MAXILLO- FACIAL PROSTHESIS: A MINI REVIEW

INTRODUCTION

The structures may be missing or mutilated as a result of surgery, trauma, or congenital defects. Maxillofacial prostheses are used to transform congenital, developmental, and acquired defects of the head and neck into natural–appearing reproduction of missing parts, thus providing an acceptable appearance and improved function. There is not a more severely handicapped person then the person with the gross facial disfigurement. Since the most exposed portion of his body is cruelly distorted. Maxillofacial prosthesis is defined as “Any prosthesis used to replace part or all of any stomatognathic and or any craniofacial structure. The search for more acceptable materials for maxillofacial prosthesis have been made in past several decades through the quality of materials remain less than satisfactory.

HISTORICAL REVIEW

An exact point in history where man first attempted to disguise the presence of congenital or acquired facial deformity by artificial means is not known. Materials that could have been used would have been limited at the time to animal skins, clay and wood. These were the only substances available that might have been used. Over the years, with the increase in knowledge in human anatomy and physiology and with the introduction of newer materials, there has been a significant improvement in the fabrication of these maxillofacial prostheses. The very early use of maxillofacial prosthetic devices is somewhat obscure. In Egyptian mummies auricular, nasal and even ocular prosthesis fabricated from various materials has been found. Chinese were known to fabricate nasal and auricular prosthesis using natural waxes, resins and metals usually gold or silver. Alphonse Louis fabricated silver mask for French soldier who become injured in war by shell fragments which removed nearly all of the left side of the mandible and maxillae. According to Beder, Ambrose pare described the first obturator in 1541 which consisted of a simple disc attached to sponge. TychoBrache in 1576 used an artificial nose made from gold to replace nose. Pierre Fauchard (1678) made monumental contributions to prosthetic facial reconstruction. William Morton in 1856 fabricates nasal prosthesis using enameled porcelain to match the complexion of a patient. Kingsley in 1880 described the combination of a nasal and palatal prosthesis in which the obturator portion was an integral part of the nasal prosthesis. In the nineteenth century, vulcanite rubber was widely used by the dental profession for use in facial prosthesis. For example, in 1901, Uphama Boston dentist described the fabrication of nasal and auricular prosthesis made from vulcanite. Ottofy, Baird and Baker in 1905 uses black vulcanized rubber for maxillofacial prosthesis. In 1913 Gelatin-glycerin compounds were introduced in dentistry for use in facial prosthesis in order to mimic the softness and flexibility. Kazanjian described the use of celluloid prints for coloring vulcanized rubber facial prosthesis. In early 1940 acrylic resin was introduced in the dental profession. The introduction of various kinds of elastomers in 1960 resulted in major changes. Barnhart was the first to use silicone rubber for construction and coloring of facial prosthesis. Tashma used dry earth pigments dispersed in colorless acrylic resin polymer powder for intrinsic coloring of a silicon facial prosthesis. Gonzalez in 1978 explain the use of polyurethane elastomer. Lewis and Castelberry described the potential use of siphenylene for a facial prosthesis.

IDEAL PROPERTIES

- High edge strength.
- High elongation.
- High tear strength.
- Softness, compatible to tissue.
- Translucent.

IDEAL PROCESSING CHARACTERISTICS:
- Chemically inert after processing.
- Ease of intrinsic and extrinsic coloring with commercially available colorants.
- Long working time.
- No color change after processing.
- Reusable molds.
- Retain intrinsic and extrinsic coloration during use.

IDEAL BIOLOGICAL PROPERTIES:
- Non-allergic.
- Cleansable with disinfectants.
- Color stability.
- Inert to solvents and skin adhesives.
- Resistance to growth of microorganisms.

MATERIALS AVAILABLE:10-12
1. ACRYLIC RESIN: It was once used commonly for maxillofacial prostheses and now its use is limited where little movement of the tissue bed takes place during function.(e.g. fabrication of orbital prostheses). It is easily available, durable, easy to stain and color, color stable, can be refined and repair. Rigidity and high thermal conductivity, duplicating of prosthesis is not possible, because of destruction of the mold during processing, water sorption and increased weight 0.5% after one week is their major drawbacks.11

2. ACRYLIC CO-POLYMERS: Although this material are soft and elastic but are not widely accepted due to their questionable properties. They possess poor edge strength, poor durability, subject to degradation when exposed to sunlight. Processing coloration is difficult. Completed restoration often become tacky, predisposing to dust collection and staining.12

Antonucci and Stansbury reported the new generation of acrylic monomers, oligomers and macromers. They are thermal, chemical and photoinitiated. They can eliminate the short comings of traditional acrylic copolymers. Polyvinyl chloride co-polymer: (Realistic, medioplast, proteotype III) At one time vinyl polymers and co-polymers were popularly and widely used for facial restoration. It consists of combination of polyvinyl chloride + plasticizer (a hand clear resin that is tasteless and odorless). Advantages: - Flexible. - Adaptable to both intrinsic and extrinsic coloration. - Acceptable initial appearance. Disadvantages: - Plasticizer migration and loss result in discoloration. - Edges tear easily. - These compound can be stained easily but degrade when exposed to UV Light. - Absorbs sebaceous secretions, they compromise the physical properties. - Require metal molds for curing at high temperature.13-15

3. CHLORINATED POLYETHYLENE: - Lewis and Castleberry reported similarity of this material to polyvinyl chloride in both chemical composition and physical properties. - The processing procedure involves high heat curing pigmented sheets in metal molds.7

4. POLYURETHANE ELASTOMERS: - Polyurethane elastomers serve a variety of commercial uses.
- They can be synthesized with wide range of physical properties.
- They arise from two major reactants. In the presence of a catalyst, polymer terminating with an isocyanate is combined with one terminating with a hydroxyl group. Varying amount of isocyanates will change the physical properties of final products.

Advantages
- They can be made elastic without compromising strength.
- They can be colored extrinsically and intrinsically.
- Superior cosmetic results can be obtained, surpassing the other materials currently available.

Disadvantages
- Difficult to process consistently.
- Isocyanate is moisture sensitive.
- Water contamination is difficult to control.
- Not color stable.
- Poor compatibility of this material with adhesive systems.6,7

5. SILICONE ELASTOMERS: The silicones were introduced in 1946, but have been used in the fabrication of maxillo-facial prosthesis only for the past few years. silicones consist of alternate chains of sodium and oxygen which can be modified by attaching various organic side groups to the silicon atoms or by cross linking the molecular chains. Silicones have a range of properties from rigid plastics through elastomers to fluids. They exhibit good physical properties over a range of temperatures. Silicon can be cured at room temperature or heat.8-12

6. HTV SILICONES: Silastic 370, 372, 373, 4-4514, 4-4515. It is usually a white, opaque material viscous and putty like in consistency. It is 1-component or 2-component putty. The Catalyst / vulcanizing agent of HTV is Dichlorobenzyl peroxide/ platinum salt. Various amounts of fillers are added depending on the degree of hardness, strength and elongation. Polydimethylsiloxane may be added to reduce the stiffness and hardness of the prosthesis. Various types of HTV Silicones are Silastic S-6508, 382 and 399 (Michigan). Silastic S-6508 in raw
stage is similar to sticky modeling clay. It must be vulcanized at 2600°F and formed in pressure molds. Silastic 382 is an opaque white fluid with a viscosity like that of a thick honey. Silastic 399 resembles white Vaseline in its raw state. Silastic 382 is tougher, non-flowing, but easier to handle.10-13

7. COMMERCIALLY AVAILABLE NEWER MATERIALS: Newer materials representing a variety of polymer classes offering unique characteristics have recently been introduced which are as follows:
- Acrylic resin copolymer (Palamed - Kulzer)
- Vinyl polymers and co-polymers (Realistic – prosthetic services)
- Polyurethane elastomers
- (Epithane – 3 Daro Products)

MDX 4-4210: - This medical-grade silicone elastomer exhibits improved qualities relative to coloration and edge strength. The polymerization reaction is an addition reaction with no reaction by-products. The cured material has shown adequate tear strength and there accelerated aging tests have shown that the elastomer is very color stable.

Adhesives:
A variety of adhesive systems have been employed to retain facial prosthesis in position. They are classified as 
(a) Pastes 
(b) Liquids 
(c) Emulsions 
(d) Spray-ons 
(e) Double sided tapes – most commonly used (41%) among patients with facial prosthesis because of its easy manipulation.

RECENT ADVANCES
Silicone Block Copolymers: They are introduced to improve some of the drawback of silicone elastomers, such as decreased tear strength, low percent elongation and its susceptibility to bacterial growth.7

Polyphosphazenes: Fluoroelastomer has been developed for use as a resilient denture liner and it has the potential to be used as a maxillofacial prosthetic material.5

Cosmesil: It is a RTV silicone having a high degree of tear resistance.

Foaming silicones: Silastic 386 is a form of RTV silicone. The gas forms bubbles within the Vulcanizing silicone. After the silicon is processed, the gas is eventually released; leaving a spongy material.

Advantage: Formation of bubbles within the mass can cause the volume to increase by as much as seven fold. Purpose of the foam silicon is to reduce the weight of the prosthesis.6,7

Craniofacial and intraoral implant: A review of literature shows that intraoral implants have been designed in a vast array of different sizes, shapes and biomaterials. The particular design of threaded pure Titanium Branemark implant is predicated on several key 7 principles, including the biomechanical principles. With craniofacial implants, one difference is that craniofacial bone sites will differ from intraoral bone sites, as they are thinner, comparatively. The effective implant length in craniofacial sites is often only 3-4 mm. A craniofacial implant has a flange above the threaded portion which provides initial stability of implant design during the healing period and especially helps in prevent tilting of the implant under the action of lateral forces and movements. Also the flange helps to prevent accidental perforation of the implant through thin bone sites that may be encountered in craniofacial anatomy.5-10

CONCLUSION:
Not a single maxillofacial material is ideal for every patient. Each material has its own pros and cons. The continued effect of sunlight and vascular dilatation and contraction on the natural tissues cannot be duplicated in the prosthesis. The variations of skin tone when the patient is exposed to different light sources (e.g., incandescent, fluorescent, and natural light) cannot be duplicated in the prosthesis.

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