Review Article **IJDRR (2021) 4:45**

International Journal of Dental Research and Reviews
(ISSN:2637-3750)

Craniofacial implants: what maxillofacial surgeon needs to understand

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ABSTRACT

Since discovery of the osseointegration of titanium in the 1950s, dental implants have been made of titanium the 1960s. In 1977, the first extraoral titanium implant was inserted for craniofacial rehabilitation aims. Craniofacial implants start to be popular for craniofacial reconstruction and rehabilitation. Craniofacial implants become as revaluation in rehabilitation fields, to day even large facial defect can be reconstructed via this surgical –prosthetic technique. The aim of this review is to explain and clarify the indications and techniques for such procedure.

Keywords: craniofacial implants, facial defects, facial rehabilitation.

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How to cite this article:
Faris Almutairi. Craniofacial implants: what maxillofacial surgeon needs to understand. International Journal of Dental Research and Reviews, 2021, 4:45

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Website: https://escipub.com/

Introduction:

Facial defects almost always lead to a severe emotional burden requiring rehabilitation .In order to reconstruct the facial defects , the surgeon has two main path ways: either surgical option purely (autogenous reconstruction) of surgical-prosthetic pathway (craniofacial implant)[1,2]. prefabricated surgical template or guidance is highly recommended for accurate placement at the time of surgery.[2]

Surgical- Prosthetic pathway:

patient's lifespan, poor hygiene, or psychosocial implications can be contraindications for an implant-retained prosthesis. Ear reconstruction via prosthetic option is superior than pure surgical option in such area cosmetically and in term of time consuming as well patient satisfaction. Craniofacial implant can be adhesive or implant- retained, however the advantages of implants are as following:

1. provide secure attachment of the prosthesis.
2. enhance the patient's quality of life.
3. Skin reaction is much less compared to adhesive techniques.
4. More hygienic.

As implants is providing a very considerable advantages, however some disadvantages have been documented in the literature as following:

1. necessity of prosthetic/implant maintenance.
2. prosthesis may be dislodged at inopportune times such as social or athletic events.[2,3]

Pure surgical pathway (Autogenous reconstruction):

Advantages over prosthetic pathway	Disadvantages over prosthetic pathway
long-term reconstruction with living tissue. Less infection. growth potential in younger patients. No need to remove some tissues to facilitate reconstruction. superior option for the poorly compliant patient. elimination of prosthetic support/maintenance that can be a significant expense to the patient.	the final result is often less than satisfactory. requires multiple-staged procedures. increase the risk of surgical complications. Time consuming.

Facial unites and techniqual considerations:

Temporal Implants:

In this area, the surgical dissection need to be superiosteal either superior based or inferior based flaps. The ideal positioning parameters and recommended placement approximately 18 mm from the external auditory canal at the 6:00, 9:00, and 12:00 o'clock positions for the right ear and the 12:00, 3:00, and 6:00 o'clock positions for the left ear. The distance between implants should be approximately 11 mm (center to center).

Orbital Implants:

Implant can be inserted within the lateral rim. Medial wall is not recommended due to lake of bone and support, unless bone grafting is considerable, and staging surgeries will be considered. three to four implants are placed in the lateral rim to provide adequate stability.

Nasal Implants:

Due to poor availability of bone, and complex nasal anatomy this area considered the poorest area for craniofacial implants. Implants are inserted in a triangular arrangement with one fixture superior (radix) and two placed in a lateral position with the frontal process of the maxilla.

Surgical techniques:

Collaboration with the oncologic surgeons before the resection of maxillofacial lesions is mandatory for full comprehensive plan. Presence of adequate bone to support the

implants is the key of craniofacial successful implants. Proper *emergence profile* of the prosthesis is affected directly via soft tissues thickness. The transition line of the prosthesis with the patient's skin should be as subtle and low profile as possible to allow for a lifelike appearance (feather like appearance).[1-3]

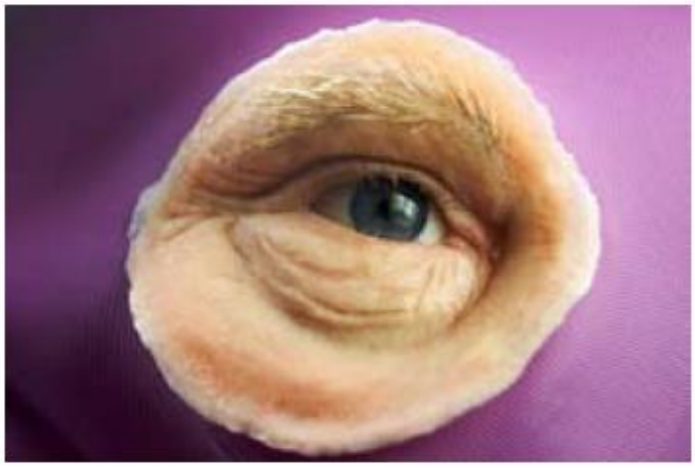

Fig 1: orbital prosthesis , notice the transition line is thin and transperant.

Recently with evaluation of dental digital softwares, craniofacial implants can be very easy and safe procedure as computer guided procedure. For example the guide or templates will used the contralateral ear (the intact ear) to determine the position of affected ear[3].

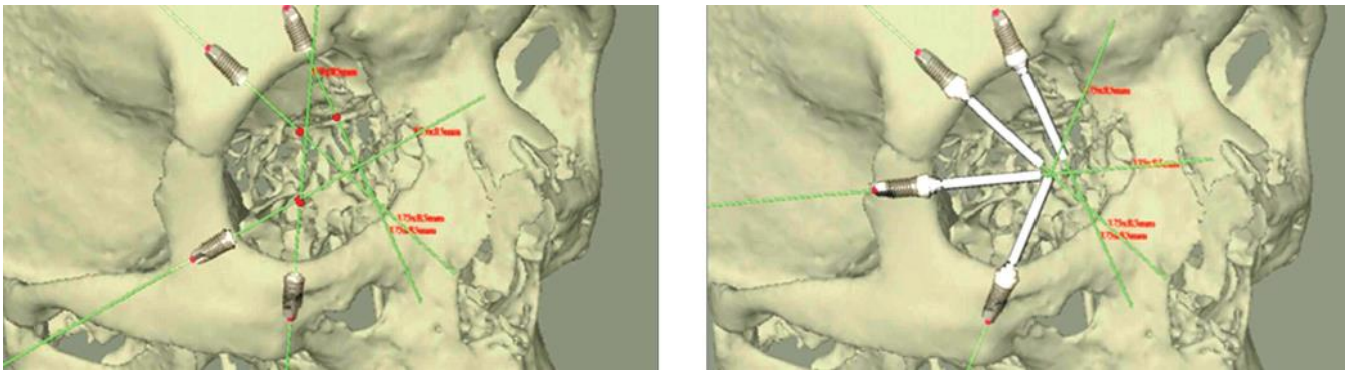

Fig 2 : Craniofacial implants and abutment planned virtually before surgical procedure.

Surgical consideration in craniofacial implants:

Extra oral implants	Intraoral and Intranasal Implants
The implants used are the regular platform implants. machined surface regular platform Brånemark, 4.0-mm implants, except in cases of bone-anchored hearing aid (BAHA) appliance or to support a prosthetic ear. Vistafix implants developed also by Brånemark and more currently revised are the implant of choice for ear prosthetic stability and BAHAs. available in 3.0- and 4.0-mm lengths with a 1.5-mm collar that is slightly submerged in the bone to increase the surface area of bone contact.	Intraoral and intranasal implants are also the machined surface, regular platform implants or conical cranial implants available from Straumann. Brånemark zygomatic implant with the 45-degree angulated Platform.

Surgical site preparation:

Sharp dissection through skin layers to exposes the residual bony defect in a subperiosteal plan. The drilling sequence to prepare the osteotomy is the same as for conventional intraoral implants (follow manufacture recommendations).

In **Orbital Defects,** insertion of two to three implants is generally adequate to support the orbital prosthesis. The proper site is the lateral supraorbital rim, if it has not been resected if it is, then consider to graft the medial wall. Special consideration for treatment planning the orbital prosthesis is the available depth of the orbital defect. Inadequate orbital depths will not allow the tipping of the trajectory of the implant into the center of the orbit, resulting in inadequate space for the fabrication of the substructure and the orbital prosthesis. orbital depth is established intraoperatively by *debulking* of the orbital contents. After exposure of the orbital rim, a round bur is used to identify the position of the implant paralleling pin is placed upon completion of the 2-mm osteotomy to better evaluate the trajectory of the implant. The final osteotomy depth is 3 mm followed by the insertion of the implant. osseointegration period usually is 3-4 months.[1,7]

In **auricle defects** , Any remnants of the auricle still present Should be removed the classic regions for implantation would be eight o'clock or, even better, 9 o'clock, as well as between 10 and 11 o'clock at a distance of 2 cm from the external ear canal it is corresponds roughly with the anthelix and thus allows a sufficiently high space for the abutment of the auricular prosthesis. Two abutments are sufficient for a bar construction. [1,4]

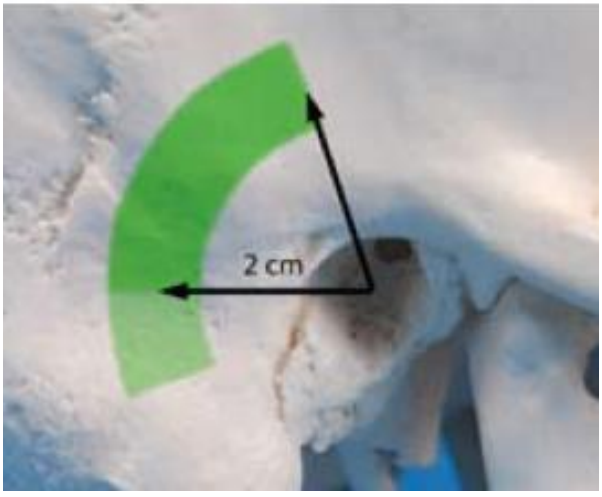

Fig 3: The ideal placement of craniofacial implants for ear reconstruction

In **Nasal Defects,** The available bone volumes that can support the implants are in the premaxilla. A 2- to 3-mm area of incisal tooth display is aesthetic at rest for the female patient. In order to establish the proper lip drape, a "gull-wing" resection of the upper lip immediately below the nasal apertures is performed through the skin, connective tissues, and periosteum (in cases of long upper lip). Debulking of the paranasal connective tissues allows for the maxillofacial prosthesis *artistic license* to create favorable contours for a thin *finish line* of the prosthesis.3-4 months needed for successful osseointegration.[8]

Healing process:

Two-stage or the one-stage surgical protocol may be adopted per the surgical teams' preference. *For the two-stage approach,* after insertion of the implants, cover screws are placed and the implants are submerged. Stage II surgery; exposure of the extraoral implants through the cutaneous tissue, is performed 3 to

6 months after the stage I surgery. The final abutments are placed approximately 2 to 4 weeks after the stage II surgery this will allow the resolution of the soft tissue swelling around the temporary healing abutments installed at stage II surgery. *For the one-stage approach,* temporary healing abutments or the final abutments are secured to the implants immediately after their insertion (with daily hygiene). For the one-stage protocol, impressions may be taken at the stage II appointment, 3 to 4 months after placement of the implants.[8]

Complications :

The rate of soft tissue reactions around percutaneous implants has been reported between 3% and 60%. Most authors have noted soft tissue reactions of approximately 3% to 7% of percutaneous implants, with the majority of the reactions being mild erythema or irritation. Holgers et al. have described scoring system for the classification of these skin reactions:0: no reaction, 1: reddish, 2: red and moist, 3:granulation tissue, 4: skin infection to such a degree that the abutment has to be removed. Utilizing Holgers and Tjellström's classification system, they found that 95.6% of the cranial implants tissue reactions fell within classes 0 to 3 and required only local measures to control soft tissue reactions.[5] The most common isolates from peri-implant cultures obtained from skin-penetrating cranial implants are *Staphylococcu* (most commonly *Staphylococcus aureus*) and *Streptococci* species, gram-negative bacilli, and yeast species such as *Candida parapsilosis.*[9]

Successful rates and clinical longevity of craniofacial implants:

Long-term success rates in the temporal region have been reported ranging from 92% to 98% in larger studies. Success rates in orbital implantation have been reported from 91% to 96%. Success rates reported in the literature when implanting the nasal region range from approximately 70% to 80%.[8,9]

Craniofacial implants in irritated patients:

Soft tissue fibrosis with the loss of the microvasculature occurs in the recipient bed, leading to decreased oxygen delivery and affecting in a negative way. Most authors report significantly increased failure rates (range 17%–42%). Jacobsson and coworkers, noted a success rate of 62.7% (as compared to 92.1% in non-irradiated bone). The timing of implant placement at the conclusion of radiation therapy remains controversial, with most authors recommending a delay of 6 to 19 months before implant placement. hyperbaric oxygen (HBO) can be used to increase the successful chance.[6]

Conclusion:

Craniofacial implants are a tool that can be used successfully to reconstruct facial defects with a very satisfactory result.

Acknowledgements:

The author would like to appreciate the unlimited support that provided by deanship of scientific resarech in Qassim University.

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