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Review Article

A literature review on different materials used in the fabrication of maxillofacial prosthesis

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Abstract

Rehabilitation of patients with congenital or acquired defects of the oral cavity is a very challenging task. These defects might range from minor defects of the oral cavity to the major functional defect. Defects of maxillofacial region can be due to result of congenital or might be due to any trauma. To close these defects, prosthetic rehabilitation can be done. The success of the prosthetic rehabilitation is totally dependent on the physical as well as mechanical properties of the material, which is supposed to be used. The prosthodontics management of the patient should aim, not only restricted to function and esthetic, but along with this also ensure the psychological well-being of the patient. Materials used in the rehabilitation of the defects should fulfill some requirements like function of the prosthesis, longevity of the prosthesis, and as well as esthetics of the prosthesis. These materials used for the rehabilitation of the defects, should suits the selection criteria to satisfy and fulfill the demand of function, biocompatibility esthetics and durability.

Keywords: Maxillofacial prosthesis, Maxillofacial defects, Trauma, High temperature vulcanizing silicones, silicones, resins, Primers

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1. Introduction

In the few recent years we found a sudden increase in the demand for prosthetic rehabilitation. Surgical reconstruction is often found contraindicated in high risk patients. Prosthetic rehabilitation gives advantage of quick, reversible as well as uncomplicated rehabilitation of the patient. In addition to this, the prosthesis can be removed readily and easily from the mouth to check the underlying health of the soft tissue and as well as the health of the site, over which the prosthesis has been given.[1-7]

Historically many types of materials has been used in the fabrication of the prosthesis , earlier under the category of the rigid materials , wood , wax metals , vulcanite and different types of plastic has been used and under the category of flexible materials, materials such as mixture of gelatin glycerine , latex and elastic plastics found of little use.[2-3]

Maxillofacial prosthesis, is that branch of prosthodontics which deals with the restoration and replacement of stomatognathic and associated facial structures, with the help of an artificial substitute that may or may not be removed. With the recent advancements and in the development of the plastic surgery field, still there is need of rehabilitate small or large defects with the help of alloplastic materials.[6-11]

In the present time, materials used in the fabrication of the prsothesis are, vinyl plastics, polyurethane, silicone rubber and acrylic. Till time no material has been developed, that totally resembles or duplicate the human skin.

Ideal properties of the maxillofacial materials are as follows:

Physical and mechanical properties[8-14]

1. They should have high tensile strength.
2. They should posses high resistance to abrasion.
3. Should have low coefficient of friction
4. Should have low glass transition temperature
5. Should have low surface tension
6. Should posses property of lo thermal conductivity
7. Should have low specific gravity

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8. It should be odorless
9. Should be translucent

Biological properties[11-16]

1. It should be compatible with the surrounding soft tissue
2. Material should be non-toxic
3. Material should be non-allergic
4. Material should possess the property of easy cleansibility that too without loss of details of the prosthesis at surface as well as at margins.
5. Material should have stability in color
6. Material should be dimensionally stable
7. Material should possess the property of flexibility which is comparable to the soft tissue
8. Material should be inexpensive
9. Material should possess the property of resistance to environment discoloration.

2. Different Materials Used in the Fabrication of the Prosthesis

Under the category of impression materials, reversible hydrocolloids, irreversible hydrocolloids, and plaster come. Under the category of modeling materials, modeling clay, plaster, plastolene, waxes. under the category of fabrication materials, acrylic resins, acrylic copolymers, polyvinyl chloride and co polymers, chlorinated polyethylene, polyurethane elastomers, latex, slicones: HTV silicone, RTV silicones, foaming silicones, under newer materials, silicone block copolymers , poly phosphazones.[2-6]

Surgical reconstruction materials, it includes, alloplastic materials, implants, metals, tantalum, titanium, stainless steel, auto polymerizing methylmethacrylate, heat polymerizing methyl methacrylate, polyethylene.

2.1. Acrylic resins

These acrylic resins are most commonly used for the fabrication of the denture base and it becomes popular for the fabrication of facial prosthesis soon after world war second. These materials can be used because of the property of rigidity in specific defects. This material is commonly available in the market and most of the dentists are habitual how to use this material. With this material both intrinsic as well as extrinsic stains can be given. Heat activated polymerizing resin is preferred over auto polymerizing resin because of the presence of free tertiary amines in the latter.[12-17]

2.2. Acrylic copolymer

These are of acrylic and methacrylic acid. These materials are readily available in the market in three different skin color tone i.e. in pale, medium and dark shade. Palamed has a property of chemical bonding to the hard acrylic and thus it enables the sections of the prosthesis to have supporting acrylic structure in it.[7-8]

2.3. Vinyl plastisols

The first poly vinyl chloride resin for prosthetic was lightly filled with the resin, introduced by vrenon Ben Shoff in the year 1943. Presently this is the widely accepted material in the fabrication of the prosthesis. Some of the advantages of the materials are, it is flexible, very much adaptable to intrinsic as well as extrinsic coloration.

Along with it, some of the disadvantages of the material are, it is not dimensionally stable, it can stain when exposed to the UV light, specifically require metal molds for its curing.[1-8]

3. Chlorinated Polyethylene

It contains chlorine atoms in it and it is compounded with low density state of calcium and soybean oil. The main advantages of this material is, it is very much inexpensive, it is very easy to manipulate, and it is lifelike facial prosthesis. Along with this, it is having some of the disadvantages like time consuming procedure, having not good color stability, it is having very much poor edge strength.[16]

3.1. Polyurethane

It serves variety in terms of commercial as well as medical blood contacting devices. The major advantages of this material is, it is having life like feel texture on touch, this material shows very excellent edge strength, this material can be extinscially as well as intrinsically stained to match the color of the skin, very high esthetic results can be obtained with the use of this material. Some of the disadvantages of the material is, it is very much difficult to process, having poor color stability, this material shows poor adhesive property.[13-15]

3.2. Silicone elastomers

It is chemically known as polydimethyl silicone. Silicones are found to be the most popular in the fabrication of the prosthesis. Silicones are classified into three groups, first classification is implant grade classification, the second classification includes the medical grades, which is especially used for external use only, and the third classification is specifically industrial grade, which is specifically used for industrial use only.[12-14]

3.3. Heat vulcanizing silicones

Heat vulcanizing silicones are translucent in nature, milky white and semisolid materials. These materials are available in one component system or in two component putty system. The catalytic agent in this is dichlorobenzoyl peroxide or the platinum salt, the major advantage of this material are, it shows excellent thermal conductivity, it is very much color stable, even when exposed to the ultra violet light, it shows high strength and is biologically inert material. Some of the

disadvantages of the material are, it shiows low edge strength, that why reinforcement with nylon is very much required at the margins, extrinsic coloration is difficult with the use of this material, for the process of incorporation intrinsic coloration, milling device is specifically required for that purpose.[9-11]

3.4. Room temperature vulcanizing silicone

They are two types of room temperature vulcanizing silicones, one is of addition type and the other is of condensation type, according to their curing mechanism. Addition type silicones are low temperature vulcanizing silicones. The main advantages of room temperature vulcanizing silicones are they are very easy in handling, they can be fabricated in normal laboratory, as such no specific requirement, it shows excellent thermal stability, shows excellent color stability even when exposed to ultra violet light. Some of the dis advantages of this material is, they shows poor wettability, they have poor adhesive properties.[9-12]

3.5. Under the category of newer materials

3.5.1. Silicone block co polymers

These co polymers of silicone blocks are newer materials, which are still under development to improve the drawbacks of silicone elastomers. Literature revealed that these new materials of silicone block co polymers show high tear resistance when compared to conventional silicone polymers.[11]

An other material, polyphoshazines flour elastomers has been developed to serve the purpose of resilient denture liner and can be used as prosthetic material.

4. Discussion

Maxillofacial prosthesis is the replacement of the missing facial part, with the help of an artificial substitute. A thorough knowledge of the material is very much required in the prognosis of the treatment. One should know the actual anatomy of the defect and choose the material according to it.

5. Conclusion

Now days variety of different materials are available in the market, but choosing the right material is very much important in the well-being of the patient. The choice of material should include specific considerations in the well-being of the patient.

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7. Conflict of Interests

None.

References

1. Ma T, Hicken SC, Buchanan CR. Chairside color verification for facial prosthesis. *J Prosthet Dent*. 1988;60(2):219-21.
2. Chalian VA, Drane JB, Standish MS. Maxillofacial prosthetics-multidisciplinary practice. Williams & Wilkins Company, 1972;54(52):2682-90.
3. Kiat-amnuay S, Mekayarajjananonth T, Powers JM. Interactions of pigments and opacifiers on color stability of MDX4-4210/type A maxillofacial elastomers subjected to artificial aging. *J Prosthet Dent.* 2006;95(3):249-57.
4. Kiat- Amnuay S, Beerbower M, Powers JM. Influence of pigments and opacifiers on color stability of silicone maxillofacial elastomer. *J Dent.* 2009;37(1):e45-50.
5. Dahl JE, Polyzois GL. Irritation test of tissue adhesives for facial prostheses. *J Prosthet Dent.* 2000;84(4):453-7.
6. Polyzois GL. Color stability of facial silicone prosthetic polymers after outdoor weathering. *J Prosthet Dent.* 1999;82(4):447-50.
7. Han Y, Powers JM, Kiat-Amnuay S. Effect of opacifiers and UV absorbers on pigmented maxillofacial silicone elastomer, part 1: color stability after artificial aging. *J Prosthet Dent.* 2013;109(6):397-401.
8. Abdelnnabi MM, Moore DJ, Sakumura JS. In vitro comparison study of MDX-4-4210 and polydimethyl siloxane silicone materials. *J Prosthet Dent.* 1984;51(4):523-6.
9. Andres CJ, Haug SP, Munoz CA. Effects of environmental factors on maxillofacial elastomers: Part I- Literature review. *J Prosthet Dent.* 1992;68(2):327-30.
10. Maller US, Karthik KS, Maller SV. Maxillofacial prosthetic materials- past and present trends. *J Indian Acad Dent Spec.* 2010;1(2):25-30.
11. Haug SP, Moore K, Andres CJ. Color stability and colorant effect on maxillofacial elastomers. Part II: Weathering effect on physical properties. *J Prosthet Dent*. 1999;81(4):423-30.
12. Lewis DH, CastleberryDJ, Fischer TH. New and improved elastomes for extraoral maxillofacial prosthesis. *J Dent Res.* 1977;51:23-8.
13. Borle RM, Nimonkar PV, Rajan R. Extended nasolabial flaps in the management of oral submucous fibrosis. *Brit J Oral Maxillofac Surg*. 2009;47(5):382-5.
14. Abdelnnabi MM, Moore DJ, Sakumura JS. In vitro comparison study of MDX-4-421 and polydimethyl siloxane silicone material. *J Prosthet Dent.* 1984;51:523-26.
15. Chen M, Udagama A, Drane JB. Evaluation of facial prosthesis for head and neck cancer patients. *J Prosthet Dent.* 1981;46:538-44.
16. Udagama A. Urethane-linked silicone facial prosthetics. *J Prosthet Dent.* 1987;58:351-54.
17. Gonzalez JB. Polyurethane elastomers for facial prosthesis. *J Prosthet Dent.* 1978;39:179-87.
18. Moore DJ, Glaser ZR, Tabacoo MJ, Linebaugh MG. Evaluation of polymeric materials for maxillofacial prosthetics. *J Prosthet Dent.* 1977;38:319-26.

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