Immediate Rehabilitation Of Atrophic Jaws Using Tilted Implants

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Since many years, rehabilitation according to the Brånemark protocol (Toronto-Brazilian rehabilitation concept) is considered the gold standard in case of full-arch fixed implant hybrid prostheses 1. This approach consists in the use of six implants, axially placed in the pre-maxilla or in the interforaminal region of the mandible, supporting a final bridge with bilateral distal extensions (cantilevers) 2. Implant and prosthetic success rates were very high in the long term, exceeding 20 years of follow-up 3, 4. The original protocol entailed a healing period of at least 6 months for the mandible and 8 months for the maxilla, necessary for the osseointegration of the implants before the prosthetic phases can start 5. Professor Brånemark, who stated the first protocol for implant dentistry 1, considered that period of time sufficient for the integration of the implants. Today, this prerequisite is no longer fundamental for the final success of the rehabilitation and implants can be loaded immediately after the surgery. In fact, as testified by recent consensus reports and systematic reviews 5, 6, full-arch rehabilitations and immediate implantation seem to be a predictable approach if precise guidelines during surgical and immediate prosthetic phases are followed. In all those papers, authors pointed out that the key factor for the immediate function seems to be a minimum implant primary stability of 30 Newton 7. This can be achieved by using specific implant morphologies and oncoplastic surgery in combination with a proper preparation of the surgical site that can guarantee a precise fit of the implant and a stable bone engagement 8. Therefore, a rigid splinting of implants with a final bridge is important to provide a firm structure stabilization under occlusal load 9.

The use of tilted implants

The trend in modern implant dentistry is the reduction of number of fixtures supporting a full-arch fixed restoration as well as the time elapsing between surgical phase and prosthetic loading 10. Lower number was the Brånemark concept 10, in which three implants of 5 mm diameter were inserted in the interfascial area with the help of a surgical guide and prefabricated components. This approach was not very versatile because of the prefabricated components and it was indicated only in patients with a specific mandibular morphology and occlusal class 1 2. Nowadays, therefore, the loss of one fixture led to complete failure of the prosthesis structure in a high percentage of patients. Those results led to the conclusion that at least four implants properly distributed are required to support a fixed prosthesis and ensure long-term success.

In a recent technique called All-on-4™ (Nobel Biocare AB, Göteborg, Sweden) 11, 12, 13, Paolo Malo proposed the use of two anterior implants placed axially in region of lateral incisors and two posterior fixtures tilted between 30 to 45 degrees relative to the occlusal plane. A provisional screw-retained prosthesis with 10 teeth can be delivered after fewer hours from the surgery, while the final restoration will be made after 6 months. Median term results are very encouraging: Malo reported 98.95% implant survival rate for 867 mandibular dental implants followed up for 10 years 14, while Agliardi showed 98.36% in the maxilla and 97.73% in the mandible, respectively, up to 60 months of loading 15.

One of the innovative aspects of this technique is the inclination of the distal implant, which offers surgical and prosthetic advantages. By tilting the implants, it is possible to place longer fixtures and achieve higher level of primary stability because of the greater surface in contact with the bone 16. Furthermore, the area of emergence of the inferior alveolar nerve and the anterior wall of the maxillary sinuses are characterized by a good bone quality and this enables clinicians to find a solid internal support. Therefore, when implants are tilted distally, the prosthodontic solution is also reduced. Further prosthetic consequences from implant inclination consist of an increased interimplant distance, the creation of a more regular prosthetic polygone and an increase in the anteroposterior (AP) index 17 compared with the Toronto-Brazilian rehabilitation, especially in mandibles of a rectangular shape. With the reduction of the number of platforms, it is easier to achieve a passive prosthetic fit, both for the provisional and for the final rehabilitation. Patients can maintain optimal levels of oral hygiene because of the fewer number of surfaces and the wider distance between implants.

Tests on models and by finite element analysis performed on single angulated implants showed that tilting implants may increase the stress to the surrounding bone. Tilted fixtures may also be subjected to bending, possibly increasing the marginal bone stress. However, when the implant belongs to a multi-implant supported prostheses, the spread of the implants and the rigidity of the prosthesis structure should reduce the bending 18. Furthermore, no difference in the marginal bone loss between tilted and axially placed implants placed after the jaw has been reported 20, suggesting that tilting implants does not cause any detrimental effect on the osseointegration process.

Immediate full-arch fixed prosthesis

Immediate loading procedures have gained high popularity among clinicians. The reduction of total time of treatment and the possibility to deliver a functional implant bridge few hours after the surgery represent a notable advantage for patients. Therefore, partial edentulous patients with a failing residual dentition can avoid the psychological trauma and discomfort of a transitional removable prosthesis 21.

The rehabilitation of edentulous jaws is often complicated by a reduced bone quality, especially in posterior region, because of the resorption of the inferior alveolar nerve. To face these limitations, clinicians have different therapeutic options, such as long distal cantilever 22, the use of short fixtures 23, sinus lift and bone augmentation 24 or implants placed in specific anatomical areas such as pterygoid region 25, the tuber 26 or the zygoma 27.

Any of these procedures requires surgical and prosthetic expertise and has its own advantages, limits, risks and complications, involving sometimes high biological and financial costs. In the last years, different clinical studies assessed tilted implants as a feasible treatment option, with encouraging results 26, 27. These studies and case reports demonstrate the benefits of tilted implants in comparison to axially placed fixtures.

Case report

A 62-years old male patient was referred to our office with a precise chief complaint: fixing his failing dentition without going through multiple surgeries and in a rather short period of time (Fig. 1-3). Functional and esthetic demand was high, he has to visit his dentist 2-3 times a month, has financial limitations. He has relevant periodontal disease and compromised aesthetic aspect of the edentulous zone. Therefore, he was not satisfied of his clinical status. After discussing possible therapeutic options we decided to exclude extensive bone grafts (sinus lift with bone grafting) and to use the residual bone available, restoring both arches with a hybrid titanium prostheses supported by two anterior implant and two posterior angled fixture according to the All-on-4 concept. Final prosthetics will be realised with titanium CAD/CAM framework with CAM Procera ® (Nobel Biocare) and using the Ivoclar® Invisio™-injector.

Surgical and prosthetic phases

Implant surgery was done under intravenous sedation with the upper jaw. After local anesthesia, compromised teeth were exfoliated and sockets were carefully deburred with sterile saline water. A ridge split was done in keratinized gingiva starting from mesial to distal region. A non-parallel lateral side and a mucoperiosteal flap was elevated exposing the vestibular bone wall until the buccal plate. Bone crest regularization was done with bone graft and bone substitute. Bone crest regularization was done with bone graft and bone substitute. Bone crest regularization was done with bone graft and bone substitute. Bone crest regularization was done with bone graft and bone substitute. Bone crest regularization was done with bone graft and bone substitute. Bone crest regularization was done with bone graft and bone substitute. Bone crest regularization was done with bone graft and bone substitute. Bone crest regularization was done with bone graft and bone substitute. Bone crest regularization was done with bone graft and bone substitute. Bone crest regularization was done with bone graft and bone substitute.

Once the surgical phase was finished, polyamide impressions and vertical dimension registrations were taken. Three hours after, full acrylic provisional bridges with 10 teeth were delivered, keeping full contact with the maxillary incisors and preventing any lateral excursion (Fig. 18-20). After six months, final restorations with titanium CAD/CAM framework with CAM Procera ® (Nobel Biocare) were made and full occlusion with 12 teeth were given (Fig. 21-29).

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Fig. 1 This 62-years old patient presented with a clear chief complaint: “improve my smile with a fixed restoration.”

Fig. 2a and 2b: Intra-oral view showed remaining teeth in the upper jaw and residual roots on the mandible. Partial removable prostheses did not provide comfort during mastication and aesthetic appearance anymore.

Fig. 3a and 3b: Occlusal view of both arches with an adequate amount of keratinized gingiva.

Fig. 4: Panoramic x-ray evidenced bone loss in both arches due to chronic generalized periodontitis, with horizontal resorption and endo-peri lesions in the mandible. The extensive sinus pneumatization did not allow posterior implants placement without a preliminary sinus augmentation procedure.

Fig. 5a and 5b: Note the inclination of the surgical sites and the maintenance of the entire rehabilitation.

Fig. 6: Four verification pins evidenced bone defect in an underprepared surgical site to increase primary stability.

Fig. 9a and 9b: Parasympathetic nerves are located between canines with no lateral excursions.

Fig. 10a and 10b: Post-surgical contacts are limited between canines with no lateral excursions.

Fig. 11: Occlusal view showing implants distribution along the anterior maxilla.

All implants have been placed with a 50 Newton torque. 39 degrees abutments are positioned in the posterior implants to correct their inclination, while 17 degrees abutments are screw-on the anterior fixtures for a favourable emergence of the prosthetic screw on the palatal side.

Fig. 16: Post-surgical gain was filled with autogenous bone before flap closure. The flap was sutured in a way to create a minimum 2 mm collar of keratinized gingiva all around every abutment. This peri-implant seal will be very important for the long-term maintenance of the entire rehabilitation.

Fig. 19: Final prostheses were achieved by means of three hours after the surgery.

Fig. 9a and 9b: Full occlusal contacts are limited between canines.

Fig. 12: Final prosthesis will be realized with titanium CAD/CAM frameworks and composite teeth and using the IvoBase® Injector.

Fig. 13b: Provisional acrylic prosthesis with the final restorations.

Fig. 14: All implants were inserted in gypsum casts of lateral incisors.

Fig. 15a and 15b: Full arch prostheses with abutments.

Fig. 16a and 16b: Mandibular final bridge containing 12 teeth.

Fig. 17a and 17b: Full occlusal view of prosthetic distribution and bone level maintenance.

Fig. 18: Panoramic radiograph after one year of loading showing implants distribution and bone level maintenance.

Fig. 19: Panoramic radiograph after one year of loading showing implants distribution and bone level maintenance.

Full list of references is available from the author.