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Maxillofacial Prosthesis as an Insight of Future Prosthodontics: A Review

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Abstract

Maxillofacial disfigurement can be congenital, developmental, traumatic or because of ablative surgery. Such defects compromise appearance, function and render an individual, incapable of leading a relatively normal life and affect his\her psyche. As the patients quality of life is altered; social integration becomes difficult and the expectation to return to "normalcy" collapses. The prognosis for a successful treatment outcome is dependent upon making a correct diagnosis and anticipating issues beyond the realm of dentistry alone. Microvascular surgical reconstruction by free flaps is usually the treatment of choice. However, radiation therapy, anatomic complexity, possibility of recurrence, and procedural complexity may exclude it as an option.

Keywords: Esthetics, Facial defects, Maxillofacial prosthesis, Obturator, Resin

Introduction

Face is the patient's contact with the world and it forms the physical basis for personal recognition. As the father of Indian surgery Sushrutha Samhitha said hundreds of years ago, "the love of face is next only to the love of our life and thus the mutilated cry for help." Hence in this appearance conscious society of ours, it is virtually mandatory now to have a reasonably pleasant appearance, to be accepted. Thus, people having severely disfigured or missing parts of the maxillofacial skeleton or the face in particular come for a normal appearance by artificial restorations to us. Today, with the improved knowledge, skill, materials and technique in the dentistry, it has

become easy to rehabilitate oral, and facial defects with the maxillofacial prosthesis.[1]

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. Maxillofacial prosthesis is defined as any prosthesis used to replace part or all of any stomatognathic and/or craniofacial structures.[2]

Desirable Properties of Maxillofacial Prosthetic Material

1. Physical properties- The material should be flexible, dimensionally stable, 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 six months without significant compromise of esthetic and physical properties. [3]

3. Fabrication characteristic- 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. [4]

Classification of Maxillofacial Prostheses

In general, maxillofacial prostheses can be classified as restorative or complementary. Restorative prostheses substitute for bone loss or repair deformities of facial contour. They can be located internally within the tissue or externally as oral, ocular, or facial prostheses. Complementary prostheses help with plastic surgery, in the pre-, trans-, or postoperative period, or in radiotherapy sessions.

Requisites of Materials Used For Maxillofacial Prosthesis

Biocompatibility is the major prerequisite for a prosthetic material, but the prosthesis must also be easy and in expensive to fabricate. The finished prosthesis must be skin-like in appearance and touch. The desirable qualities include translucence, color, texture, and the tactile sensation of softness. The finished prosthesis should be resistant to chemical and physical insult, including ultraviolet light. It should be durable and strong enough to prevent tearing and should be color stable. A large number of materials have evolved in the field of anaplastology like porcelain, natural rubber, gelatin, latex, etc., in which methyl methacrylate and silicones have established themselves. [5] Methacrylates are relatively hard and more durable. Silicones are soft and flexible. Different elastomers have their own physical and mechanical properties and share common clinical problem such as discoloration over time (intrinsic and extrinsic discoloration due to environmental factors and loss of external pigments) and degradation of physical and mechanical properties (tear) at the margin, lack of compatibility with medical adhesives, weakening of margins by colorants, adhesives, solvents and cleansers and deterioration of static and dynamic mechanical properties. [6] Over the years, there has been some improvement in facial biomaterials; but still there exists a clear need for new or improved facial materials in all clinical situations. Many tests and small clinical trials were conducted on new facial prosthetic material made of low cost thermoplastic chlorinated polyethylene (CPE) at charity hospital of New Orleans(Louisiana state University). [7-10] However, studies have shown that CPE

may have an advantage over conventional silicone rubber material in its ability to be repaired, relined or reconditioned, extending the life of the prosthesis. In addition, it can be used with any adhesive type. It has greater edge strength, does not support fungal growth and is cost effective as compared with silicone materials except processing of this material is complex and difficult. [11]

Materials Available

Acrylic resin: Acrylic resins are employed for specific types of facial defects, particularly those in which little movement occurs in the tissue bed during function (e.g. fabrication of orbital prosthesis) and for temporary facial prostheses. Acrylic resin is easily available, easy to stain and color, has good strength to be fabricated with feather margin and a good life of about two years. 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 upon curing. The matrix is a urethane dimethacrylate with microfine silica and contains a camphoroquinone amine as photoinitiator.[12]

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. [13]

Polyvinylchloride and copolymer: Earlier these consisted of a combination of polyvinyl chloride and a plasticizer. But these days 5 to 20% vinyl acetate is being added. They exhibit many desirable properties like flexibility, easy coloration and acceptable initial appearance. The primary deficiency arises from migration of plasticizer leading to discoloration and hardening of the prosthesis. [14]

Chlorinated polyethylene: Lewis and Castleberry [15] 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. The reactants are a polymer terminating with hydroxyl group and others terminating with isocyanate in the presence of a catalyst. They can be synthesized with a wide range of physical properties by varying the reactants and their amounts. They have excellent properties like 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.[16]

New Materials

Silicone block copolymers: Silicone block copolymers are new materials under development to improve on some of the weaknesses of silicone elastomers, such as 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.

Polyphosphazenes: Polyphosphazene fluoroelastomers have been developed for use as resilient denture liners and have the potential to be used as maxillofacial prosthetic materials.[17]

Maxillofacial Prosthetics as an Alternative to Plastic Surgery

Maxillofacial prosthetist normally provides appliances and devices to restore esthetics and function to the patient who cannot be restored to normal appearance or function by means of plastic reconstruction. The prosthetist also may be called upon to treat individuals who are poor surgical risks for extensive plastic surgery/or those who refuse further surgery.[18]

Discussion

A large number of studies point to the development of new materials and techniques to optimize the treatment of congenital and acquired orofacial defects. Recent studies identified several areas for further investigation when evaluating different properties of maxillofacial prostheses and their management, such as biocompatibility [19], cleaning protocols, pigment incorporation, and material bonding efficiency. [20] Ferreira foresaw the development of new prostheses that substitute for bone tissue without requiring bone grafts, thus reducing the morbidity and the recovering time, as a possible future approach in maxillofacial reconstruction. Several steps in the fabrication of maxillofacial prostheses are still artisanal, requiring time and skill.[21] Modern techniques for ocular prosthesis fabrication, such as 3D printing and digital imaging, are able to reduce the treatment time, better replicate the patient characteristics, eliminate taking facial impressions, and reduce the complexity of wax pattern sculpting.

Conclusion

Maxillofacial prostheses restore several types of orofacial defects as well as improve the patient's quality of life. This is an ancient treatment modality that has developed over centuries. -e current situation is promising, and there are positive expectations for the future. The maxillofacial prosthodontist should always try to provide the treatment to the fullest of his ability. Sophistication in the prosthetic reconstruction of structural and functional defects improves the final results, if carefully planned, unbiased rehabilitation regimens are established.

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