Epithane-3 adhesive, acrylic with Medico, and Polyurethane with Davol.

Krill's findings are as follows:

Silicone adhesive type B (aerosol) is the most effective for silicones.

The pressure-sensitive tape is the most effective adhesive for polyvinyl chloride.

Butyl alpha-cyanoacrylate is the most effective adhesive for Polyurethane

Implants as a retentive aid in maxillo-facial prosthesis.[11]

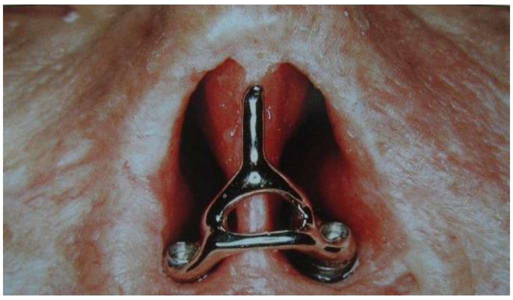


Fig 20: Implants as a retentive aid

COLORATION

Realistic Coloration of an external facial prostheses is important feature for patient satisfaction and acceptability

Three basic techniques:

1. Extrinsic
2. Intrinsic
3. Combination of both

Intrinsic coloring:

According to Chalian et al. (1972, 1974), intrinsic color in H.T.V. silicones is accomplished with a milling machine.[11]

Metallic oxides/pigmented silicone concentrates are generally used & red fibers may be incorporated to simulate blood vessels.

Fig 21: Intrinsic colors

- Coloring in R.T.V. silicones (MDX 4-4210) is accomplished by adding various dry earth pigments.

- For accurate measurements, these pigments are mixed with R.T.V. in the ratio of 3 grains of pigments to 10 ml of thinner

- According to Chalian et al. (1972) & Beder (1974), the intrinsic coloring is more effective than extrinsic techniques due to longer service life.

- Intrinsic coloring with minimal characterization is helpful in achieving skin like the coloring of the prosthesis.[12]

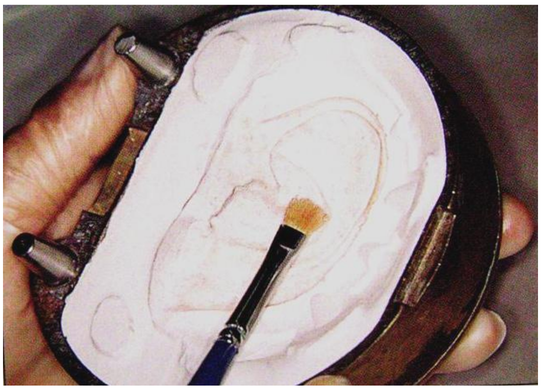


Fig 22: Intrinsic staining

Extrinsic coloring:

- Bartlett et al in (1971) recommended extrinsic coloring of the maxillofacial prosthesis with use of medical adhesives.

- Silicone type A adhesive has been thinned with xylene & stored in containers.

- Each container is tinted with selected inorganic pigments.

- This adhesive will then be applied with a cotton swab to the prosthesis, which will provide a life-like texture to the prosthesis.

- Ouellete (1969) described spray coloring of silicone e1astomer maxillofacial prosthesis.[13]

- According to Schaaf (1970), the color easily peels off or rubs off during manipulation of the prosthesis or during daily cleansing

- The prosthesis should be made in a lighter color, which can be obtained by the intrinsic coloring of prosthesis with a minimal surface characterization according to the needs of the patients

Fig 23: Extrinsic staining

Stain Removal:

Environmental stains were removed from maxillofacial elastomers by solvent extraction. Silastic 4-4210, an R.T.V. silicone, was stained with lipstick, disclosing solution, and methylene blue. These stains were then removed by solvent extraction with four chemically dissimilar solvents: toluene, benzene, 1,1,1-trichloroethane, and n-Hexa. Results obtained from spectrophotometric there was little or no change in the color of the pigments or the base elastomer.

VI. LIMITATIONS OF THE MAXILLOFACIAL MATERIALS

No single maxillofacial material is ideal to every patient. Some of the limitations of all these materials are:

- The continued effect of sunlight and vascular dilatation and contraction on the natural tissues cannot be duplicated in the prosthesis.
- The variations of the skin tone when patient is exposed to different light sources (e.g., fluorescent, incandescent, and natural light) cannot be duplicated in the prosthesis.
- The inflammation caused by recent surgery, which subsides with time and necessitates remaking the prosthesis.
- Emotional factors that cause color changes in the skin cannot be duplicated in the prosthesis.
- The varying physiologic conditions of the patient in everyday living (e.g., lack of sleep, infectious diseases, and edema resulting from interrupted lymph drainage caused by surgery) cannot be duplicated in the prosthesis.[14]

- The prosthesis cannot duplicate the full facial movement of the non-defective side. Lack of predictability of the life of prosthesis because of variations among patients (i.e., secretions, smoking, and environment) Common problems of maxillofacial materials.
- Discoloration of intrinsic and extrinsic coloration due to external environmental factors.

VII. RECENT ADVANCES

Cosmesil: Introduced in 1982 as condensation type – R.T.V.

•1993- addition type (platinum cure system)
•2-part – elastomer & catalyst – paste form in tubes
•Shelf life – 6 months

Fig 24: Comesil

The gas forms bubbles within the vulcanizing silicone. After the silicon is processed, the gas is eventually released, leaving spongy material.[15]

Primer

With the introduction of urethane-line silicone prosthesis, there has been an increased interest in primers used for the promotion of bonding between silicone and other maxillofacial prosthetic material 1200, 1205, S-2260, 4040, Z6032 and Z 607.[17,18]

Fig 25: Primer

Foaming silicones:- Silastic 386 a form of R.T.V. silicone

CAD-CAM MAXILLO - FACIAL PROSTHESES

This unit consists of two laser beams and two charges coupled device camera where the image from camera is transferred into an image processor to generate a three-dimensional image.

Production of a wax model- Two alternative CAD-CAM three-dimensional modeling techniques, i.e., Laser lithographic model and numerically controlled milling model, which are connected to fabricate the prototype wax model

Completing the final silicone facial prostheses, the prototype wax model is tried on the patient's face to check for the accurate fit and proper adaptation of the margins and the shape. Then wax model is flasked and fabricated conventionally.

VIII. CARE FOR PROSTHESIS:

The prosthesis should be removed at least once a day to clean. The adhesive should be removed with a rolling motion of the ball of the finger in the direction of application. No cosmetics should be used, should clean the prosthesis with soap and a brush. If any problem occurs, then prosthesis should be discontinued, and the patient is suggested to consult the Prosthodontist. The area should be free from oil and clean. After applying the adhesives, should apply pressure for more than 5 mins. While cleaning the prosthesis, should clean secretions thoroughly to avoid any contamination.[19,20] The materials that can generally be used for cleaning and disinfection of the prosthesis are:

- Neutral soap & water
- 4% chlorhexidine
- Efferdent

CONCLUSION

When reviewing each of these materials advantages and disadvantages, it is evident that no single material is ideal for every patient.

Some of the problems which are inherent in these materials are: The continued effect of the sunlight and vascular dilation and contraction on the natural tissues cannot be duplicated in the prosthesis.

The variations of the skin tone when the patient is exposed to different light sources (e.g., fluorescent, incandescent, and natural light).

Fig 26: Dis-infection solution.

- Emotional factors that cause color changes in the skin.

- The inability of prosthesis to duplicate the full facial movement of non-defective side.

- Lack of predictability of life of the prosthesis because of variations among patients (i.e., secretions, smoking, and environment)

The overview deduced that the materials currently available still do not entirely meet our needs. It might be a dream, but fabricating a high-quality life-like 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 Oro-facial defect who deserves the best we can offer.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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