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Original Research Paper

Prosthodontics

RETENTION IN MAXILLOFACIAL PROSTHETICS: A LITERATURE REVIEW

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ABSTRACT Maxillofacial prostheses are used to treat facial deformities caused by trauma, accidents, tumours, or congenital anomalies. Aside from aesthetics, retention is one of the most essential criteria in the success of a maxillofacial prosthesis. The advantages of adhesives and implants, as well as the implementation of 3D technology and rapid prototyping, were critically appraised in the current article review. Prosthodontists are on the rise With the advancement of adhesive material science, technical understanding, and implant technology, the success of maxillofacial prosthesis in meeting the expectations of patients. The latest techniques, as well as novel materials, treatment possibilities, and applications, are discussed. An improvement in retention improves the prosthesis's long-term prognosis by making it easier to operate and psychologically acceptable to the patient.

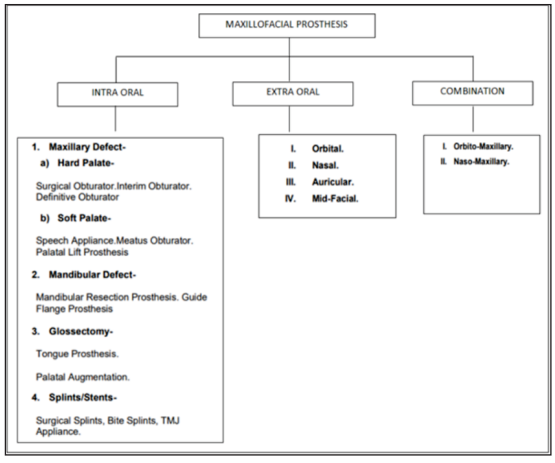
KEYWORDS : rapid prototyping, 3D technology, Retention, Maxillofacial prosthesis, Adhesives, Magnets, Implants.

INTRODUCTION:

The face is the most noticeable part of the human body. It is the god-given right of every human being to appear human. Speech, mastication, quality of life, psychology, and social behaviour can all be affected by any impairment, whether acquired or congenital. Because of his knowledge of anatomy, physiology, and pathology, the prosthodontist plays a key role in maxillofacial prostheses. The Prosthodontist, on the other hand, is limited by the lack of materials available for facial restorations, moveable tissue beds, the difficulty of keeping large prostheses, and the patient's capacity to accept the final result.[1] The major goal of maxillofacial defect rehabilitation is to restore mastication, deglutition, and speech functions, as well as to achieve a normal orofacial appearance.[2] The size, location, and severity of the defect, the patient's age and satisfaction, and finally the cost of the prosthesis all influence the choice and success of the prosthesis. The treatment's ultimate goal is to create an illusion by building a prosthesis for the missing portion that will improve the patient's quality of life.[3] Maxillofacial prosthetics defined by the current Glossary of Prosthodontic Terms - "as the branch of Prosthodontics concerned with the restoration and/or replacement of the stomatognathic (jaws) and craniofacial (facial) structures with prostheses that may or may not be removed on a regular or elective basis".[1]

The use of implant support to support a combination of intraoral and extraoral restorations has become a realistic treatment option. Extraoral implant placement and orientation are critical for a successful prosthetic outcome.[4] Due to the lack of anatomic undercuts, limited retention options, soft tissue movement, and the weight of the prosthesis, large face abnormalities are difficult to correct prosthetically.[5] In maxillofacial prosthodontics, retention has always been an issue. Increased retention improves the patient's comfort and confidence. Eyeglasses, magnets, adhesives, implants, and combinations of the above are all examples of supplemental retention systems. In the last several years, there have been significant advancements in the techniques and materials used for maxillofacial prosthesis retention.[6] Osseointegrated implants have been used to increase the grip and retention of facial prostheses for the past two decades. Implants have been used in the intraoral and extraoral craniofacial regions for retention.[7]

Classification:



Intraoral prosthesis Obturators:

A prosthesis that closes a defect and fits into the mouth or other parts of the body. Obturators are used to treat abnormalities that are both congenital and acquired. A basic plate-type prosthesis to aid with feeding, a palatal lift prosthesis, or an overlay obturator can be created for congenital abnormalities. Surgical, intermediate, or definitive obturators are used to treat acquired deformities.

The different types of intraoral prosthesis include:

1. Obturators for defects involving hard palate

- **Definitive obturator:** The definitive obturator is made after the interim obturator has been worn for 6-12 weeks.
- **Surgical obturator:** Before the maxilla is resected, a surgical obturator is made.

Speech bulb prosthesis/Pharyngeal obturator/Speech bulb prosthesis are obturators for soft palate abnormalities. For these problems, a speech bulb prosthesis is the best option.

- **Meatus obturator:** It merely provides static obturation and is not reliant on surrounding muscle activity to maintain physiologic separation of the oral and nasal tissues.

The palatal lift prosthesis (PLP) is a device that is used to treat soft palate dysfunction. The palatal component of the PLP is securely maintained by the teeth in dentulous patients, while the palatopharyngeal section lifts the soft palate physically.

2. Prostheses for mandibular continuity defects

- Mandibular resection prosthesis
- Guiding flange prosthesis

3. Prostheses for total/partial glossectomy

- Tongue prosthesis
- Palatal augmentation prosthesis.[8]

Modes of retention

a. Intraoral

1. Anatomical[6] Both hard and soft tissues, such as teeth and mucosal and bone tissues, are used in intraoral retention. under cuts in the palatal, cheek, retromolar, labial, septal, posterior nasal pharyngeal, and anterior nasal spine areas. Extra-oral retention necessitates the use of both hard and soft head and neck tissues.

2. Mechanical

- **Magnets:** They are thought to be the greatest possible source for maxillofacial prosthesis retention stabilisation and maintenance. Patients who have had a maxillectomy or who have microstomia will benefit from this.[4]
- **Eyeglass:** By using newly developed eyeglass frames for the patients, it may be feasible to keep a nose, ear, or eye prosthesis in place. To avoid retention marks from becoming obvious, the eyeglass frame should be opaque rather than translucent.[4]
- **Cast clasps:** Stability, splinting, bilateral bracing, reciprocation, and retention will all be provided by a correctly designed and fabricated clasp. It aids in a more balanced load distribution as well as prosthesis retention.[9]
- **Acrylic buttons:** Acrylic buttons retained facial prostheses usually have an acrylic substructure that fits into the defect and one or more mushroom-shaped acrylic projections (buttons) are connected to the substructure.[2]

3. Adhesives

When choosing an adhesive method for a facial prosthesis, there are several things to consider:1. The strength of the adhesive bond to the skin and the facial prosthetic material. 2. Biocompatibility of the adhesive. 3. Material used in the fabrication of prosthesis. 4. Components of the adhesive. 5. Texture of patient's skin. 6. Ease of handling of the adhesive by the patient. Various materials used for their tissue adhesive properties are acrylic resin, latex, silicone, pressure-sensitive tapes, spirit gum, water-based adhesives.[6]

The MDX silicone material has a higher edge strength than other silicone materials, and its additional nylon mesh reinforcement offers adequate edge strength, allowing it to be used in thinner sections that must blend in with the surrounding skin. A light adhesive does not irritate the tissues or harm the prosthesis; it just serves as a sealant and hence does not serve as a primary source of retention.[9,11]

4. Implants

Endosseous implants can be used as an alternative anchorage system for stability, diminished retention and support and can be used in edentulous and partially edentulous jaws, as well as for congenital, developmental, and traumatic defects.

Surgical implant procedure in maxillofacial prosthetics Implant placement procedures is of 2 types. They are

1) Single-stage procedure and
2) Two-stage procedure

Recovery screws are placed and the incision is closed with wire sutures in a single-stage surgical process. The skin is then dressed with ointment-soaked gauze to protect it. In a two-stage surgery, two surgical operations are performed. The first procedure is for implant placement in the planned craniofacial defect location. Second stage surgery is performed after a sufficient healing interval and osseointegration.[2,9]

Implant retained auricular prosthesis

Position of implants: Implants can also be placed 15mm apart in the mastoid area, 20mm away from the auditory canal entrance. In most cases, two implants are placed.

Implant retained eye prosthesis

Mode of retention: Spectacle frames, Adhesive, Straps, and Implants.

In the defective space, anatomic undercuts must be used in conjunction with a flexible conformer. The conformer will fit into the socket and secure the prosthesis while preserving the socket's size. Maintains eyelid dexterity and residual muscular activity while preventing scar tissue contractures from altering the socket bed.[6]

Position of implants: Implants can be placed in the outer or inner canthus, as well as the superior orbital rim. A second or two implants were frequently placed in the inferior orbital rim or zygoma.[12] The implant should not be oriented in front of the face.[13] The length of the implant is usually 3-4 mm, with a 10 - 12 mm space between them to allow for hygiene access. Magnets are the most widely employed retentive mechanisms with implants.[14]

Implant retained nasal prosthesis

Mode of retention: spectacle frames, Adhesive, straps, and implants.

Implant position: The floor of the nose, piriform ridge, or inferior orbital foramen, and the glabella are all places where implants are placed. Fixtures of 4 mm or longer are commonly utilised.[13] When supporting both intraoral and extraoral prostheses, a thickness of 7-10 mm is employed. These implants are known as bifunctional implants because they may support oral prosthesis on both the intraoral and extraoral ends. The recovery time is 6-8 months.[2]

Recent advances in maxillofacial prosthetics

1. Rapid prototyping

Rapid prototyping was recommended by Wolfaardt et al.[2] in 2003 as an adjunctive tool in digitally designing maxillofacial prosthesis in head and neck construction.[15]

Advantages: Reduces the chance of a prosthesis being displaced during actions such as coughing or sneezing; maintains the aesthetic prosthesis; maintains voice resonance The sub-dermal part of the prosthesis is preserved using intra anatomy designs.

The Infinite Technologies Orthotics and Prosthetic 3D scanner, which is currently used in the fabrication of cranial helmets, smaller paediatric devices such as a prosthetic finger, foot orthotics, and small componentry used to put together the helmet, is one of the most recent innovations in the field of rapid prototyping.[2]

2. Computer-aided design/computer-aided manufacturing, laser scanning It is a speedier method of producing provisional prostheses since they can be digitally planned and constructed. It restores patients' aesthetics and adds comfort. It is a low-cost and simple method.

3. Three-dimensional printing along with digital scan

In ocular prosthesis: for example, 3dMD face™ system, is a recent advancement in digital technology (3dMD, Atlanta, GA). This method involves taking an impression without contacting the impression surface in a 3-d pattern, which causes less discomfort for the patient and does not deform the soft tissue like traditional impression material does. It produces more lifelike facial prosthetics with a more precise fit. In burn victims and people who have had an acid attack, this medication is used. The approach is easy and inexpensive.[15]

DISCUSSION

A slew of innovative strategies for treating congenital and acquired orofacial abnormalities have emerged from a slew of investigations. Recent research has identified a number of areas in which more research on the manner of retention in maxillofacial prostheses and their care is needed. There are other studies that indicate the use of implants in intraoral and extraoral prostheses. As a possible future method in maxillofacial reconstruction, Ferreira envisions the creation of new prostheses that replace bone tissue without the need for bone grafts, lowering morbidity and recovery time. Engineering, computer-aided design and manufacturing (CAD-CAM), Rapid Prototyping Technique, lasers, and surgical guidance, according to Ferreira, should be used to create these new prostheses.[2] Several processes in the manufacturing of maxillofacial prostheses still rely on a prosthodontist's aesthetic ability and time. Modern ocular, auricular, and nasal prosthesis manufacturing techniques, such as 3D printing and digital imaging, can minimise treatment time, better duplicate patient characteristics, eliminate facial imprints, and simplify wax pattern sculpting. Modern procedures, together with lower costs and wider availability, must yet be improved in order for maxillofacial reconstructions to have a bright future.[16]

CONCLUSION

To maintain a maxillofacial prosthesis in position, a variety of techniques and equipment are available. Because prosthodontist is responsible for planning the prosthetic rehabilitation that best matches the patient, the prosthodontist must be knowledgeable with all available alternatives in order to select the best retentive device. In all situations of maxillofacial defects, optimal outcomes may be difficult to attain, but a thorough examination of the problem, as well as careful judgement and treatment planning, can result in an acceptable quality of prosthesis that improves the patient's quality of life. The current scenario appears to be encouraging, and there are high hopes for the future.

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