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Methodology

Implantology

Simplified protocol using a translucent transference guide in immediate implant loading in the edentulous mandible

G Albertini[1]*, G Cagnone[2], M Troiano[3]

Abstract

Introduction

Immediate implant loading in the edentulous mandible is supported by numerous studies demonstrating predictability and a success rate similar to or even greater than the conventional load. The purpose of this article was to report a protocolised technique that places four to six rough-surface implants in the mandible by means of a translucent transference guide.

Methodology

The use of this device simplifies the location of implants, their transference and the taking of aesthetic and intermaxillary records. Screwed prosthesis was done by the dental technician, and the implants were loaded within 72 h.

This article describes the presurgical, surgical and prosthetic stages, elaboration of the prosthesis, installation and subsequent tests. A total of 20 patients (111 implants) were placed with this protocol and were controlled for 18 months (+3). The survival rate of the implants was 100%, and the prosthetic success was 95%.

Conclusion

This technique along with the translucent guide allows simplifying pick-up impressions and intermaxillary registration, providing more accuracy when fabricating transitional prosthesis and its final result.

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Introduction

The original protocol submitted by Branemark in 1977[1], after a decade of clinical research, required that implants remain submerged for 3 to 6 months to start loading them. One of the reasons was the belief that immediate loading 'per se' was responsible for the fibrous encapsulation around implants instead of direct bone apposition[2], even though this justification was described as empiric[3]. Years after, it was established that the causing factor of fibrous encapsulation was an excess of forces at the bone–implant interface[4]; however, those slight or moderate forces should not exceed the micromotion threshold admitted by this interface to decrease wound healing times and improve bone quality[5]. For rough-surface implants, this micromotion threshold is in the range of 50–150 mm[6,7].

That is to say that one of the main reasons why immediate loading implants have shown a low success rate in these first studies was the lack of knowledge with regard to the necessary biological and mechanical principles that today are well known to obtain clinical success.

In recent years, numerous studies report high success rates with immediate implant loading[8,9].

A fundamental condition of this paradigm shift, besides the perfection of the surgical techniques, the advancement in the implant macrostructural design and improvements in the surface treatment, is the condition of having an adequate primary stability when placing the implant. This is achieved using a 'cross-arch stabilisation' during the implant healing period when using the prosthesis. Primary stability may be evaluated by means of torque insertion values with digital motors (Intrasurg®, Kavo, Biberach-Alemania), by means of a percussion system Ptv (Periotest Value, Siemmens) or by means of a resonance frequency analysis ISQ (Osstell®, Osstell AB).

In the last decade, this allowed numerous standardised protocols of immediate loading implants in the edentulous mandible to achieve success rates similar to or even greater than those implants loaded conventionally[10,11] (Table 1).

There are techniques that adapt a complete removable denture immediately after the surgery, in order to install the prosthesis the same day of the surgery[12], and there are others that delay its installation in a period no longer than 72 h. This gives time to fabricate the prosthesis in the laboratory with better mechanical and aesthetic features[13].

The objective of this article is to describe a protocolised technique of immediate implant loading in the mandible, placing four to six implants using a translucent transference guide (TTG) which allows intermaxillary registration and a fast and efficient transference.

Methodology

This work conforms to the values laid down in the Declaration of Helsinki (1964). The protocol of this methodology has been approved by the relevant ethical committee related to our institution in which it was performed. All subjects gave full

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Table 1 Clinical studies of immediate loading in the edentulous mandible with a total fixed prosthesis supported by multiple implants

Reference	Number of patients	Number of implants	Long-term follow-up	Survival (%)
Schnitman (1997)	10	28	10 a	85.7
Tarnow (1997)	6	36	1–5 a	97.4
Branemark (1999)	50	150	6m–3 a	98
De Bruyn (2001)	20	60	1 a	90
Chow (2001)	14	56	1 a	100
Testori (2001)	15	103	4 a	98.9
Testori (2001)	62	325	1–5 a	99.4
Wolfingeret (2003)	24	144	3–5 a	97
Gallucci (2004)	6	34	1 a	100
Engstrand (2003)	95	295	1–5 a	93.3
Henry (2003)	51	153	1 a	91
Aalam (2005)	16	90	3 a	96.6
Total	385	1474	--	95.6

informed consent to participate in this study.

A total of 20 patients treated in private practice, 11 women and 9 men with an average age of 68 years old, within a range of 51 to 87 years old, were rehabilitated with fixed implant-supported prosthesis in the lower jaw with a total of 111 implants.

Most of the patients have remaining teeth with crown destruction and a deficient periodontal state (grade III mobility, loss of insertion, chronic periodontal disease), which makes it necessary for extraction followed by rehabilitation with a full arch hybrid denture (Figures 1–3).

A complete anamnesis was performed to evaluate the patient´s general condition, and a clinical and radiographic diagnosis (Panorex and

Figure 1: Initial clinical situation of a patient treated by this protocol.

Figure 2: Initial clinical situation of a patient treated by this protocol.

Computed Axial Tomography) was made in order to assess the quality and quantity of the mandibular bone.

Initial occlusal situation is analysed, given the fact that after surgery correct interocclusal relations will be decisive in determining failure or success of the treatment. Either aesthetic or functional factors should be taken into account. The aim is to achieve adequate interocclusal relations to generate axiality, stability and a correct force distribution in a recently implanted area.

The majority of patients of advanced age who require this treatment always wear a complete removable denture in the upper jaw. This is beneficial from

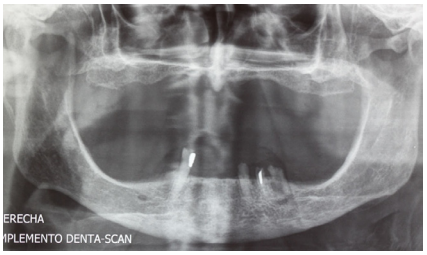

Figure 3: Preoperative Panoramic image.

the mechanic point of view due to the fact that the mandibular prosthesis will receive fewer forces during the healing period. If the antagonist denture is deficient, it should be immediately replaced. In those patients with teeth or fixed prosthesis with altered occlusal planes, correction by means of provisional crowns is mandatory.

Preliminary impressions with irreversible hydrocolloid (CA37, Cavex®) of both maxillae are made. Primary models are obtained to fabricate customised trays. Then, working models in type IV dental stone (Whip Mix®) are obtained, as well as occlusal rims for intermaxillar bite registration.

Reference lines and planes in relation to aesthetical parameters are marked in the occlusal rims. Static facial bow registration is taken to place the upper cast to complete the information with the other cranial elements as well as the terminal hinge axis, the utmost reference of every mounting on an articulator. Afterwards, bite registration for occlusion in centric rela-

Figure 4: A transitional complete removable denture which will be used during the first 72 hs.

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tion (OCR) is taken in order to relate the lower jaw with the upper jaw.

Mounting in a semi-adjustable articulator for teeth setting is performed and clinical evaluation of functional and aesthetic parameters is done.

The dental technician produces three prosthetic elements:

- A transitional complete removable denture which will be used during the first 72 h (Figure 4).
- A duplication of the complete denture in a clear resin acrylic with a wide notch in the lingual aspect, which will be used as a surgical and transference guide (Figure 5).
- If necessary, a new upper complete denture will be made (Figure 6)

TTG is of utmost importance in this protocol, given the fact that it has all the aesthetic and functional information (see Figure 7).

Amoxicilin 875 mg p.o. every 12 hours is indicated along with 1 ml of betamethasone sodium phosphate IM injection.

When starting surgical procedure, a horizontal incision in the mandibular ridge is made, and if necessary, posterior and/or medial releasing incisions are made as well. In the case of remaining teeth, extraction and alveolar curettage is done. It is paramount to eliminate the crest of the alveolar ridge with burs aiming to make an even surface, increase its width (5.5 mm minimum) and decrease postextraction bone remodelling. In those cases in which the implant is placed into a tooth socket and the discrepancy implant–bone socket is less than 2 mm, a graft is not necessary.

Figure 5: Information that is obtained TTG.

Figure 6: Full prosthesis superior antagonist.

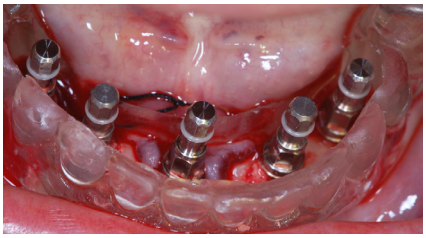

Figure 7: Functions and information provided by Translucent transference guide (T.T.G.)

TTG is used to identify the correct distribution and implant location. Precise bone drilling starts, and parallelism between them is a priority. This device is fundamental to simplify pickup techniques, the fabrication of the future prosthesis and the correct fitting of the connectors. These will favour passiveness of the prosthetic structure.

In the case of good bone availability in the posterior areas, six implants are placed with a distribution of four between mental foramina and two implants in the posterior area. In those cases in which only the anterior area can be used, five implants will be placed. The technique dictates to start with the two implants closer to mental foramina, then a medial one and finally the two remaining implants placed equidistant from each other in the bilateral spaces of the mandibular midline. In the case of a reduced space between the mental foramina, four longer implants equidistant from each other are placed.

Insertion torque in a single immediate implant loading will be higher than 30 Ncm[14]. In these cases of cross-arch splinting, insertion torque could be slightly lower.

Selected implants for this type of protocol were of internal connection and of a single surgical phase (Tissue level, Straumann). Nine millimetre straight abutments for multiple provisional restorations (048.650, Straumann) previously coated with acrylic resin to ease connection with the TTG during the pickup phase were used (Figure 11).

Afterwards, the prosthesis fitting is checked, and in the case that some of the abutments interfere, drilling of the prosthesis will be necessary upon completion of a perfect seating. This will be verified through direct visualisation of a space between the prosthesis and each one of the abutments as well as the correct sitting of the posterior denture bases in the retromolar area.

Another way of evaluating the prosthesis fitting is making the TTG occlude with its antagonist in position (Figures 8 and 9)

An isolation with small pieces of dental rubber dam around each abut-

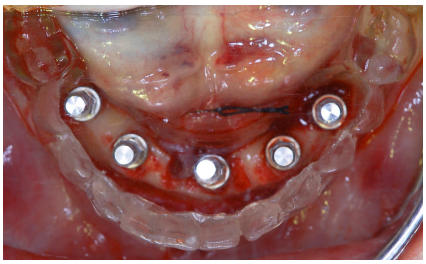

Figure 8: Five implants were placed between the mental foramina.

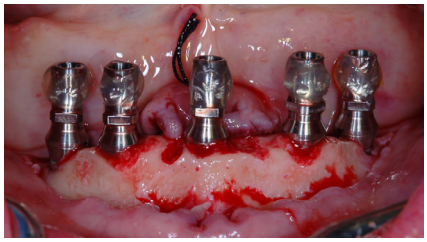

Figure 9: Direct visualisation of a gap between the implants and that TTG placed in the correct position.

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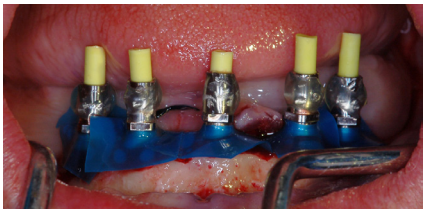

Figure 10: The titanium abutments were placed over the implants.

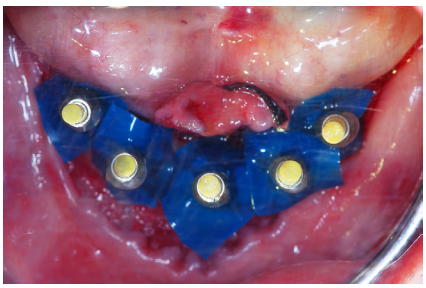

Figure 11: Protection titanium cylinders.

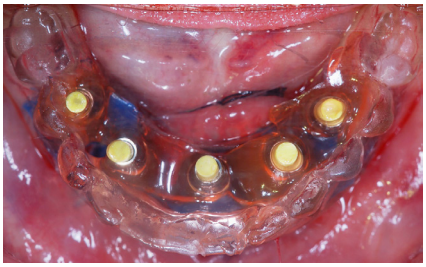

Figure 12: Occlusal view of abutments.

ment is made, and silicone cylinders -specially prepared for such a purpose are prepared to fill the access chimney, in order to protect the abutment screw. Therefore, penetration of the acrylic resin is avoided and the possible aggression to soft and hard tissues is prevented (Figures 10 and 12).

TTG is repositioned and the delicate task of bonding the connectors with light curing acrylic resin (*Triad Gel- Dentsply*) starts.

In this stage, two assistants are needed; the operator must check the right intermaxillary relations manually guiding the patient into a position of occlusion in centric relation (OCR). The technique consists of placing both index fingers onto the zone of the external oblique lines, leaning against the lateral flanks of the TTG. The patient must perform opening and closing movements up to 20 mm, while the operator slightly pushes the mandible in a posterior–inferior direction until finding a stable and a repeating position between both prosthesis. This last position (OCR) is the one we should register during the pickup of the implant position.

Once the correct relations with the antagonist are checked, the patient must open their mouth and the operator should keep the TTG in a stable position. One of the assistants places the light curing acrylic resin around the straight abutments with a Woodson spatula connecting them to the TTG (Figure 13). With the patient's collaboration, the operator re-establishes the OCR between the prosthesis and the second assistant light cures the acrylic resin, taking the halogen unit towards the buccal aspect of the translucent teeth which allows halogen light transmission, thus enabling the task in this crucial step of the treatment (Figure 14).

Once verified that all the connectors are bonded, the TTG is retrieved unscrewing the fixation screws.

Figure 13: Light-cured resin acrylic were placed over the abutments to join the TTG.

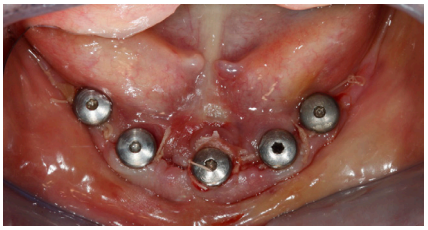

Figure 14: Check occlusion in TTG.

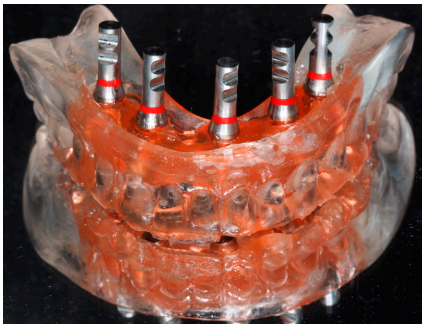

Figure 15: Thumbnail healing caps to keep perimplantar mucosa in stable position. Note the reabsorvable suture.

Dental rubber dam protections are withdrawn and healing screws are placed, thus finishing the surgical stage with flaps approaching by means of neat resorbable sutures (*Vycril-Ethicon 4-0 and 5-0*) (Figure 15). The election of these sutures is due to the fact that the future denture will not be retrieved during the 2 months for osseointegration purposes. Also, the consistent discomfort of suture withdrawal under the hybrid prosthesis will be prevented.

During the following 48 to 72 h, the patient will use a lower com-

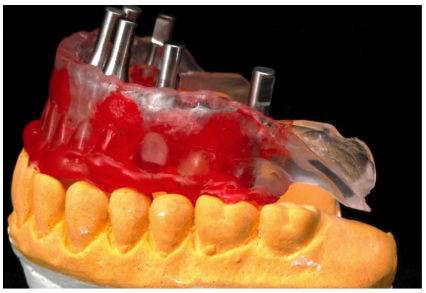

Figure 16: Thumbnail analogues in the laboratory.

Figure 17: The correct alignment of controlled GTT and intermaxillary registration antagonist model.

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plete removable denture, relieved and relined with a resilient material (*Coe–Soft/GC)*.

Postsurgical indications consist of a semisolid diet, a minor rest and the prescribed medication (flurbiprofen 100 mg p.o. every 8 h).

In the dental laboratory, implant replicas are screwed to the picked-up abutments connected to the T.G. Pouring of the impression is performed to obtain the working cast (Figures 16 and 17). Then, mounting in a semiadjustable articulator is accomplished as well as a wax up to obtain a lingual customised metallic reinforcement of the abutments (Figure 18). This last element is critical during the osseointegration period, to decrease fracture possibility, which is mostly responsible for implant failure adjacent to the aforesaid fracture. Subsequently, a teeth setting is performed until the first molar in cases of a cantilever and then the flasking procedure including the metallic reinforcement (Figure 19) is done. The prosthesis is polished and set for its installation (Figure 20).

Before the 72 postoperative hours, installation of the prosthesis is completed. In this healing stage, if uneventful, the patient experiences little inflammation, nor bleeding or pain, and the operator is more relaxed and calm. All these factors are evidently more advantageous with regard to the immediate denture installation at the very end of the surgical procedure (Figure 21).

Fixation screws are tightened with 30 Ncm torque and access chimneys are filled with Teflon and light-curing resin for provisional restorations (*Voco F)* (Figure 22 and 23).

Little adjustments during the osseointegration phase are needed to establish a convenient occlusal pattern from the biomechanical point of view. In maximum intercuspation, we have a variation in our traditional protocol, that is we provide anterior and posterior teeth contact minimising strains in the cantilever span. With regard to disocclusion, there are two different situations that will depend on the antagonists. In the case of a fixed antagonist in the upper maxilla, we prefer an anterior disocclusion (incisive and canine), but if the antagonist is a complete removable denture, a bilateral balanced occlusion is preferred.

Patients are instructed to maintain a correct daily hygiene softly brushing his/her prosthesis and to do mild rinses with 0.12% chlorhexidine (*Plac–Out*).

After 3 weeks, daily hygiene can be completed with the use of a water flosser (Waterpick, USA).

The first 4 weeks of the diet will be soft, then semisolid. It is recommended to avoid certain types of food during the first 2 months to prevent system overloading, given the fact that this could affect implant healing. During the first 3 weeks, control appointments are scheduled, in order to observe mucogingival healing, resorbable sutures and oral hygiene.

Figure 18: Confección of a metal reinforcement.

Figure 19: Occlusal view of the prosthesis.

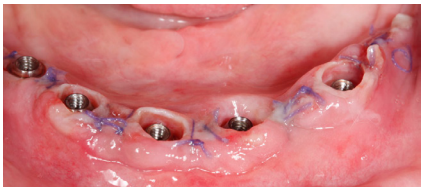

Figure 20: Gingival view of the prosthesis.

Figure 21: Clinical situation 72 h later.

Figure 22: Installing the prosthesis.

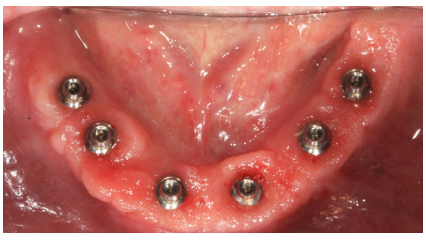

Figure 23: Occlusal view of the hybrid prosthesis installed.

Figure 24: Occlusal view of implants and soft tissue healed 2 months later.

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After the healing period, the prosthesis can be retrieved and a clinical monitoring of each one of the implants could be done (Figure 24). Thereon, we are able to perform the necessary prosthetic adjustments, that is pink acrylic resin addition to close some space generated during soft and hard tissue healing.

Regarding the antagonist and the patient's requirements, it is possible to start with the impressions and bite records for a definitive metal ceramic prosthesis or with a zirconium structure (Figures 25–29).

Figure 25: Structure of zirconium prepared for lamination with feldspathic ceramic.

Figure 26: Front view of zirconium structure obtained by CAD-CAM.

Figure 27: Final prosthesis feldspathic ceramic coated.

Figure 28: Front view of final prosthesis.

Figure 29: Occlusal view of the posterior teeth.

Discussion

One of the main factors for a successful immediate loading protocol is the achievement of a micromotion compatible with osseointegration. This decisive factor is closely related with initial fixation, passiveness of the installed prosthesis and the type of the interocclusal relations in the prosthesis as well as in the antagonist jaw. The achievement of a stable occlusion from the very first moment is obtained with a correct pickup and transfer impression as well as the intermaxillary bite registration taking. For such a delicate step, the use of the TTG along with light curing acrylic resin decreases chair time, in virtue of the low fluidity and polymerisation shrinkage of this material versus the self-curing acrylic resins.

Immediate loading technique in total edentulous patients requires that the pickup impressions be done during the closing in occlusion in centric relation (OCR). Light curing through the translucent guide avoids the risks produced when using auto polymerised acrylic resins with opaque guides which prevent correct visualisation if the acrylic resin runs towards undercut areas, thus making it difficult for its removal.

Regarding the prosthesis type, although there are publications which back up the use of removable prosthesis and with acceptable success rates[15,16], we prefer the use of screw retained fixed prosthesis, given the fact that the anterior zone of the mandible allows the insertion of four to five implants between the mental foramina, which are enough to support a fixed prosthesis with the cantilever upon the first molar. Literature shows a success rate of 95–100% when placing four to five implants versus 90–98% when only three implants between mental foramina are placed[11]. The potential overload forces due to the use of a transitional soft-tissue-supported prosthesis in the healing stage are avoided because a fixed prosthesis renders much more comfort from the functional and biomechanical point of view. Finally, the elected one will be a screwed fixed prosthesis[17,18].

Even though postponing denture installation 48 to 72 h after the surgery may seem to have a disadvantageous effect for the patient, we have seen a higher acceptance vis a vis immediate installation. Immediate installation technique requires many hours to adjust the prosthesis. During that period of time, the patient should wait longer, the effect of the anaesthesia will be gone and pain will arise promptly during the prosthesis try on. Another disadvantageous factor is that the addition of auto polymerised acrylic resin, along with the anatomical restitution of the teeth where the prosthetic screws access are, sometimes is not as precise as if a new teeth setting was made anew.

More availability of time allows the dental technician to add a cast metallic reinforcement to the inner part of the prosthesis and its following flasking with pressed heat-cured acrylic resin; therefore the result is a prosthesis with higher mechanical and anatomical features.

Conclusion

Immediate loading protocols in the edentulous mandible offer many advantages in terms of fewer visits

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to the dental office, immediate function improvement, reduced number of surgeries, etc. However, this is a treatment modality that requires a deep preoperative analysis. Also, an exhaustive planning respecting the protocolised prosthetic surgical technique is necessary.

There are many well-documented protocols in the literature, and in the specific case of immediate implants loading in the lower jaw, data are scientific and clinically well validated with similar or even greater success rates to those reached through the conventional technique.

This technique along with the translucent guide allows simplifying pickup impressions and intermaxillary registration, providing more accuracy when fabricating transitional prosthesis and its final result.

Abbreviations list

OCR, occlusion in centric relation; TTG, translucent transference guide.

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