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Case Series

INTEGRITY CONCEPT, A Clinical Study of Edentulous Patients Rehabilitated According to the "All on X" Immediate Function Protocol

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Abstract

Purpose: is to evaluate the success of the application of a work protocol called ALL ON X - integrity concept in the resolution of cases with atrophic jaws, through the integrated application of numerous surgical and implantological techniques with the use of fixed supported rehabilitation protocols that allow the reduction of treatment times and costs for our patients.
Materials/Methods: For the present study, 8 healthy patients with a diagnosis of partial and total edentulism of the maxillomandibular arches were selected, with a reverse planning protocol supported by post-extractive implants, w/ immediate or delayed loading, was applied where implant-supported fixed rehabilitations were used for their resolution. The effectiveness of planning, integration of surgical-prosthetic techniques, marginal bone loss, treatment times, osseointegration failure and prosthetic failure were recorded at 6 and 12 months of follow-up.

Results: Sixty-two implants were placed in 08 patients (4 male and 4 female) and 12 fixed implant-supported full-arch rehabilitations were performed, 06 with immediate loading protocols and 02 with delayed loading protocols after 4 months. Patients considered that the integration of all protocols was very effective (100%), the application of the immediate loading protocol was very effective (100% in the 06 cases that were applied) and immediate provisionalization was effective (92%). Only 01 implant was lost (survival rate = 98%). At 6-month radiographic evaluation, the average peri-implant-crestal bone loss was 0.56 ± 0.12 mm for maxillary implants (n = 36), 0.59 ± 0.16 for mandibular implants (n = 25), and the average peri-implant crest bone loss at 12 months was 0.67 ± 0.11 mm for maxillary implants (n = 36) and 0.69 ± 0.16 for mandibular implants (n = 25). There were no episodes of unscrewing and one fracture of the provisional prosthesis. There were no paresthesias or prosthetic or surgical complications in definitive prostheses in the entire sample.

Conclusions: To our knowledge, the report of this series of cases describes in detail the application of a work protocol that allows the application of: numerous surgical techniques, rehabilitation on dental implants, immediate loading protocols and reduction of treatment times in the rehabilitation of atrophic jaws.

Introduction

Atrophic jaws rehabilitation has become a real challenge for today's clinicians. Due to its anatomical-physiological aspects, the resorption of the maxillary and mandibular bone presents limitations in implant placement through the conventional technique and in order to achieve it, numerous surgical and oral rehabilitation techniques must be combined. All these techniques must follow the same path from the diagnosis phase, planning and treatment with the correct execution of a reverse protocol that allows aesthetic and functional results that last over time.

An important limitation (aesthetic-functional) that can be found approaching these cases is time, a period in which the patients are expected to go through changes or different stages of bone healing, implant osseointegration, among others, which does not allow the use of any provisional rehabilitation system to avoid excessive forces or loads that endanger the success of the treatment.

This is why through this case series it is intended to find the standardization of procedures in the area of oral implantology that can allow to develop the rehabilitation of cases providing an effective surgical and restorative solution through which patients achieve immediate results from the first surgery.

Becoming the main objective to apply technologies that allow the development of a digital flow that is perfectly adaptable and applicable to the establishment of the Reverse Protocol and that is understandable by patients, colleagues and laboratory technical personnel. New concepts and minimally invasive surgical techniques that allow the development of multiple procedures in a single surgery to guarantee the physiological potential response of the jaws reducing: surgical times (trauma), pharmacological treatments (prolonged intake of medications, such as analgesics and antibiotics), oral rehabilitation times (patient discomfort) and costs of application of the protocols (multiple stages). Finally, merging concepts of modern implantology under two different integrated points of view, (Surgical-Rehabilitation) under the premise of achieving aesthetic and functional changes in all cases.

When the literature review was done, it was found that due to the physiological bone phenomena by which the vertical and horizontal bone atrophies of the maxillo-mandibular complex occur, it is difficult to place dental implants in ideal areas [1], having to do the indicated clinical and imaging study (CBCT) of the existing bone condition to properly select the reconstructive surgical technique prior to implant placement [2].

In order to provide an effective therapeutic option to our patients, numerous innovations in the world of oral implantology have been described in the literature for many years, including not only variations in the macrodesign of the implant [3] and prosthetic components, but the combination of surgical techniques in their placement, being standardized and combined with immediate loading protocols [4,5] that guarantee the reduction of treatment times (osseointegration period described by Adell et al.) [6] and show the evolution in this field with the incorporation of immediate loading.

The combination of various implant techniques provided by the versatility of the available implant systems (narrow, short, extra-short, zygomatic and pterygoid) [7] used for the resolution of maxillomandibular bone atrophies in our daily practice, means a great advantage at the time of decision making of the case, adding the importance of selecting the proper surgical technique [8] (postextraction, sinus floor elevation, osseodensification, vertical-horizontal bone regeneration and guided surgery) whose main objective is to achieve the insertion of implants with the least number of surgeries possible reducing treatment time with an aesthetic-functional result [9,10].

Currently there are numerous articles published in the literature regarding the use of immediate loading protocols in the consult. A study demonstrated survival rate of 93% at patient level and 98% at implant level after 5 year follow up [11]. Immediate implant loading protocols have been proposed to reduce the time interval between implant surgery and the delivery of the prosthetic rehabilitation with the objective of improving patient comfort and satisfaction. These protocols, however, are not frequently used by most clinicians and for all clinical indications due to uncertainty although similar outcomes can be achieved when compared with the standard loading protocols. It is, therefore, important to understand the risks and possible effects of this therapeutic implant strategy [9]. The purpose of this cases report is to create in a didactic and simple way the schematization of: techniques, phases, times and protocols that must be taken into account for the execution of these cases, for which we propose the use of the acronym INTEGRITY to, in a didactic way, formulate and outline the rehabilitations of our cases [12-14].

- **I:** Implants (implant selection by their macro-design [shape, threads type, size and connection]).
- **N:** Number (implant distribution in each arch to restore).
- **T:** Technique Implant surgical technique (post-extraction, sinus elevation, osseodensification, GBR, GTR).
- **E:** Establish Case establishment (use of immediate loading protocol, deferred, emergency profile design).
- **G:** Get temporary prostheses (use of immediate loading, provisional fabrication).
- **R:** Rehabilitation phase (starts at 8 weeks after the provisional phase).
- **I:** Impression technique (open or close tray technique and intra oral scanner).
- **T:** Technique rehabilitation design related to selecting the type of prosthetic design PF1, PF2, PF3.
- **Y:** Yearly related to radiographic and clinical follow ups (attached gingiva level, plaque index, occlusal control, prosthesis status) that must be done once a year.

Protocol Phases Detailed

Initial Phase – DX:

A clinical history and general patient data collection is carried out. Revision of devices and systems, detailing the clinical protocol of photographic registration, intraoral scanning and/or study models with their respective interocclusal relation. Imaging registration with Panoramic radiography and Cone Beam tomography, where all the hard tissue structures are compared with the situation of the soft tissues, taking into account details such as dental and facial midline, insertions of labial and lingual frenulums, axis inclinations and maxillary planes, presence of microbial entities associated with the remaining dental organs, probing depth and their mobility.

For this reason, systematic application of extraoral facial study photographs will be performed: frontal, lateral, three-quarters, smile, full smile and intraoral: frontal and lateral in occlusion, frontal of the upper and lower jaw and finally occlusal. If necessary in the case, dynamic videos of the seated patients will be included to observe in greater detail all the records with the movements of facial expression.

Once all these records have been obtained, an intraoral scan is done and final export of the files to create a personalized folder per patient that contains all the information collected that can guide to establish an accurate interdisciplinary diagnosis with different possible treatment plans.

To be able to explain patients and have a close approach, the REVERSE PROTOCOL is used as a routine. It is define as a series of steps that have to be programmed from the final result (restoration) until the construction of each of the pillars (soft and hard tissues) going through surgical, periodontal, rehabilitation and orthodontic phases (if needed) that have to be done to achieve the final goal using digital diagrams and mock up models that will stimulate patients.

Provisionalization phase. Provisional fabrication in Laboratory

All the implant planning is made in the planning system, selecting the number of implants and brand, abutments with probable widths, heights and type of provisionalization system, taking into account the strict fabrication of the provisional before surgery with their respective tests to be able to handle and contour all the emergence profiles of all the provisional implant-supported restoration.

Pre-Surgical Phase:

Once all the information is obtained, from a comprehensive point of view it is analyzed: laboratory tests (pre-surgical blood analysis), current medication, degree of anxiety (stress and if it is treated), degree of invasion of the chosen surgical procedure, classifying the intervention by complexity: uni or bimaxillary, combined or not, with reconstructive procedures, orthognathic surgery – facial aesthetics, and if the implant placement will be with immediate loading, which is the main principle of this work philosophy. The selection of these variables will lead the decision making to perform surgery under intravenous sedation, monitoring all vital signs, and in the company of an anesthesiologist and a nurse who will help channeling pre-medication, sedation itself during the surgical act, venipuncture to obtain the APRF-SPRF protocol from Dr. Joseph Choukroun and finally the intravenous administration of an analgesic, corticosteroid and antibiotic.

Most of the patients who undergo this interdisciplinary work protocol begin antibiotic prophylaxis 72 hours before the procedure with Amoxicillin + Clavulanic Acid 875/125mg (orally) every 12 hours, continuing 7 days post-operative. In cases of maxillary sinus floor elevation procedures this prophylaxis is combined with the administration of allergy medication such as Desloratadine 10 mg 1 tablet daily at night 3 days before surgery continuing 7 days post-operative, combined with Oxymetazoline nasal spray 1 puff in each nostril (morning -night) 3 days before surgery, continuing 7 days post-operative.

Surgical Phase:

The work protocol, whether maxillary or mandibular, is basically the same in terms of biosafety, use of sterile operative fields and surgical times. Starting the procedure with registered vital signs, local anesthetic is provided: Lidocaine/ Epinephrine Normon (R) 20mg/ml + 0.0125 mg/ml with infiltrative - block technique depending on the degree of invasion of the procedure to be performed (extractions, reconstructive surgery (bone grafts), maxillary sinus floor elevation, placement of implants), the important thing to highlight in the execution of the protocol is the surgical times, where we begin by performing all the extractions atraumatically, applying odontosection technique (buccolingually or mesiodistally) trying not to touch or place any instrument on the bone crest or the root of the tooth to avoid injuring or fracturing the buccolingual cortical bone. The extraction socket is revised, enucleation of apical cysts and profuse bone curettage mechanically and manually are performed. In a second instance, the preparation of the surgical sites receiving the implants is carried out executing different techniques described in the literature (post-extraction, maxillary sinus floor elevations, open technique (SLA) or closed technique (Summers or osseodensification) and a controlled sub-drilling protocol is used to guarantee the stability of our implants). The reconstruction of the alveolar process is performed by using the platelet-rich fibrin protocol (Dr. Choukroun) combined with harvesting autologous grafts, preferably from the retromolar trigone through the use of collector drills (ACM - Neobiotech (R)). Using a 50:50 GBR protocol (xenograft: autogenous), combining all these with the use of APRF - SPRF.

Finally, the dental implant placement phase is carried out, based on the principles of bi-tricorticality to guarantee primary stability and to be able to guarantee immediate

loading. An important aspect to mention in the surgical technique for dental implant placement is:

i. Average arrangement of 4 - 6 implants in the mandible, placing 2 anterior implants parallel to each other at the level of the parasymphyseal area and two in the posterior area (angulating the apex of the implant medially) avoiding the inferior alveolar nerve loop in its course and emergence itself.

ii. Average arrangement of 4 - 6 implants in the upper maxilla, placing 2 anterior implants medially inclined in the apical part in the naso-maxillary crest (nasomaxillary pyramid area) and two in the posterior area (maxillary tuberosity) trying to guarantee the anchorage by its crestal part using wide implants (considerable diameter).

iii. Use of osseodensification techniques in cases where the maxillary sinus is involved with bone heights equal to or greater than 5mm and, on the contrary, in cases where we do not have sufficient bone height (less than 4mm), the lateral window technique (SLA technique) will be performed differing their placement in that area for 6 months (graft osseointegration period).

iv. Use of osseodensification techniques in cases of narrow ridges (maxillo-mandibular) to expand them and achieve placement of the dental implant, covering the defect with the aforementioned biomaterials.

v. Placement of post-extraction implants, guaranteeing the use of the extraction socket and the palatal cortex to favor anchorage and therefore primary stability.

vi. Implants are submerged (Morse taper) 3-4mm using the vestibular ridge cortical as a reference to achieve better bone stability in the osseointegration phenomenon, moving the implant connection away from the bone interface and reducing the saucerization phenomenon widely described in the literature.

vii. In the anterior Canine-Canine sector the use of connective tissue grafts is considered, depending on their indication, they will be obtained from the palate or from the maxillary tuberosity itself, making no difference in maxilla or mandible cases, also indicating them in posterior areas that show absence of keratinized tissue, to achieve an increase of collagen fibers around the platform and connections of our implants.

Once the implants are placed in the desired positions, a series of periapical radiographs are taken to verify the parallelism between each one of them, and a CBCT to evaluate the correct disposition within the alveolar process, angulations, proximity to vital structures and future emergency profiles. It is important to highlight the intraoperative use of the fixture direction pin (Neobiotech (R)), a device that allows adjustments within the implant, without mobility and with retention to guide the placement of the subsequent ones [15,16].

Loading Phase (Provisional fabrication):

At this stage the patients rest for a moment from the surgical procedure, we change the team from OMFS to Oral Rehabilitation and proceed to reinforce the local anesthetic in the area, administration of NSAIDs (OR) or in case of working under intravenous conscious sedation and hemorrhage control, with 0.9% sodium chloride, cleaning all the implant platforms and allowing to more easily recapture the provisional prosthesis (previously made of acrylic or PMMA).

i. Selection of the multiunit abutments by angulation (straight or angled), depending on the arrangement of the implants in the arch and according to the depth (millimeters of implant insertion). This depends on the amount of soft tissue (mucosa thickness), trying to place them 1.5mm lower than the gingival margin, especially for PF1-type restorations.

ii. Once selected, torquing the multi units is achieved following the manufacturer's instructions, in this case what is suggested by Neobiotech is 30Ncm.

iii. The temporary cylinders are placed on each of the multiunit abutments selected for loading.

iv. The insertion axis of the provisional prosthesis in the provisional cylinders is verify.

v. An insulating material is placed such as a rubber or eflon dam to separate and protect the surgical site at the time of provisional recapture.

vi. Recapturing the provisional and fixing it with Bisacryl, fluid resin, dual cement or any relining material.

vii. The prosthesis is removed from the mouth and the missing areas are filled, giving an adequate contour to the rehabilitation.

viii. All excess material is removed and the correct finishing and polishing of all contours is performed (eliminating edges and imperfections of the material).

ix. The prosthesis is placed back in the mouth with a passive fit and tightened with the fixation screw from the commercial company following its references (Neobiotech 15Ncm R).

x. Final adjustments and occlusion checking with all the contacts and final polishing.

Control Phase:

Constant communication with the patient is maintained during the critical period of post-surgical inflammation of 72 hours (3 days), controlling: pain, hemorrhage, inflammation, fever, reminding the basic care of soft and atraumatic diet, hygiene of the areas intervened (use of 0.12% chlorhexidine rinses and topical application of chlorhexidine gel + Hyaluronic Ac. on the wound).

The follow ups in the protocol are established at 3, 7, 15 and 21 days respectively (where a clinical and radiographic control is done), evaluating stability of sutures, hygiene control, occlusion, probable dehiscence, persistent edema, discharge of suppuration, pain or localized inflammation. At 15 days (partial removal of suture begins), 21 days (complete removal of sutures, stabilizers of soft tissue grafts).

Clinical, photographic and radiographic records (orthopantomography, control CBCT) are included in this control phase until the bone healing period is completed. If there is any post-operative complication regarding the osseointegration of the implants, it is evaluated in the control period (8 weeks) of immediate loading, moment when the second phase begins. The provisional prosthesis is removed and the intraoral scans are performed again. Mucosa and crestal ridge cleaning, removal of lasts sutures that persist and corrections in the provisional in case of any fracture of the prosthesis [17-19].

As mentioned above, all the multi-unit abutments, healing abutments, closure screws, etc. are adjusted and verified, and in the event of any failure in terms of osseointegration not recorded in the initial consolidation phase (8 weeks), everything is ready to comprehensively address this situation with the immediate placement of a new implant, as long as it is possible and all the bone conditions in the same area are good, using a longer and wider implant that will give greater primary stability or with the replacement in a new anchor point trying not to vary the position in the alveolar ridge, so as not to modify the initially planned prosthetic design [20-23].

Case Report Integrity all on X Protocol

Figure 1 Case #1: Before – After.

(Case # I)

43 year old male patient with no significant medical history, social alcohol drinker. Chief complaint: to have a significant change in his dental condition because since he was young he went through non conservative and aggressive treatments in his country that led him to lose several teeth. Diagnosis of Periodontitis, bimaxillary partial edentulism, root fractures, multiple periapical lesions. The case planning will be done in two stages starting with the maxilla with a combination of multiple surgical procedures, dental implant placement and their immediate loading.

Surgical procedures under local anesthesia: Surgical Extractions, Bilateral SCA Sinus Lift, ALL ON SIX protocol [4] where the immediate loading of provisionals was done only in 4 implants, GBR GTR, Soft Tissue Management. A monolithic Zr prosthesis was made, stained with MIYO and cemented to interfaces in the upper jaw and a metal-ceramic dentogingival prosthesis in the lower jaw. Both prostheses are screw-retained to allow prosthetic reversibility. The patient is currently undergoing controls and continuous follow-up every 3 months during the first year and then every 6 months, not showing any clinical or radiographic changes.

Figure 2 Case #1OPG series: a) Post operative immediate implant placement. B) Post operative immediate loading in the mandible. C) Control series 4 years.

(Case # II)

Figure 3 Case # 2: Before -After.

67 year old female patient with hypertension and controlled diabetes with no other significant habit. She presents to the clinic asking very precise for an evaluation to make an immediate loading over dental implants protocol in the maxilla similar to the one she has from another clinic from years before. Diagnosis of Periodontitis, partial maxillary edentulism, bone atrophy due to maxillary horizontal bone ridge deficiency. The case is planned to be done under conscious sedation with local anesthesia to achieve the bilateral stabilization and reconstruction of the posterior alveolar ridge, posterior dental implant placement and immediate loading application. Initial treatment objective: Achieve the same confort, confidence and stability in the immediate loading procedure as her previous dentist did.

Surgical Procedures under conscious sedation + local anesthesia: Surgical Extractions, Bilateral SLA Sinus Lift, ALL ON SIX protocol (4) where the immediate loading of the provisional was done only on 3 implants, GBR GTR, Bone recontouring, Soft Tissue Management. A monolithic Zr prosthesis was made, stained with MIYO and cemented to interfaces in the upper jaw 2 months after surgery. The patient is currently undergoing controls and continuous follow-up every 3 months during the first year and then every 6 months, not showing any clinical or radiographic changes including control and maintenance of mandible restoration.

(Case # III)

67 year old male patient with no significant medical history, smoker around 5 cigarettes daily and daily alcohol drinker. He presents to the clinic referring that he suffered from a maxillofacial trauma, a pallet fell directly into his face 3 weeks before suffering from a fracture in the left maxillary sinus anterior wall, maxilla and zygomatic-orbital complex which caused him to lose ipsilateral teeth.Diagnosis of Left Zygomatic-Orbital Complex Fracture, dental fractures, Periodontal Disease and bimaxillary partial edentulism. Due to the three-dimensional reconstructions of the alveolar process, the case will be planned in two different stages starting from the bi-maxillary reconstructive surgery, implant placement, conventional provisionalization (tension free and with no loading in the ridge) and posterior implant supported rehabilitation.

Figure 4 Case # 3: Before - After

Surgical procedures under local anesthesia: Surgical Extractions, ALL ON FIVE protocol. 3D GBR GTR. Bone recontoruring. Soft Tissue Management. Provisional. Conventional loading. For personal reasons and trauma history a metal-ceramic dentogingival definitive rehabilitation was done 2 months after. The patient is currently undergoing controls and continuous follow-up every 3 months during the first year and then every 6 months, not showing any clinical or radiographic changes.

Figure 5 Case # 3: (Intraoral) Before - After.

(Case # IV)

69-year-old female patient with controlled hypertension and under treatment with oral bisphosphonates for more than 5 years. She goes to our center with her son with a main complaint: to find a solution and a real change in her oral condition because since she was little went through endodontic treatments, implants and prostheses that have not been effective and led her to lose many teeth. Diagnosis of Periodontitis, bimaxillary partial edentulism, multiple periapical lesions and maxillary periimplantitis. This case planning will be performed with an immediate loading in two stages beginning with the maxilla with a combination of multiple surgical procedures due to the fact that these areas presented chronic infections as a consequence of periimplantitis.

Initial treatment bjective: Recover a good oral hygiene condition, function and esthetic by applying minimally invasive techniques that allow a fast recovery.

Figure 6 Case # 4: Before – After.

Surgical procedures under local anesthesia in two surgeries, maxillary surgery first: Surgical Extractions, Bilateral SCA Sinus Lift, ALL ON SIX protocol (4), Immediate Loading – Provisional combined with a previously placed osseointegrated implant in upper right quadrant, GBR GTR, Soft Tissue Management, Periimplantitis. During the second stage surgery one implant had failed, due to personal reasons the treatment was divided in two different phases and a monolithic Zr prosthesis was made cemented to interfaces in the maxilla 2 months after surgery and 2 months after the posterior mandible. The patient is currently undergoing controls and continuous follow-up every 3 months during the first year and then every 6 months, not showing any clinical or radiographic changes.

Figure 7 Case # 4 OPG series: a) Post operative immediate implant placement. B) Post operative immediate loading in the mandible. C) Control series 1 year.

(Case # V)

48 year old female patient with no significant medical history, occasional smoker 8 cigarettes per day. She presents to the clinic by several referral because she belongs to the dentistry industry, esthetics area specifically, so her estheticfunctional demands are really high. Due to the esthetic demand requested by the patient and the presence of a big cystic cavity localized in the alveolar process communicating with the nasal fossa.

Figure 8 Case # 5: Before – After.

Diagnosis of Periodontitis, partial bimaxillary edentulism, large anterior periapical lesions communicating with the floor of the left nasal cavity., this case planning was forced to go through guided surgery with minimally invasive approaches that will allow the correct enucleation of the lesion, reconstruction and placement of 5 implants with immediate loading. Initial treatment bjective: recover the bone condition following the cyst removal and guaranty the primary stability due to the patient's esthetic functional requirements.

Surgical procedures under local anesthesia in two surgeries, maxillary surgery first: Surgical Extractions, Enucleation- Periapical cyst, Nasal floor-communication, ALL ON FIVE protocol Guided Surgery (1 anterior implant deferred due to apical lesion communication), 3D GBR GTR, Bone recontoruring, Soft Tissue Management, Immediate loading. A monolithic Zr prosthesis was made cemented to interfaces in the upper jaw. Patient is currently under controls and follow up every 3 months during the first year due to the size of the lesion and then every 6 months not showing any clinical or radiographic changes.

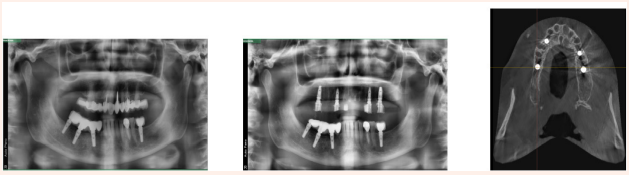

Figure 9 Case # 5 OPG series: a) Post operative immediate implant placement. B) Post operative immediate loading. C) CBCT.

(Case # VI)

69 year old female patient with history of controlled hypertension and under anxiety treatment for more than 1 year, smoker of 1 pack of cigarettes per day presents to the clinic with her son referring being really worried about her oral condition, especially because of the severe mobility of her incisives that will not let her chew properly and give her more anxiety limiting her quality of life. Diagnosis of Periodontitis, bimaxillary partial edentulism, multiple periapical lesions, alveolar ridge resorption with horizontal bone loss. Due to the presence of a tumor and bone loss in the maxilla, the case planning will be enucleation, curettage and correct management of the periapical cyst and during the same surgical procedure guaranty the three-dimensional reconstruction of the defect and placement of 4 implants with immediate loading. Initial treatment objetive: Recover the bone condition after the cyst removal and guaranty the primary stability.

Figure 10 Case # 6: Before – After.

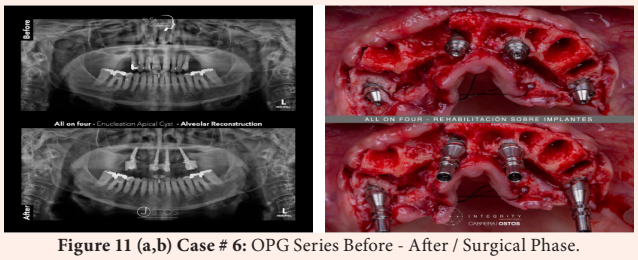

Figure 11 (a,b) Case # 6: OPG Series Before - After / Surgical Phase.

Surgical procedures under local anesthesia in two surgeries, maxillary surgery first: Surgical Extractions, Enucleation- Periapical cyst, Nasal floor-communication, ALL ON FOUR protocol, 3D GBR GTR, segmental osteotomy, Soft Tissue Management, Immediate loading. a metal-ceramic dentogingival definitive rehabilitation was done 2 months after. The patient is currently undergoing controls and continuous follow-up every 3 months during the first year and then every 6 months, not showing any clinical or radiographic changes including control and maintenance of mandible restoration.

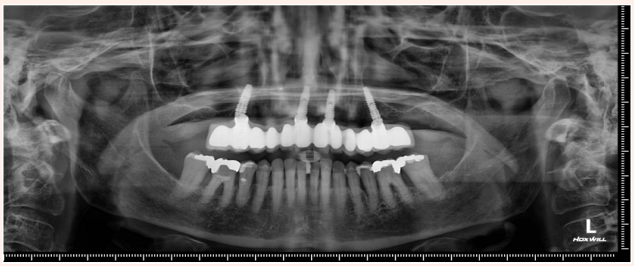

Figure 12 Case # 6: OPG Control 36 month.

(Case # VII)

66-year-old male patient, controlled hypertension, diagnosed with Hepatitis B, comes to our dental office referring to having suffered from a very poor oral hygiene condition throughout his life, being a carrier of a removable prosthesis for a large part of it and decides to start a radical change. Diagnosis of Periodontitis, bimaxillary partial edentulism, alveolar ridge resorption with horizontal bone loss.

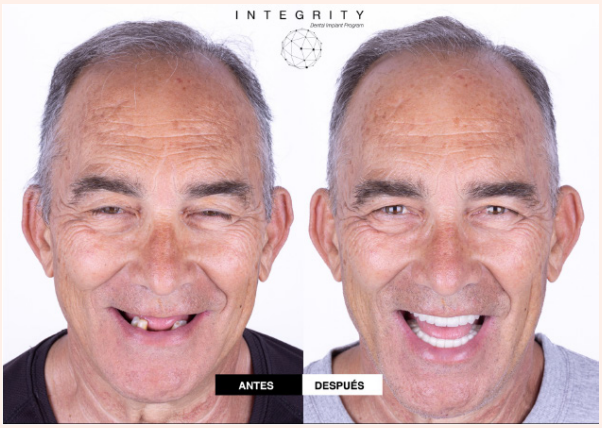

Figure 13 Case # 7: Before – After.

Due to the three-dimensional reconstructions of the alveolar process this case planning will be carried out in two different stages, starting from the bimaxillary reconstructive surgery, implant placement, soft tissue management, conventional provisionalization (tension free and with no loading in the ridge) and delayed implant supported rehabilitation. Initial treatment bjective: Recover the lost bone condition due to fractures, condition important for the implant placement. Because of this it was decided not to apply an immediate loading protocol despite the excellent primary stability achieved in the surgical procedure.

Surgical procedures under local anesthesia: Surgical Extractions, Bimaxillary ALL ON FIVE protocol 3D GBR GTR. Bone recontoruring. Soft Tissue Management. Provisional. Conventional loading. Due to personal reasons and infection history a definitive metal-ceramic prosthesis is done after 2 months. The patient is currently undergoing controls and continuous follow-up every 3 months during the first year and then every 6 months, not showing any clinical or radiographic changes.

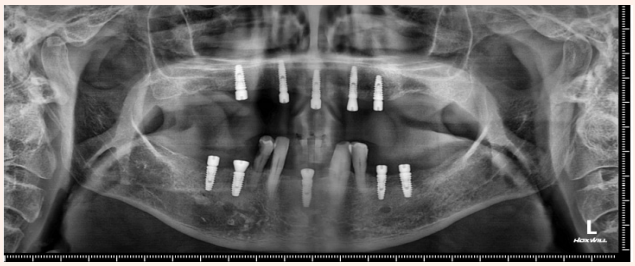

Figure 14 Case # 7: OPG Post-operative

(Case # VIII)

50 year old male patient with controlled hypertension and history of cancer lesions in the alveolar ridge, smoker of 15 cigarettes per dar presents to the clinic referring having suffered from a very bad oral hygiene throughout his life and he decided to start a drastic change. Diagnosis of Periodontitis, partial bimaxillary edentulism, multiple periapical lesions. Due to his poor oral health the case planning will start with surgical extractions and immediate implants evaluating the possibility of doing inferior immediate loading. Initial treatment objetive: Recover a good oral hygiene condition, function and esthetic by applying minimally invasive techniques that allow a fast recovery.

Surgical procedures under local anesthesia: Surgical Extractions, it was decided not to extract the impacted canine (due to the degree of inclusion). ALL ON Four mandibular. 3D GBR GTR. Bone recontoruring. Soft Tissue Management. Provisional. Immediate loading. Due to personal reasons and infection history a definitive metal-ceramic prosthesis is done after 5 months. The patient is currently undergoing controls and continuous follow-up every 3 months during the first year and then every 6 months, not showing any clinical or radiographic changes.

Figure 15 Case # 8: OPG Pre-operative.

Figure 16 Case # 8: OPG Post-operative.

Assessments

Throughout the study, only radiographs and cbct consistent with standard implant procedures were taken. Bone level changes were assessed based on available and evaluable standardized periapical radiographs with a film-holder using parallel-technique or panoramic radiographs. Baseline was defined as the time of the surgical procedure or first prosthetic installation (immediate loading) if it has been done. The authors performed their own measurements on either digital or analog radiographs, as available. All periapical and panoramic radiographs were individually calibrated (distance of three threads) to account for the distortion of the pictures. The distance from the implant shoulder to the first visible bone contact at the mesial and distal aspect of the implants was measured. The measurements at the mesial and distal site were averaged to obtain the bone level per implant. The changes in the bone level were calculated over several intervals: from loading to 6 months 12 months loading and at yearly intervals starting from 1 year post- loading to evaluate the success criteria. Bone quality [23] was assessed during the surgery (D1 to D4) Density of bone D1: mainly homogenous bone, D2: compact bone thick, D3: compact thin/cancellous good density, D4: compact thin/ cancellous low density. Clinical parameters to assess the soft tissue health, including Modified Plaque Index and pocket probing depth (PPD) (if measured), were recorded during the control dates after surgical procedures, during placement of the definitive prosthesis, and at each subsequent follow-up visit.

The primary stability of the implant was assessed during surgery, second phase + stability test records (Anycheck medical device Neobiotech (R)). Implant success and survival were evaluated in the group of implants restored with multiunit abutments at both placements of the provisional and definitive prostheses and at each follow-up visit thereafter. Implants were deemed successful in accordance with the criteria for implant success laid down by Albrektsson et al. [24]. Implants were successful if there was less than 0.2 mm bone loss annually after the first year of loading, if they were clinically immobile, if there was no peri-implant radiolucency, and if there was no persistent and/or irreversible pain, infection, neuropathies, or paresthesia. During the course of the study, the criterion of bone loss by Albrektsson et al. was scrutinized, and the scientific relevance was not considered to be suitable anymore [24]; therefore, implant success was assessed post hoc, according to Buser et al. [25], that is, there was no persistent and/or irreversible signs or symptoms such as pain, infection, neuropathies, or paresthesia, no peri-implant infection with suppuration, no mobility, and no continuous radiolucency around the implant. Radiological evaluation for radiolucency and bone loss was measurable only with available evaluable radiographs. In the case that no complications were reported by the clinician, and the patients reported being satisfied according to the set criteria, then radiographs were not necessary and the implant was deemed successful. The patients rated their satisfaction regarding the ability to chew, to taste, their comfort, appearance and fit of restoration, and general satisfaction on a categorical scale (very unsatisfied, unsatisfied, middle, satisfied, very satisfied) via a questionnaire at each visit beginning from loading [26-28].

Graphics + result analysis:

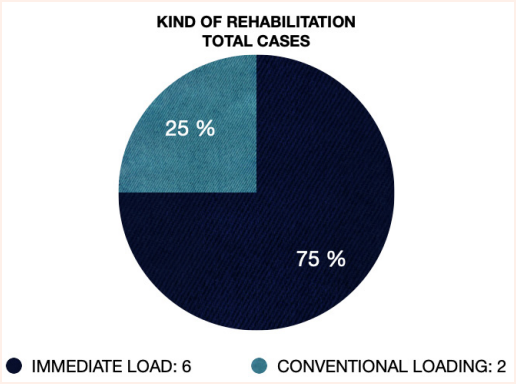

Figure 17 Table # 1: Total patients with rehabilitation protocol.

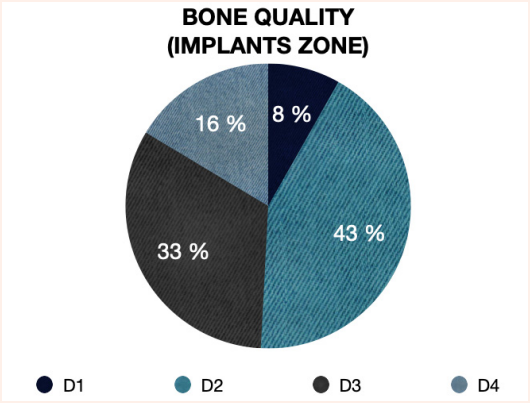

Figure 18 Graphic # 1: Bone Quality Misch Classification.

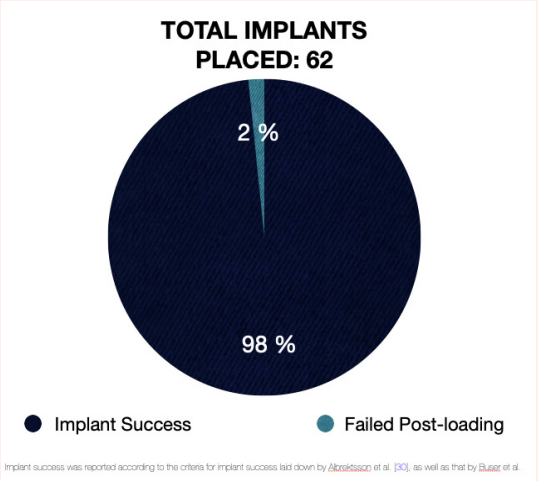

Figure 19 Graphic # 3: Implant success criteria by Buser et al.

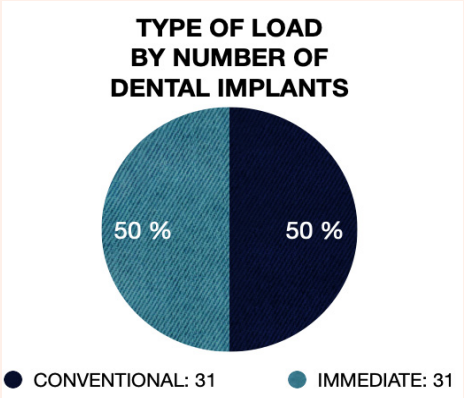

Figure 20 Graphic # 4: by number of dental implants.

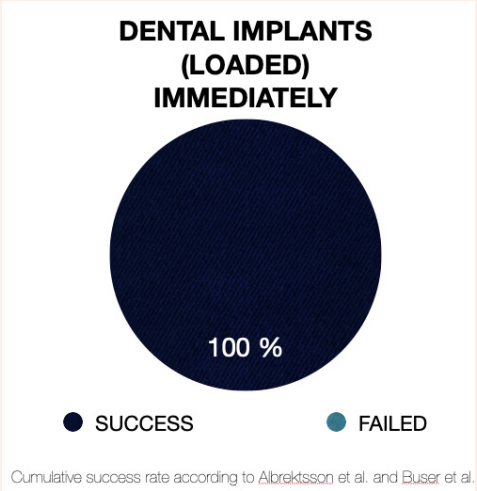

Figure 21 Graphic # 5: Cumulative success rate Dental implants loaded immediately.

PATIENTS	SMOKERS	NO SMOKERS	UNIMAXILLARY	BIMAXILLARY
MEN	2	2	1	3
WOMEN	2	2	3	1

Marginal bone loss	Maxilla N:36	Mandible N:25
6 months (mm)	0,56(+/-)0,12	0,59(+/-)0,16
12 months (mm)	0,67(+/-)0,11	0,69(+/-)0,16

Figure 22 Table #1: Patient classification # 2: Marginal bone loss.

6 MONTHS FOLLOW-UP	NUMBER	RATE
Implant failure	1	2 %
Prosthetic un-screwing	0	0 %
Fixture fracture	0	0 %
Mucositis	1	2 %
Perimplantitis	0	0 %
Episode of pus	0	0 %
Pain	0	0 %
Paresthesia	0	0 %

Figure 23 Table # 3: Comparative variables at 6 post-op months.

Implant Quality Scale			
Group	Clinical Conditions	No. of implants	%
I. Success (optimum health)	a) No pain or tenderness upon function b) 0 Mobility c) <2mm radiografic bone loss from initial surgery d) No exudates history	58	95 %
II. Satisfactory survival	a) No pain on function b) 0 mobility c) 2-4 mm radiographic bone loss d) No edudates history	3	5 %
III. Compromised survival	a) May have sensitivity on function b) No mobility c) Radriographic bone loss >4 mm (less than 1/2 of implant body) d) Probing depth >7 mm e) May have exudates history	0	0 %
IV. Failure (clinical or absolute failure)	Any of following a) Pain on function b) Mobility c) Radiographic bone loss >1/2 length of implant d) Uncontrolled exudate e) No longer in mouth	0	0 %

Figure 24 Table # 4: Implant quality scale.

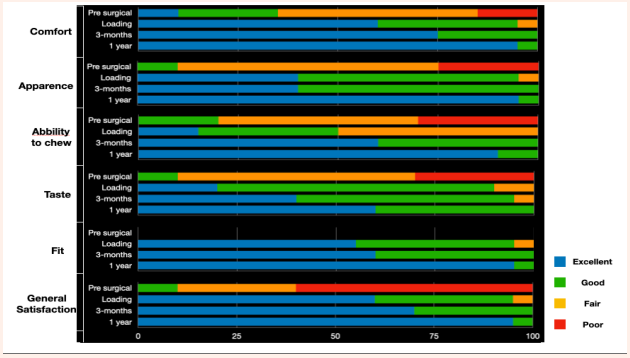

Figure 25 Table # 5: Patient reported outcomes measures (pre-surgical, loading, 3-months, 1 year).

Discussion

Implant placement and loading protocols have been widely presented as key elements of implant treatment planning. However, their assessment has mainly been by separating the surgical parameters pertaining to the implant placement technique from the loading aspects related to the restorative phase [26]. In literature revision it was found similar guidelines regarding the All on four protocol that was used as the primary loading protocol in almost all of the cases reports, highlighting why is it so used in most of the rehabilitations. Some of the main conditions of its frequent use are: Inadequate availability of residual alveolar bone. (posterior areas), Nerve proximity, Systemic Condition, Treatment time, Avoid bone reconstruction, Aesthetic and biological conditions where complex procedures are avoided like: GBR (VERTICAL -HORIZONTAL), Nerve transposition and grafting that prevent the patient to use their removable prosthesis or the use of loading protocols over the area for 6 to 8 months. The augmentation (GBR) procedure has the potential to increase patient ´s morbidity and complications. The concept of "All on four" was given by Paulo Malo and his coworkers in the year 2003. In this technique two implants placed vertically in the anterior region and two most posterior placed implants are placed in angled position bypassing anatomical structures i.e. mental nerve, maxillary sinus [20,21]. The all-on-four treatment concept arises as an attempt to allow treatment

with affordable time and cost through immediate implant-supported restorations, providing relatively straightforward and predictable treatment in edentulous patients with atrophic jaws. The outcome is favorable in terms of quality of life [9], when compared with the traditional 3-6 months during which the fixtures are protected from premature loading, requiring second surgery to expose them and connect the trans- mucosal components, and increasing the time and cost of treatment, as well as patient morbidity.

It cannot be forgotten to mention the basic initial diagnostic conditions related to bone quality and quantity, number and length of implants to be used, their arrangement, the need to apply reconstructive surgeries (sinus lifts, GBR, GTR), systemic conditions of the patient and the stabilization of the hard and soft tissues are variables that are considered in all the protocols described in the literature summarized in the article by Soballe et al. [15]. That is why it was considered and was incorporated in the execution and resolution of the cases, both in the surgical and prosthetic part, some important factors related to the surgical phase, such as: achieving a minimum primary stability of 35Ncm up to a maximum of 45Ncm (in maxillary), availability of 5mm of bone width and 10mm of bone height, splinting of the implants that can be considered if they have an angulation greater than 30º [10], which we point out as follows:

i. Primary stability of minimum 35Ncm up to maximum of 45Ncm. It was considered that it a protocol cannot be set for the number of primary stability achieved during the implant placement because it is relative and depends on implant macro design, bone conditions, implant localization, patients physiological condition. It is important to eliminate micromovement between implants and osteotomies. It is therefore recommended to have insertional torque values of at least 30 Ncm when placing immediate implants [16].
ii. There should be minimum 5mm of bone width present in the implant placement site.
iii. Minimum of 10mm of bone height should be available from canine to canine region in the maxillary arch and 8mm in the mandibular edentulous arch.
iv. Splinting of tilted implants can be done if the angulation of the implants placed between 30 degree to 45 degree. Regarding implant inclination, the reported angulations vary between 30 to 45 degrees, although this depends on the anatomical location [29]. The use of tilted implants to support fixed partial and full-arch prostheses for the rehabilitation of edentulous jaws can be considered a predictable technique, with an excellent prognosis over the short and middle term, though it has been suggested that differences in angulation of dental implants might not affect implant survival or marginal bone loss [30,31].
v. Tilted implant placement will help avoid distal cantilever so the stress over implants is reduced [17]. In case of tilted implants placed in the posterior edentulous region, the access hole to the distal screw should be located at occlusal face of first molar, second premolar and on the first premolar.
vi. Micromotion of 50 to 150 µm can be accepted at the interface between bone and implant surface. Micromotion of approximately 100 µm may constitute a threshold value for implants to osseointegrate properly [15].
vii. The assumption that joining several implants together via a rigid construction will reduce micromotion, thus facilitating the healing process and the immediate loading [18,19].
viii. Adequate interocclusal space (18 to 20 mm) prothesis PF3.

All on four surgical procedure:

- **Upper Jaw:** 2 distal implantes were placed in the maxillary posterior zone (edentulous region) and these 2 implants are tilted anterior to the maxillary sinus.
- **Lower Jaw:** the implants should be located anterior to the mental foramen region the two distal could be tilted.
- Abutments straight or 17 degree multiunit abutments and 30 degree angulated abutment with different height of collar should be placed over the implant to achieve relative parallelism so that the prosthesis should be seated easily and passively.

All on four occlusal scheme:

- Minimal length of the cantilever.
- Should be bilateral, simultaneous contact present over all the teeth.
- In Lateral movement, group function could be given.
- In Protrusive, guidance in all anterior sector.
- No Balancing contacts given when implants supported fixed prosthesis is occluding with removable.

Moreover, regarding the indication to perform immediate loading in relation to insertion torque, the present review found the implants to be inserted with a final torque between 25-50 Ncm. The insertion torque is frequently enhanced through implant site under-drilling by avoiding the countersink to maximize implant stability [29]. This approach is biologically plausible due to the fact that mechanical stimulation around a recently placed implant positively modulates the release of bone mediators around immediately loaded implants. But in contrast to this concept it has to be considered that the insertion of implants with high torque following an under-drilling protocol commonly used for immediate loading may reduce crestal bone to-implant contact in the early healing stages, However, more prospective clinical evidence is needed to confirm this [30].

Additional to the standard success criteria, patient reported outcomes are important factors when evaluating an implant system [28]. In our study, if the patient was satisfied, no further radiographs were taken and the implant was deemed successful, with exceptions and taking into consideration the follow ups X-rays. Furthermore, in some success criteria, overall patient satisfaction should be good or excellent for the treatment to be successful (Levi et al. cited in Papaspyridakos et al. [28]). Our study reveals an exceptionally high level of patient satisfaction. The majority of patients reported excellent outcomes for all measured categories at each time point throughout the study, with most remaining patients reporting good outcomes (Graphic 1). No patient reported a poor outcome, hay are all under radiographic and clinical with their restorations in function. Despite the time, the terms “success” and “survival” of implants are still causing some confusion, in literature review it was found the thesis of RAMNEEK KAUR BATTH:

WHAT IS THE DIFFERENCE BETWEEN IMPLANT SUCCESS AND SURVIVAL AND HOW WILL IT CHANGE THE FUTURE USE OF IMPLANTS AS A PERMANENT SOLUTION TO TOOTH LOSS? He makes an excellent reflection of all the details concerning this point by defining Survival rate of an implant indicates that the implant is physically in the oral cavity but does not indicate if the implant is functional or operative and Implant success is defined as the implant-displaying ideal clinical conditions and should also include the prosthetic survival rate. The implant should serve as a prosthetic abutment for at least 12 months.

Another important point that has to be considered is that some authors report the use of guided surgery to obtain optimal insertion with adequate angle inclination – this being an affordable choice for full-arch fixed restorations with immediate loading. However, associated complications such as agresivo osseous regularizations, cyst and tumor presence that require more aggressive approaches, implant loss, prosthetic or surgical guide fractures, and low primary stability are often observed, and it is considered that we are currently in the learning curve and improvement to apply the technique in all of the cases as a protocol [29].

Regarding the surgical technique, it is very important to consider several points: starting with the extraction of the affected teeth with the respective debridement of the granulation tissue or degranulation of the alveolus, which will lead to the eradication of the cultivated microorganisms. The surgical technique definitely takes advantage of the regenerative potential of the organism after extraction and helps preserve the volume of both bone and soft tissues. In this way, it reduces the crestal bone loss that occurs after bone removal and healing. Immediate implant placement may be beneficial in maintaining the integrity of extraction sockets and contributing to the maintenance of interdental papillae around implant restorations [32]. Subsequently, the ridge crest was trimmed to remove any sharp edges. However, it is important to consider the reasons for tooth extraction, since previous reports point to a critical role of periodontitis as a contributor to mucositis and periimplantitis, which seems to be related to implant loss [33].

Of all the factors involved, primary stability appears to be the most important determining factor in immediate implant loading. The functional loading placed on an immobile implant is an essential factor in achieving osseointegration. If an implant is placed in soft cancellous bone with poor initial stability, it often results in the formation of connective tissue encapsulation. In addition to the high success rates achieved with this technique, the reduction in treatment time together with the high level of aesthetic satisfaction of patients has made immediate implant placement a routine procedure in many dental clinics.

Conclusion

The immediate loading procedure was born from the need to be able to offer patients a comprehensive treatment that would allow the patient to continue practicing their daily habits normally and unfolding in a normal life environment as quickly as possible within what is allowed, while being returned Health. Especially in patients with high aesthetic compromise, cases in which the patient could not or refused to be a carrier of removable prostheses, at the same time that he was given a fixed treatment and maintained over time.

Throughout the time in which we have been able to implement the immediate loading protocol step by step, in addition to all the bibliography that supports it, it could be determined that performing an immediate loading protocol, as long as it is carried out with the optimal conditions , previously mentioned throughout the article, such as: prior study of the patient to verify that he meets the selection requirements, complete radiographic and photographic study, approach and planning of the case, which subsequently have to be accompanied by a surgical phase where carry out the corresponding extractions with the elimination of granulation tissue and infectious processes that could be associated with teeth, placement of implants with good primary stability (minimum 35 Nw of insertion), correct anatomical and bone conditions, performance of the pertinent regenerative techniques according to the case, placement of a suitable prosthesis, with adequate occlusal care and good management of the soft tissues to achieve the desired emergence profiles will be decisive in obtaining a successful final result.

In addition to it being a treatment with high success rates, it is a procedure that has multiple benefits, especially for the patient, who is always kept in function, with a comfortable fixed prosthesis, adapted to their needs, reducing the time which translates into a reduction in the total treatment time, less morbidity for the patient, maintenance of soft tissues and bone preservation of the patient, less exposure to drugs such as anesthetics, antibiotics, corticosteroids and analgesics. Likewise, the benefit of the patient to the adaptation of what will be his new denture, maintaining functionality and aesthetics at all times, at the expense of a provisional that will be subject to especially aesthetic changes that the patient requires throughout the treatment.

According to the study carried out, we found that of the 31 implants placed with the standardized immediate loading protocol described in the article, 31 implants were described with a high rate of survival and success maintained over time.

There is no doubt that today's standardized protocol to carry out this type of procedure will be modified as time goes by in order to be able to implement and incorporate new scientific advances that arise in the world of dentistry, both in surgical and regenerative phase, as in the prosthetic phase, however, in the meantime, the current protocol continues to be the treatment of choice in patients who require complete rehabilitation, without losing function or aesthetics at any time.

Another of the important advantages of immediate loading is that it was shown to be a highly accepted treatment by patients thanks to surveys carried out on those who underwent this procedure, verifying that they find it a treatment with which they are comfortable improving their appearance, good ability when exercising the chewing function without affecting the taste of food and with a good adaptation, which has resulted in a high percentage of general satisfaction for patients, despite being a surgery that involves going thorough a lot of studies and procedures.

This is why we can say that immediate loading is a treatment that must be implemented under a rigorous action protocol in addition to the techniques described, but as long as it is carried out properly, it is loaded with multiple benefits and advantages compared to other type of treatment options that are also implemented today, with numerous studies and bibliographic review that support it, and with a significant acceptance by the patient.

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