Navigation System Approach in Zygomatic Implant Technique

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Abstract: In some patients, the resolution of severe maxillary atrophies can be hardly achieved without the use of zygomatic implants. Although many scientific studies have already demonstrated the excellent immediate stability in long term, the use of zygomatic implants is not yet widespread. Among the complications of this technique, the most threatening is the risk of damaging the eyeball or the maxillary nerve.

The use of the navigator system as a surgical aid for implant placement allows to control, at any time, the position of the drill in the bone, avoiding any injury to ocular and nervous structures. The authors present a clinical report which shows a patient affected by a very severe form of post-traumatic maxillary atrophy that has been solved through the of zygomatic implants placement using the "Implant Bone Navigation" system. This procedure allows both to cut down the risks on ocular and nervous structures of the maxilla and also to reach excellent rehabilitation results in such severely compromised patients.

Key Words: Atrophic upper jaw, fixture, navigator system, zygomatic implant

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The zygomatic implants (ZI) have been conceived in order to restore a physiological occlusion in those patients who cannot be treated with traditional approaches. The ZI are indicated only when no other possibility to rehabilitate the maxilla has shown to be feasible both with permanent prosthetics or mobile ones.

The ideal patients for ZI placement are those who have undergone a vast maxillary resection or damage for oncological or traumatic causes, or those affected by severe atrophies which has resulted untreatable with any other technique.[1–3]

The surgical technique has been extensively described and many studies in literature have attested its predictability and assessed its results and safety.[2–9]

However, this surgical technique has also shown some adverse effects and among which the most threatening one is the loss of the visual function caused by injuries to the eyeball or the optic nerve.[8] Fernández et al[4] reported an overall complication rate of 9.9% among more than 200 ZI placed, including sinusitis as the most frequent complication (7.5%), followed by paresthesia (0.4%) and oroantral fistula (0.4%). Despite these results, Maló et al[6,7] reported that every biological complication occurred in the 80 treated patients (22.7%), resolved in the majority of the patients, providing an estimated cumulative success rate of 94.4% at 7 years.

Garcia et al[10] also reported that complications of ZI are relatively common but they have rarely led to implant loss or removal.

Therefore, in order to avoid these and other complications, we have decided to combine the zygomatic fixtures placement technique with the use of navigator system (NS) which allows major control on the implant placement site.[11]

CLINICAL REPORT

In October 2014, a 36-year-old woman referred to our department of Oral and Maxillofacial Surgery of Catholic University of the Sacred Heart, Rome, Italy.

She was affected by a severe upper jaw atrophy caused by a severe facial trauma (Fig. 1).

In 2002, the patient had suffered from bilateral Le Fort III fracture with loss of the sagittal and vertical projection of the maxilla.

She had already undergone numerous surgical treatments with no improvements. Among the former were a free fibula flap and a free iliac crest bone flap. Both surgical treatments failed; moreover, they led to worsening of the atrophy itself causing a complete loss of the premaxilla from 1.4 region up to 2.5. Many efforts were spent in order to rehabilitate the patient with the use of mini-implants and even these attempts were not successful.

Once every possible rehabilitative approach was excluded, additional diagnostic studies were required, particularly a computed tomography (CT) dentascan, a CT of the maxillofacial complex and the creation of a stereolithographic model of the orbital-maxillary-zygomatic district.

Following the analysis of these diagnostic studies, placement of 2 implant fixtures on the right side and only 1 implant fixture on the left side was planned. Even if this plan did not respect the correct distribution of the functional loads, it was the only possible therapeutic option because of the minimal residual bony structure left on the left side.

A virtual operating planning on the stereolithographic model was also performed in order to precisely evaluate the points of entrance and exit of the implants in the zygomatic bone.

The use of the NS during the surgical time allowed us to position the implants with great precision, completely avoiding any risk of damage to ocular and nervous structures.

Under general anesthesia and nasotracheal intubation, an incision to the upper gingival fornix from 1.6 region up to 2.6 was performed. After that soft tissues were elevated and the nasal fossa was isolated, the bony region from 1.4 up to 2.5 was skeletonized. Before using the pilot drill, we accurately established

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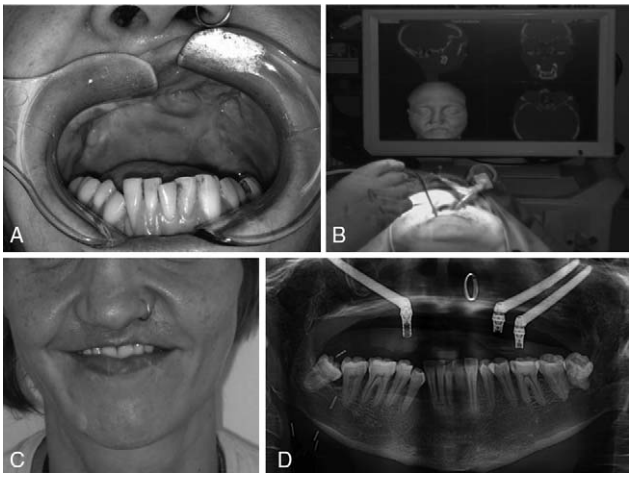

FIGURE 1. (A) Intraoral view: It is possible note the severe deficit of the upper jaw following the trauma. (B) Intraoperative view: Evaluation to the correct position of the pointer on the monitor. (C) Frontal view: Patient with the upper prosthesis placed. (D) Postoperative orthopantomography.

the entrance points of the fixtures in the bone with the help of the NS, according to the plan.

Although the maxillary sinuses of our patient were extremely hypoplastic, lifting of the Schneiderian membrane was also performed in order to preserve its integrity while using the various burrs.

The most delicate step was using the pilot drill. In this phase, we used the NS in order to reach with great precision the entrance point of the drill in the bone as simulated the stereolithographic model.

By the activation of the ''target function,'' we carefully established the exit point of the fixture through the bone using the CT scan. Based on the indications given by the NS, we followed the drill path in the bone, carefully drilling ''in steps'' 0.3 cm at a time, always checking its position and direction.

At the moment, it is still impossible to set a fully ''navigated'' tip for the drill, since the rotation of the tip disturbs the NS, so it is only possible to navigate the tip of the drill when it is not moving. The pointer position was thereby assessed every 0.3 cm of progression.

We have defined this surgical procedure ''Bone Implant Navigation.''

The NS has shown being extremely useful for us especially through the zygomatic body in order to prevent any possible breach through the orbit.

After using the pilot drill we completed the osteotomy with the remaining drills with increasing diameter, and after every step we ensured we were in the predetermined path with the help of the NS.

After fixtures placement we sutured the soft tissues. The prosthesis was loaded 2 days after the operation.

During 1, 3, 6, and 15 months follow-up, no negative event was reported.

DISCUSSION

Our aim is to demonstrate the gain in safety, the navigator is able to provide during surgical procedures.

The use of the NS has allowed us to achieve the exact targets, we set during the planning phase and it has also shown to be easy to handle and highly effective and reliable for the ZI placement, drastically cutting down the risk of perioperative complications.

The surgical procedure has shown to be a little slower than the normal procedure for the ZI placement. Despite this fact, the time we lost using the NS was recovered since the use surgical templates was not necessary, and it would have also been impossible in this patient for her complete loss of bony reference points.

A negative point of this surgical procedure is the elevate cost of the NS which discourages its use on a larger scale. The ''Bone Implant Navigation'' technique will surely encounter more favor when the rotating drill will become fully navigable. This will provide a better speed in the insertion steps, also a decrease in the cost can lead to more popularity.

CONCLUSION

The ''Bone Implant Navigation'' has shown to provide a better accuracy in ZI placement, reducing the rate of complications, and injury to the surrounding structures.

Despite the advantages that the system provides development of fully navigated rotating instruments and reduction in its cost should be carried out before its use can be fully implemented.

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