ZYGOMATIC IMPLANTS – A REVIEW
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Abstract:
Implants have always been sensitive in the maxilla than in the mandible. The situation becomes undesirable when the maxilla is severely resorbed and atrophic, so various protocols such as sinus augmentation & hipbone grafts have been recommended to provide an optimal solution for this complex problem. A new technology was developed in Europe to do the upper jaw dental implant treatment without using the hipbone graft. This ‘graft-less technique’, also called the ‘Zygoma technique’ using the cheekbone (zygoma bone) to anchor the longer zygoma implants known as zygomatic implants was developed in the year 1998 by Branemark as an alternative to atrophic maxilla.

Key words: Zygomatic implant, atrophic maxilla, graftless solution, edentulous maxilla

INTRODUCTION
Dental implants are used for replacing missing teeth. Placing dental implants is limited by the presence of adequate bone volume permitting their anchorage. With a high predictability for some systems, increased applications have been developed for compromised patients. Also conventional implants have always been sensitive in the maxilla than in the mandible.1 The situation becomes undesirable when the maxilla is severely resorbed and atrophic, so various protocols have been recommended to provide an optimal solution for this complex problem.
A new technology was developed in Europe to do the upper jaw dental implant treatment without using the hipbone graft.

This ‘graft-less technique’, also called the ‘Zygoma technique’ uses the cheekbone (Zygoma bone) to anchor the longer zygomatic implants. The implant is a titanium endosteal implant. These are self-tapping screw-shaped implants in commercially pure titanium with a well-defined machined surface. They are available in eight different lengths ranging from 30 to 52.5 mm. They present a unique 45° angulated head to compensate for the angulation between the zygoma and the maxilla.

The portion that engages the zygoma has a diameter of 4.0 mm, and the portion that engages the residual maxillary alveolar process a diameter of 4.5 mm.
CLASSIFICATION
Aparicio C in 2011\(^2\) proposed a classification for zygomatic implant patients based on the zygoma anatomy guided approach (ZAGA). The morphology of the lateral sinus wall, residual alveolar crest and the zygomatic buttress was taken into major concern. The five basic anatomical groups were named as ZAGA 0, ZAGA 1, ZAGA 2, ZAGA 3 & ZAGA 4.

REVIEW
Branemark in 1997 first developed a specific implant called the zygomaticus fixture to provide fixed solutions even when the conditions for implant insertion were poor in the posterior maxilla.\(^3\)

The classic technique of zygomatic implants was first introduced by Branemark in 1998 and was used in eighty-one patients with a 97% success rate where standard implants and zygomatic implants were placed on each side of the posterior maxilla.\(^4\) This new technologic development offers alternatives to bone grafting or sinus-lifting procedures, which involve rather invasive surgery.

Stella and Warner (2000)\(^5\) presented a modification (the “slot technique”) that featured a minimal opening of the sinus wall and implant placement that was better suited to the prosthetic design. Bothur et al (2003)\(^6\) presented a new technique that used multiple zygomatic implants in critical conditions, and the use of four zygomatic implants has been confirmed as a viable alternative with a high success rate. Petruson (2004)\(^7\) examined the maxillary sinus of fourteen patients with zygomatic implants using sinuscopy and found no signs of adverse reactions. Penarrocha et al (2007)\(^8\) confirmed the success of the “sinus slot technique” of zygomatic implant placement by Stella and Warner in 21 patients. Aparicio et al (2010)\(^9\) proposed extrasinus placement of the zygomatic implant, which further simplified the surgical technique and reduced patient discomfort. In the extrasinus approach, no opening of the sinus wall is made and the implant path is along or lateral to the sinus wall, so that the zygomatic bone can be visualized and the implant engaged in it. Aparicio (2011)\(^2\) proposed classification for zygomatic implant patients based on the zygoma anatomy guided approach (ZAGA).

INDICATIONS OF ZYGOMATIC IMPLANTS
1. Treatment of severely atrophic edentulous maxillae without using any bone augmentation, sinus lifting or other grafting procedures.
2. There may be two different clinical situations:
3. There is enough bone in the frontal maxillary region to allow the placement of at least two short implants; or
4. There is not enough bone in the frontal regions and two to three zygomatic implants can be used in each upper quadrant to hold a fixed prosthesis without using any conventional dental implants.
5. Free-end situations in maxilla with insufficient bone height.
6. Total edentulism together with reduced bone height.
7. Pneumatization of maxillary sinus. In cases with very severe resorption of anterior maxilla
8. Maxillary reconstruction after partial or total maxillectomy. Zygomatic implants can be used to fix maxillary obturators as an alternative to non-implant retained obturators, local and regional flaps, and microvascular free flaps.

CONTRAINDICATIONS OF ZYGOMATIC IMPLANTS
1. Medically compromised patient
2. Acute sinusitis
3. Adequate maxillary bone for conventional implants
4. Severe trismus (relative contraindication)
5. Previous history of head and neck radiation therapy (relative contraindication)

ADVANTAGES OF ZYGOMATIC IMPLANTS
1. Avoids use of grafts in atrophic maxilla
2. No additional donor site surgery and morbidity
3. Zygomatic implants placed with two to four traditional premaxillary implants can be either immediately loaded, or, more traditionally, a final fixed prosthesis can be placed after a 6-month healing period.
4. Good anchorage from tough zygomatic bone which enhances stability of prosthesis.
5. Zygomatic implants do not necessarily require hospitalization, which is usually needed for autogenous bone harvesting from the iliac crest.
6. The total treatment time is routinely 6 months or less for zygomatic implants compared with grafting with subsequent implant placement.
7. Less number of patient visits.
8. Fewer implants are required to support a prosthesis compared with traditional bone grafting and implant placement.
9. The overall laboratory fees are equal to or slightly less than those for traditional implants.

DISADVANTAGES OF ZYGOMATIC IMPLANTS
1. Difficulty in implant placement and the palatal emergence profile.
2. Because the platform of the zygomatic implant might be palatal to the crest, the perception is that the patient will feel excess bulk and have problems with the prosthesis. The restorative dentist must have the clinical proficiency to fabricate a full arch implant supported prosthesis, which could exclude dentists who do not have the clinical experience with this type of prosthesis.
3. The placement of the zygomatic implant is limited by the anatomy of the zygoma.
4. In patients with concave lateral walls of the maxilla, surgical placement of the zygomatic implant within the bone might be difficult. The surgical access to the zygoma and orbital rim requires a surgeon who has experience with surgery in this area.
5. Although the palatal emergence of the implant does add to the difficulty of maintaining oral hygiene, minimal long-term phonetic sequelae from the prosthesis design have been reported.
6. The surgeon must attain training for surgical placement of zygomatic implant.

COMPLICATIONS OF ZYGOMATIC IMPLANTS
1. The reported complications associated with zygomatic implants include postoperative sinusitis, oroantral fistula formation, periorbital and subconjunctival hematoma or edema, lip lacerations, pain, facial edema,
temporary paresthesia, epistaxis, gingival inflammation and orbital penetration/injury.
2. Post-operative concerns regarding difficulty with speech articulation and hygiene caused by the palatal emergence of the zygomatic implant and its effect on the prosthesis suprastructure.
3. The zygomatic implant prosthesis system is complex from the biologic point of view as a result of the interfaces towards different tissues such as bone, oral mucosa and sinus mucosa.
4. Zygomatic implants were associated with periimplant bleeding and increased probing depths, possibly caused by difficulties in implementing appropriate hygiene because of the positioning of the zygomatic implant head and abutment, and the design of the prosthesis. Thus, the risk of soft tissue problems and sinusitis should not be underestimated.

DISCUSSION
There is insufficient bone volume in posterior maxilla which can be due to bone resorption as well as to pneumatization of the sinus or to a combination of both. In any case, insertion of implants in this region remains extremely unpredictable.

Treatment with zygomatic implants was introduced for the rehabilitation of atrophic maxillae without the use of grafts. Zygomatic implants are long screw shaped titanium endosteal implants ranging in length from 30 mm to 52.5 mm & inserted through the posterior alveolar crest passing through or externally to the maxillary sinus to engage the body of zygomatic bone. A couple of conventional dental implants may also be needed in the frontal region of the maxilla to stabilise the prosthesis.
The potential main advantages of zygomatic implants could be that bone grafting may not be needed and a fixed prosthesis could be fitted sooner.

Another specific indication for zygomatic implants could be maxillary reconstruction after maxillectomy in cancer patients. The surgical procedure is carried out under general anaesthesia.
Bilateral elevation of the buccal mucoperiosteal tissue is done after anaesthesia.
Lateral sinus bony window is removed from its posterior aspect and antral mucosal lining is reflected.
Two zygomatic implants are then inserted engaging the dense bone of the body of zygomatic arch, emerging intraorally in the upper premolar region just palatal to the alveolar crest.
Each implant is introduced into the second premolar area, traversing the maxillary sinus, and is placed into the body of the zygomatic bone.

CONCLUSION
The zygomatic implant, the zygomaticus fixture appears to be a promising development in implant technology. It offers an interesting alternative solution to heavy bone grafting in the severely resorbed posterior maxilla. It has been in use for more than 10 years and gives a predictable outcome in the rehabilitation of totally as well as partially edentulous patients without the use of bone grafts from extragenous donor sites.

REFERENCES
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