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Orofacial rehabilitation with implants - A boon for retention: A review

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Abstract

Maxillofacial prosthesis are useful in the rehabilitation of patients who have had ablative surgery, have a congenital abnormality, or have been injured. These patients' physical and mental health necessitates good organisation and communication among the health professionals involved in their care. Osseo integrated implant rehabilitation is the first true hope for individuals with such malformations to enhance their quality of life. Using the introduction of current silicones and bone anchorage, the rehabilitation of extra oral defects with implant-maintained prosthesis became more essential. Following Brane mark's development of the osseointegration idea of retention, intraoral end osseous implants have become the gold standard, with several studies proving its effectiveness, safety, and predictability. Implants have proven to increase retention, stability, and aesthetics while also lowering the issues associated with other retentive treatments. The key elements of extra-oral implantology in maxillofacial prosthesis are discussed in this article.

Keywords: Extraoral deformities, Osseointegration, Implant, Maxillofacial prosthesis

Introduction

The area in and around the mouth is intimately linked to one's self-esteem. Individuals who have missing eyes,

nose, ears, or facial tissues may be socially unacceptable and have psychological difficulties[1]. Surgery is a popular therapeutic option for facial deformities. Prosthetic care of face abnormalities is carried out using maxillofacial prostheses when surgical treatment is not indicated or evaluated as an option. Due to the lack of teeth, adequate mucosal undercuts, and the existence of movable non-keratinized vestibular and nasal mucosa, maintaining a prosthesis in patients with complete palatal abnormalities without alveolar support can be difficult. The availability of a means of securely attaching the artificial alternative to its right place without causing discomfort or irritation to the tissues with which it comes into touch is critical to the success of a prosthetic restoration of any part of the body. When the prosthetic device, because of its anatomic placement, may be surrounding or fitted into some part of the normal structure close to the prosthesis, the problem of retention can be readily controlled. Implants have decreased the need for adhesives, overcoming the drawbacks of adhesive use while also simplifying cleaning processes and prolonging the life of prostheses[2]. The influence of the implants on the patients has resulted in their capacity to participate in society with confidence because their flaws are less obvious[3].

Discussion

In prosthodontics, retention has always been an issue. Prosthodontists have traditionally struggled with maxillofacial prosthesis retention. Increased retention increases the patient's comfort and confidence when using a facial prosthetic at work and in social situations. In the last several years, there have been significant advancements in the techniques and materials used for maxillofacial prosthesis retention. The various techniques of maxillofacial prosthesis retention are determined by the case requirements in terms of defect location and size, resilience, possible neighbouring tissue undercut, weight of the constructed maxillofacial prosthesis, and anatomical features such as undercuts and concavities.

Modes of retention[4]

Adhesives: Acrylic resin, latex, silicone, pressure sensitive tapes, spirit gum, and water-based adhesives are examples of skin tissue adhesives for facial prosthetics. They are conveniently accessible, manipulatable, and apply able. However, routine removal can harm the external pigmentation, cause the margins to rip, and cause allergic or irritative reactions in some people.

Eyeglasses, retentive clips, magnets, and acrylic buttons are all examples of mechanical retention. By using newly developed eyeglass frames for the patients, eyeglasses can be used as a feasible technique of keeping a nasal prosthesis. However, attaching a nasal prosthesis to eyeglass frames as a permanent fixation should be avoided because removing the glasses for whatever reason allows the prosthesis to be removed as well, which can be quite embarrassing. Magnet corrosion, their weight, and the necessity to repair them frequently are only a few of the difficulties encountered. In terms of breakaway retentive force, retentive clips have a higher retentive ability than magnets. Retentive clips, on the other hand, tend to wear out faster than magnets.

Implants: Following the successful clinical development of intraoral implants for the retention of dentures and other prosthetic substitutes for missing teeth, implants are now being used to retain extraoral structures. The implants' retention allows for the fabrication of massive maxillofacial prosthesis that rest on a moveable tissue bed. Osseointegration is a process that occurs with implants. Branemark defines osseointegration as "a direct bone attachment to an

implant body that can offer a foundation for a prosthesis and has the ability to transmit occlusal forces directly to bone." Craniofacial implants help to keep the prosthesis in place and give great retention. The functional life of implant-retained prostheses is extended because marginal degradation due to daily application and removal of prosthesis is reduced. Transcutaneous abutments are used to attach implant-retained craniofacial prosthesis to the implants. Despite the fact that these connections provide adequate retention, debris accumulation around the abutments is always a possibility. This condition can result in skin irritation around the abutments, microbial infection, patient pain, and eventual implant loss. In addition, the patient must make a major long-term commitment to attend frequent maintenance visits. Implant insertion necessitates a significant change in lifestyle and reduces the likelihood of eventual autogenous repair.

Multiple professions are involved in cranial osseointegration care, which is a step-by-step, protocol-driven process. For the sake of everyone, the osseointegration care process must be planned and effectively managed. Implant treatment and planning is a collaborative endeavour involving the work of a reconstructive surgeon, a prosthodontist, a dental technologist, an anaplastologist, and a dental assistant[6].

Implants in Maxillofacial Prosthesis: Biomechanical Considerations[7]: Extraoral implants are short, ranging from 3 to 5 mm in length, and have a flange on the outside. The implant surface area in contact with the bone is increased by this flange. Perforations in the flange give greater surface area and mechanical stability.

Biomechanical Considerations of Implants in Maxillofacial Prosthesis[7]

Design of craniofacial implant: Extraoral implants are short, 3 to 5 mm in length and possess a peripheral flange. This flange increases the implant surface area in contact with the bone. Perforations in flange additional surface area and provide mechanical stabilization[8] (Fig 1).

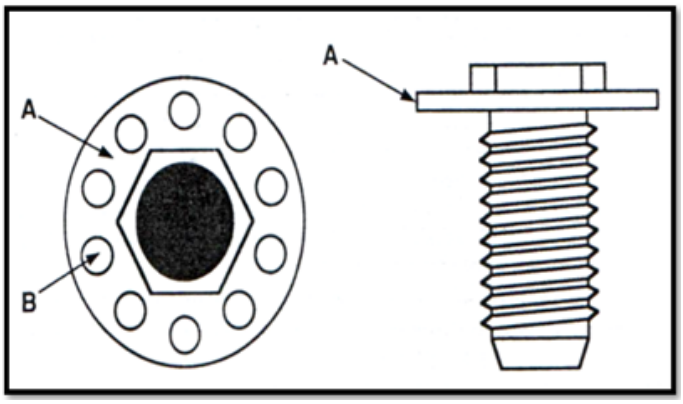

Figure 1

1. Stress Transfer from implants to bone[9]: It is essential that neither implant nor bone be stressed beyond the long-term fatigue capacity. These requirements are met by Osseo integrated implants by virtue of the close apposition of the bone to the implant at Angstrom level. Surface roughness of an implant can also have a beneficial interlocking effect similar to that of screw threads at a microscopic scale

2. Load distribution to several screws: When prosthesis is supported by several screws, the resulting combined structure forms a unit in which the distribution of any applied load depends on the relative stiffness of the several members involved, as well as geometry of their arrangement.

3. Impact of implant stiffness on stress distribution: Implant should be as stiff as possible from the biomechanical standpoint. The stiffness increased by choosing an implant of greater diameter. If the diameter is increased by 30%, implant stiffness will be five times higher thereby reducing the stresses around implant neck.

4. Impact of the implant shape on stress distribution: Irrespective of the implant shape, implant Osseo

integration in the entire bone region, will lead to stress concentrations in the cortical area during vertical and horizontal loading. Implants showing rational symmetry can be considered more favourable as it will lead to uniform stress distribution

5. Impact of the implant surface on stress distribution: The implant surface should be enlarged by applying threads or by plasma flame spray coating or surface roughening and also by acid etching to reduce compressive forces.

Implants as a retentive aid have been used both for the extraoral and intraoral prosthesis.

Restoration of extraoral defects

Surgical rehabilitation

Maxillofacial prosthesis surgical implant procedure There are two types of implant implantation procedures. They really are:

1) Procedure with a single stage and

2) A two-stage technique is used.

Recovery screws are put and the incision is closed with wire sutures in a single-stage surgical procedure, followed by dressing with ointment-soaked gauze to preserve the skin[10]. In a two-stage surgery, two surgical operations are performed. The first procedure is for implant implantation in the planned craniofacial defect location. The second stage operation is performed after a sufficient healing interval and Osseo-integration has occurred[11].

Implant retained auricular prosthesis: The use of Osseo integrated implants to retain facial prosthesis has grown in importance since the advent of end osseous implants for use with bone conduction hearing aids in the 1970s. The acceptance, contribution to the quality of life, and use of bone-anchored auricular prostheses as replacement prostheses for either a developmental or acquired impairment could all be factors in their success. Auricular implants improve the patient's confidence and sense of security by enhancing the retention and stability of prosthesis. Furthermore, attachment mechanisms facilitate in the proper positioning of prostheses, allowing persons with auricular defects to install them more easily. The external ear canal serves as a suitable landmark for implant placement in the auricle. 18 to 22 mm from the centre of the external ear opening or, in situations of atresia, the imagined ear canal entrance is excellent. For the left ear, the most cranial implant is between the 1- and 2-o'clock positions, and the caudal implant is between the 3:30 and 4:30 positions, while on the right-hand side. For the right ear, the most cranial implant is between the 10- and 11-o'clock positions, and the caudal implant is between the 7- and 8-o'clock positions[12].

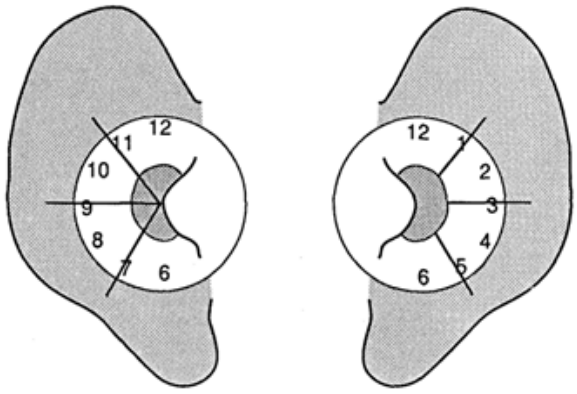

Figure 2

Implant placement: If a one-stage surgery is employed, a hole is produced immediately over the implant with a 4-mm disposable skin punch. If a two-stage operation is considered, the abutment connection is completed after the implants have Osseo integrated, which takes 3 to 6 months.

Prosthetic rehabilitation: Compared to magnets, a bar retention using clips has a stronger retention and does not contain any ferrous components, making it MRI compatible. The space between the implants should be

15 to 20 mm in most cases. The bar design should be center-to-center, and the bar should be as close to the contours of the prosthesis as possible. The cantilever parts should be about 10 mm long.

Other retentive mechanisms: Bar and clip, ball clips, and magnetic retentive cap systems are all commonly used. The recovery time is usually 3-4 months[13].

Implant retained orbital prosthesis: The rehabilitation of a patient who has endured psychological trauma as a result of the loss of an eye necessitates the use of a prosthesis that is both aesthetic and functional.

By filling the orbital volume and limiting the likelihood of socket constriction owing to scar tissue formation, orbital implants enable stable retention and enhanced postoperative cosmetic results. Adhesive retained prosthesis, on the other hand, is the recommended alternative in cases when bone density is low and bone development is incomplete. Magnetic attachment is chosen for implant-supported orbital prostheses because it takes up the least amount of space.

Implant implantation is possible on the superior, lateral, and inferior rims[14]. Implants can be put in the outer or inner canthus, as well as the superior orbital rim. In the inferior orbital rim or zygoma, an additional implant or two is frequently inserted[15].

Implant placement: The implant should not be angled facially. The implant's length is normally 3-4 mm, and there should be a 10 - 12 mm gap between them to allow for cleanliness. Magnets are the most widely employed retentive mechanisms with implants. Adhesive, Straps, Spectacle frames, and Implants are some of the other retentive mechanisms[16]. In the deficient space, anatomic undercuts must be used in conjunction with a flexible conformer. The conformer will fit into the socket and retain the prosthesis in place while keeping the socket's size. Maintains eyelid competency and residual muscular activity while preventing scar tissue contractures from altering the socket bed[17].

Prosthetic rehabilitation: Magnetic retention or, alternatively, bar and clip retention are regularly used. Given the difficulties of insertion path, the most typical solution in the orbit is to use freestanding cantilevered abutments with magnet retention.

Implant retained nasal prosthesis: Despite recent developments in surgical reconstruction techniques, restoration of massive, full-thickness nose lesions following ablative oncological surgery remains a problem. The need to reconstruct the nose's complicated three-dimensional structure with a sufficient cover, lining, and support frequently necessitates tiered treatments and the availability of healthy local tissue. Contact dermatitis and allergic reactions have been linked to the use of tissue adhesives to keep implants in place, as well as loss of adhesion and dislodgement and ugly bulky prosthetic edges. A prosthesis that is implant-retained overcomes these restrictions and provides the patient with the security of a stable prosthetic. The glabella, the floor of the nose, the piriform ridge, and the inferior orbital foramen are all places where implants are put. McHutchion described the integration of digital technology into the treatment of a patient with an Osseo integrated implant-retained nasal prosthesis in his case report, where it was reviewed that the treatment efficiency was intensification when digital technology was integrated they decided that this integration not only improved prosthetic retention and outcomes, but also reduced patient appointment time[18].

Implant placement: Fixtures of 4 mm or longer are typically used. When supporting both intraoral and extraoral prostheses, a thickness of 7-10 mm is employed. These implants are known as bifunctional

implants because they can support oral prosthesis on both the intraoral and extraoral ends.

Prosthetic rehabilitation: Mini magnets (primarily) and bar and clip retentive devices are used.

Intraoral defect restoration: The rehabilitation of such large maxillofacial defects is a prosthodontic challenge, with many issues such as lack of retention due to dislodging forces exerted by scarred postsurgical soft tissues, lack of bony base, lost structures of the posterior palatal seal area, multiple defect sites, and compromised medical status being encountered[19].The surgical site must be safeguarded from oral contamination and communication must be closed. In these types of problems, a traditional prosthesis places too much pressure on auxiliary teeth, causing periodontal disease. Cross arch stabilisation and resistance to vertical movement of the prosthesis are lost, especially for big and one-sided abnormalities. As a result, teeth that are important for handling may be lost. A few of implants placed in or around the defect site can reduce the strain on auxiliary teeth, provide cross arch stabilisation, and effective resistance to forces shifting their placements, all of which can help to prevent tooth loss. With bone grafts, implants provide enhanced osseo-integration. Contra arch stability can be accomplished by implant implantation after iliac crest grafts are implanted in the zygomatic arc region and grafts retrieved from the skull are placed on the infraorbital region.

Maxillary tumors are often treated with resection to control the progression of disease. This procedure often involves the hard palate and, if extensive, may involve the infraorbital rim and the contents of the orbit as well. Mandibular resections have been used to treat benign and malignant disease of the floor of mouth, tongue, or the mandible itself[20]. Implant-supported obturators have presented to be a good alternative to surgical reconstruction of defects in cases of intact orbital floor and with no substantial loss of soft tissues owing to their shorter treatment period, lower costs and rather, extensive reconstructive surgery could be dispensed off**.** Buurman et al compared the masticatory performance and patient reported eating ability of maxillectomy patients with implant-supported obturators and patients with surgically reconstructed maxillae and concluded that masticatory efficiency increased in patients with class ii maxillary defects compared to surgical reconstruction[21]

Implant site: The number of implants and their location are determined by the nature of the defect and the available bony sites. The most ideal location for implants for most edentulous total maxillectomy patients remains the residual anterior maxillary segment. The edentulous posterior alveolar process may serve as an alternative site for implants if at least 10 mm of bone is available beneath the maxillary sinus.

Obturators restoring defects of the soft palate and pharyngeal wall should be accurately positioned in the nasopharynx and effectively retained if speech and swallowing are to be restored[22]. Limited bone quality in the posterior maxilla results in low success rates for dental implants. Various bone augmentation methods have been described, yet most require two-step surgical procedures with relatively high rates of resorption and failure. An alternative for these patients is zygomatic implants. Zygomatic implants utilize the basal craniofacial bone whereas pterygoid implants have been primarily used in the rehabilitation of patients with **atrophic maxilla** or for purposes of avoiding maxillary sinus augmentation procedures[23].

Recent advancements: Different recent directions for reconstruction patients include.

Rapid prototyping[24]- The conventional method of making the maxillofacial prosthesis includes impression making, master cast fabrication, wax model sculpting, dewaxing, silicone packing, and coloration. It requires artistic skills and is time consuming. Transformation of 3-dimensional image data to a CAD/CAM system for successive mathematical processing, design simulation, and model production can potentially minimize the time and skill required for sculpting this prosthesis for patients with defects and provides new perspectives for future maxillofacial prosthodontics**.** It is noteworthy that this technique would eliminate any shortcomings created by human skills and when compared to traditional methods, these are comparatively more time saving[25]. Gayatri shankaran in her case report described the fabrication of a cranial prosthesis combined with an ocular prosthesis with rapid prototyping and stereolithography and concluded that the patient was highly satisfied with the prosthesis[26]

3D visual imaging[27]- The goal of a multispectral data visualization system is to provide enhanced diagnosis capabilities for use by the medical practitioner. Several pioneer research groups have already demonstrated improved clinical performance using Virtual Reality imaging, planning and control techniques. Computed tomography (CT) and, more recently, cone-beam computed tomography (CBCT) provide volumetric images of the anatomic structure of a patient's face. These data can be converted into 3D images of a patient's craniofacial skeleton and the soft tissue covering it by using a sequence of computerized mathematical algorithms. With the advancements in research and technology, the process of 3d modeling and custom implants is rapidly evolving and has opened new channels for rehabilitation. 3d modeling and recent advances in custom implants has paved way for their use in cranial, skull base, zygomatic orbital, midface, mandible reconstruction, orthognathic surgery. Parthasarathy described a method for the fabrication of custom titanium mesh cranioplasty plates for large defects using rapid prototyped models. It was observed that the implants were well fitted. the surgical time was reduced by 60 percent. after eighteen months of post-operative follow-up, it was revealed that the mesh did not shrink or resorb. this method treated three patients with a 20 months of uneventful follow up[28].

Conclusion

Patients who are candidates for implant supported facial prosthesis need to have an overall assessment. Their treatment plans should not be based solely on whether there is enough bone for implant placement. The spectrum of Osseo integrated craniofacial extra oral implant application in maxillofacial reconstructive patients is quite varied today. In the future, it will be even wider and more varied, limited only by the ingenuity of practitioners, skills of reconstructive surgeons, biology of the reconstruction, and cost restraint efforts. Simplicity of prosthetic design, long-term function, and infrequent maintenance should be the primary goal of implant-supported facial prosthetics

References

1. Pisulkar S, Pakhan AJ, Godbole SR. Psychological considerations in patients with maxillofacial defects: a literature review. Journal of School of Advanced Studies. 2018;1(2):57-60.

2. Beumer III JB, Curtis TA, Marunick MT. Maxillofacial Rehabilitation: Prosthodontic and Surgical Considerations. 2nd ed. St. Louis: Ishiyaku Euromerica 1996: 377–449.

3. Funk GF, Arcuri MR, Frodel Jr JL. Functional dental rehabilitation of massive palatomaxillary defects: cases requiring free tissue transfer and Osseo integrated

implants. Head & Neck: Journal for the Sciences and Specialties of the Head and Neck. 1998 Jan;20(1):38-51.

4. Parel SM. Diminishing dependence on adhesives for retention of facial prostheses. The Journal of prosthetic dentistry. 1980 May 1;43(5):552-60

5. Branemark PI, Hansson BO, Adell R, Breine U, Lindstrom J, Hallen O et al. Osseo integrated implants in the treatment of edentulous jaw. Experience from a 10-year period. Scand J PlastReconstr Surg. 1977; 11:1-175

6. Branemark PI (1983). Osseointegration and its experimental background. J Prosthet Dent, 50(3), 399-40.

7. Nobrega AS, Santiago Jr JF, de Faria Almeida DA, Dos Santos DM, Pellizzer EP, Goiato MC. Irradiated patients and survival rate of dental implants: a systematic review and meta-analysis. The Journal of prosthetic dentistry. 2016 Dec 1;116(6):858-66.

8. Albrektsson T, Brånemark PI, Hansson HA, Lindström J. Osseointegrated titanium implants. Requirements for ensuring a long lasting, direct bone-to-implant anchorage in man. Acta Orthop Scand. 1981; 52:155-170.

9. R. P. Verma, Materials Today: Proceedings, 2020, 26, 3148– 3151.

10. Albrektsson T, Wennerberg. Oral implant surfaces: Part 1 - review focusing on topographic and chemical properties of different surfaces and in vivo responses to them. Int J Prosthodont, 2004, 544-564

11. Drinias V, Granstrom G, Tjellstrom A. High age at the time of implant installation is correlated to increased loss of Osseo integrated implants in the temporal bone. Clin Oral Implants Rel Res, 2007\

12. Tjellstrom A, Rosenhall U, Lindstro¨m J, Halle´n O, Albrektsson A, Branemark PI et al. Five-year experience with skin penetrating bone-anchored implants in the temporal bone. Acta Otolaryngol (Stockh). 1983; 95:568- 575.

13. dos Santos DM, Goiato MC, Pesqueira AA, Bannwart LC, Rezende MC, Magro-Filho O, Moreno A. Prosthesis auricular with osseointegrated implants and quality of life. Journal of Craniofacial Surgery. 2010 Jan 1;21(1):94-6.

14. Wolfaardt J, Gehl G, Farmand M, Wilkes G. Indications and methods of care for aspects of extraoral osseointegration. International journal of oral and maxillofacial surgery. 2003 Apr 1;32(2):124-31.

15. Chen YY, Kuan CL, Wang YB. Implant occlusion: biomechanical considerations for implant-supported prostheses. J Dent Sci. 2008 Jun 1;3(2):65-74.

16. Rajani A, Mistry G, Sardar C, Kini A. Rekindle maxillofacial prosthesis with extra oral implants as retention system.

17. Mentin Sencimen, Aydin Gulses. Current Concepts in Plastic Surgery, Chapter 3, implant retained auricular prosthesis P49-68

18. McHutchion L, Kincade C, Wolfaardt J. A clinical study on the use of digital technology in the workflow for an Osseo integrated implant-retained nasal prosthesis. The Journal of Prosthetic Dentistry, Vol. 121, No. 5, 858-862, May 1, 2019.

19. Nishimura RD, Roumanas E, Sugai T, Moy PK. Auricular prostheses and Osseo integrated implants: UCLA experience. The Journal of prosthetic dentistry. 1995 Jun 1;73(6):553-8.

20. Mentin Sencimen, Aydin Gulses. Current Concepts in Plastic Surgery, Chapter 3, implant retained auricular prosthesis P49-68.

21. Buurman DJ, Speksnijder CM, de Groot RJ, Kessler P, Rieger JM. Mastication in maxillectomy patients: A comparison between reconstructed maxillae and implant

supported obturators: A cross-sectional study. Journal of oral rehabilitation. 2020 Sep;47(9):1171-7

22. Visser A, Raghoebar GM, Van Oort RP, Vissink A. Fate of Implant-Retained Craniofacial Prostheses: Life Span and Aftercare. International Journal of Oral & Maxillofacial Implants 2008;23(1).

23. Dholam KP, Pusalkar HA, Yadav P, Bhirangi PP. Implant-retained orbital prosthesis. The Journal of Indian Prosthodontic Society. 2008 Jan 1;8(1):55.

24. Sabarigirinathan C. Implants in Maxillofacial Prosthesis; Journal of Science 2015;5(12):1131-1136.

25. Tania Saia, Mohit Kheur. Maxillofacial Prosthesis: All Insight into Their Retention and Support; International Journal of Dental Practice and Medical Sciences 2013;1(2).

26. Shankaran G, Deogade SC, Dhirawani R. Fabrication of a cranial prosthesis combined with an ocular prosthesis using rapid prototyping: a case report. Journal of Dentistry (Tehran, Iran). 2016 Jan;13(1):68

27. Boyes-Varley JG, Howes DG, Davidge-Pitts KD, Branemark I, McAlpine JA. A protocol for maxillary reconstruction following oncology resection using zygomatic implants. Int JProsthodont. 2007; 20:521-531

28. Parthasarathy J, Parthiban JK. Rapid prototyping in custom fabrication of titanium mesh implants for large cranial defects. RAPID, May. 2008 May 20; 20:22.