

## Research Article

# Immediate Load Implants: Systematic Review on the Clinical Success Assessment and Follow Up

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**Received:** April 18, 2018; **Accepted:** May 24, 2018;**Published:** May 31, 2018**Abstract**

**Introduction:** The first studies of implant follow-up constituted the scientific basis of modern implantology. Early loading was identified as a critical factor and therefore, several waiting times were attempted until the establishment of a period of at least three months for the mandible and five to six months for the maxilla. Then Immediate loading (IL) was defined as “installation of a prosthetic element on implant, without osseointegration having occurred”. Objective: To demonstrate, through a systematic review, the clinical success indexes of the immediate loading technique, to present the criteria of indication and the follow-up of the procedures.

**Methods:** The main descriptors (Mesh Terms) used were immediate loading, early loading, late loading, implants, implantology, clinical trials. A total of 165 articles were found. A total of 60 articles were evaluated in full, and 46 were included and discussed in this study.

**Conclusion:** The analysis of the bibliography obtained showed that the success rates with the IL technique are compatible with those of the late load, as long as certain guidelines have been followed which were divided into: factors related to the patient, the surgical technique, the implant, the prosthesis and to esthetics. The high success rate is a consequence of correct surgical and prosthetic planning, harmony between implant system, patient and dentist surgeon.

**Keywords:** Immediate loading; Early loading; Late loading; Implants; Implantology; Clinical trials

## Introduction

Early loading was identified as a critical factor and therefore, several waiting times were attempted until the establishment of a period of at least three months for the mandible and five to six months for the maxilla [1,2]. The first studies of implant follow-up constituted the scientific basis of modern implantology. Both a two-stage surgical protocol and a single surgical procedure protocol required a waiting time for osseointegration (OI) to occur [3].

This concept of a healing period, before the implants were submitted to functional load, was based on the existing knowledge related to bone repair of fractures and osteotomies that required a period of 3 to 6 months before the functional loads could be gradually applied [4]. With the advancement of the researches, even considering the high clinical success rates of the late loading techniques, some researchers began to question the possibility of reducing the time for the implants to be submitted to the load, since the loading by itself would not impede the process of healing [5]. Therefore, Immediate loading (IL) was defined as “installation of a prosthetic element on implant without OI [6].

As a recent literature support, a total of 378 implants were placed in 56 patients. Forty upper and lower arches were restored and 16 patients received bimaxillary rehabilitation [1]. The mean duration of follow-up was 50 months, and the patient’s prevalence of implant and peri-implantitis was 14.3% and 50.0 %, respectively [7]. The

mucosa affected 56.9% of the implants and 50.0% of the patients. The survival rate was 96.4% per patient, but reached 99.5% in the implant-based analysis and the success rate was 95.5% for implants and 80.4% for patients. Full loaded full arch restorations immediately have an acceptable result after 1 to 9 years of follow-up. However, the incidence of peri-implant diseases is high, and further research is needed to confirm whether these can compromise the predictability of prostheses in the long term [8].

Another study showed that based on the present systematic review, the authors report that immediate loading of zygomatic implants for severely atrophic maxillary restoration presents a viable alternative for the treatment of the atrophic maxilla [9]. In addition, immediately loaded crossbow prostheses, supported by four to five implants, are a viable therapeutic option if the prostheses are made with resistant structures [9].

The objective of the present study was to demonstrate, through a systematic review, the clinical success indexes of the immediate loading technique, to present the criteria of indication and the follow-up of the procedures.

## Methods

### Mesh terms

The main descriptors (Mesh Terms) used were immediate loading, early loading, late loading, implants, implantology, clinical trials. For further specification, the “immediate loading” description

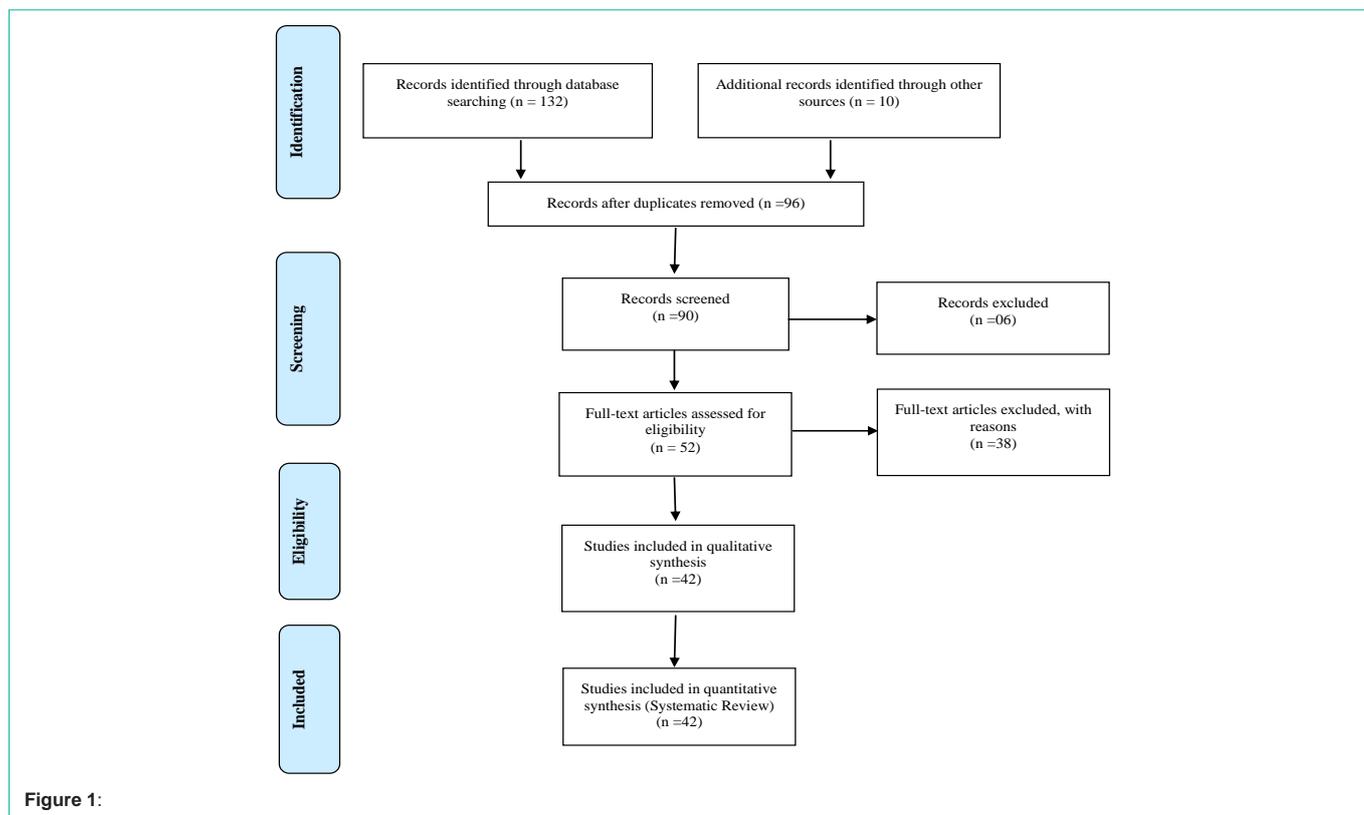


Figure 1:

for refinement was added during searches, following the rules of systematic review-PRISMA (Transparent reporting of systematic reviews and meta-analyses-<http://www.prisma-statement.org/>). The literature search was conducted through online databases: Pubmed, Periodicos.com and Google Scholar. It was stipulated deadline, and the related search covering all available literature on virtual libraries.

**Series of articles and eligibility**

A total of 142 articles were found involving immediate loading. Initially, it was held the exclusion existing title and duplications in accordance with the interest described this work. After this process, the summaries were evaluated and a new exclusion was held. A total of 52 articles were evaluated in full, and 42 were included and discussed in this study (Figure 1).

**Literature review**

Based on the current literature on implant with immediate loading, a study showed that in a total of 378 implants were placed in 56 patients. Forty upper and lower arches were restored and 16 patients received bimaxillary rehabilitation. The mean duration of follow-up was 50 months, and the patient’s prevalence of implant and peri-implantitis was 14.3% and 50.0 %, respectively [1]. The mucosa affected 56.9% of the implants and 50.0% of the patients. The survival rate was 96.4% per patient, but reached 99.5% in the implant-based analysis and the success rate was 95.5% for implants and 80.4% for patients. Full loaded full arch restorations immediately have an acceptable result after 1 to 9 years of follow-up. However, the incidence of peri-implant diseases is high, and further research is needed to confirm whether these can compromise the predictability of prostheses in the long term [1].

Another current study provided 236 titles for immediately loaded zygomatic implants and resulted in 106 abstracts for analysis. The full-text analysis was performed in 67 articles, resulting in the inclusion of 38 articles for this systematic review [2]. Based on the present systematic review, the authors report that immediate loading of zygomatic implants for severely atrophic maxillary restoration presents a viable alternative for the treatment of the atrophic maxilla [2].

In another study, the technique was developed to overcome limitations encountered with the two-stage late load technique, also offering an alternative to temporary removable prosthesis. Five to six Nobelpharma implants were placed: 3 in the anterior region of the mandible, allowing some implants to heal in a conventional manner and two additional implants were placed distal to the foramen mentonians [3,4].

In addition, another study evaluated the placement of 549 implants (195 immediate post-extractive implants). Twelve jaw prostheses were loaded late, while all others were loaded immediately. One year after loading, six patients fell, 12 implants failed in eight patients (two patients lost three implants each), and 87 implants were reworked in 68 patients, one for three implant failures, and again in the recall program (replaced two times), one due to tree implant failure and five prosthesis fractures, 10 due to prosthesis fractures and 74 in a prosthesis replacement program [5]. All patients were using the fixed prosthesis planned at the end of the first year in function. Ninety-eight complications occurred in 66 patients, but all were resolved successfully. Immediately loaded crossbow prostheses, supported by four to five implants, are a viable therapeutic option if the prostheses are made with resistant structures [6].

Based on previous literary works, a system using screwed implants with Titanium Plasma Spray (TPS) surface was used in the research and the implants were loaded within 2 to 3 days after placement through mandibular overdentures [7]. A total of 1739 implants were analyzed in 484 patients in 4 different countries: in the USA, 4 implants were placed in the anterior mandible of 129 patients, in a total of 514 implants, with a 4-year follow-up and a success rate of 96, 11%; in Switzerland, 446 implants were placed in 133 patients with 8-year follow-up and a success rate of 93.04%; in Germany, 324 implants were implanted in 92 patients with a follow-up of over 7 years and a success rate of 90.34% and in Sweden 455 implants were placed in 130 patients followed up for 4 years with a success rate of 95.16% [8].

Of the 1739 implants placed, 103 implants failed, over 96 months or 8 years, giving a cumulative success rate (TPS) of 87.96%. They concluded that TPS implants adhere to a good surgical and prosthetic technique, with an effective cost. The work, for the four countries, analyzed the success rates, which exceeded the guidelines and recommendations for implant success [9].

Another study of IL also using rehabilitations with overdentures presented data on 136 patients who were treated with 350 implants in edentulous mandibles in the region anterior to the mental foramen. Two systems were used: the TPS implant and intramobile cylinder implant (ICI) [10]. The longest follow-up time was 11 years, with an average of 5.7 years. After placement of the prosthesis, only a few implant losses were observed, although critical situations could be found in the soft tissues, according to periodontal patterns. The cumulative success rate, at 5.7 years, was 90% for both systems (83% and 97.3% for ICI and TPS implants, respectively). A 4.0 mm vertical bone loss was found [10].

A prosthesis, previously constructed, was converted into a fixed bridge supported by three implants, one in the anterior region and two in the posterior regions of each side of the foramina, in seven patients [11-15]. A total of 46 implants were used; of these, 20 were placed with IL. All implants survived for 4 months until abutment placement, but 3 failed after 3, 5 and 21 months, respectively. The follow-up time was 3.5 years. The results of this study demonstrated that implants placed in partial edentulous and mandibular total patients can be used to support an immediate fixed prosthesis [16]. They concluded that IL is an alternative technique, in selected cases, for patients who want to avoid the use of removable prostheses during the phases of the rehabilitative treatment with implants. Prosthetic therapy based on a triploidism position did not compromise implant therapy in the long term [17-19].

Another investigation was done to develop a method that would provide patients with a fixed temporary prosthesis placed on the day of implant placement. Sixty-three 3.75 mm diameter implants, Nobel Biocare, of various heights, were placed in jaws of 10 patients and followed for 10 years. Twenty-eight implants were loaded immediately, providing support for fixed temporary prostheses, while thirty-five implants were submerged and free of charge. After a healing period of 3 months, the submerged implants were exposed and the final reconstruction performed. All 10 implants supported by 28 implants placed in immediate function were successful during the cicatrization period of 3 months. Of the 28 implants with TPS implant,

4 failed. Of the 35 submerged implants, all osseointegrated. Statistical analysis showed an IL at 10 years of 93.4% for all implants (84.7% for implants immediately loaded and 100.0% for implants submerged). These data demonstrated that although mandibular implants could be successfully placed in immediate function to support fixed temporary prostheses, the long-term prognosis was more susceptible to those implants placed distal to the incisor region [20].

A multicenter retrospective study was conducted on 226 patients rehabilitated with implant-retained, mandibular overdentures. Four implants were introduced in the region between the mental foramina of each patient (1104 implants). Of the 226 treated patients, 194 were followed for at least 2 years and at most 13 years with an average of 6.4 years, since 32 patients stopped treatment. The TPS of the implants was 3.1% (24/776 of the implants) and the failure rate of the implants was 1.5% (3/194 of the bars). The results of this study showed that the TPS of the implants immediately loaded was similar to that obtained in the late loading and that the OI occurred. Unlike the late-loading technique that creates functional and psychological problems for patients, due to the frequent instability of removable prostheses, this method shortens rehabilitation treatment time with relevant satisfaction for long-term patients [21].

Immediate loading of implants with a fixed temporary restoration was evaluated in 10 patients. The patients selected were completely edentulous and had adequate bone for a minimum of 10.0 mm of height of the implant. A minimum of 10 implants were placed in each patient. Five implants were not loaded and the others were loaded on the day of surgery. The temporary restoration was cemented or screw retained. A total of 107 implants were placed in these 10 patients; 6 were placed in the mandible and 4 in the maxilla. Six patients were treated with Nobel Biocare implants, one with ITI implants, two with TiOblast implants (Astra) and one with a 3i implant. Sixty-seven of the sixty-nine implants that were loaded immediately osseointegrated, as well as 37 of 38 submerged implants. The results of this study indicated that immediate loading of multiple, rigidly spliced implants around fully edentulous arches are a viable modality of treatment in both arches [22].

## Immediate Load Analysis in Different Locations

### Total edentulous jaws

A study was how purpose to evaluate the placement of 4 to 6 implants in edentulous mandibles using the IQ technique. The implants were placed between the foramina mentonianos for the support of temporary prosthesis, reinforced with metal. One technique was used to convert existing dentures into implant-supported fixed prostheses that would be used as surgical guides. The implants were loaded early (5 days). Twenty patients with edentulous jaws or with 2 to 3 teeth were registered, who received 92 implants of commercially pure and smooth titanium. After implant installation, the prostheses received torque of 20.0Ncm. Bone quality and quantity, as well as, implant size and position were incorporated into a computer database [23].

At 2 years, TPS was 96.3% for implants and 100.0% prosthesis survival. The mean bone level at the crest at 5 days for 11 patients was 2.1mm and at 15 months it was 1.96mm, which was not significant. The conclusions of this study indicated that 4 to 5 implants can be

placed and loaded into edentulous mandibles, within 5 days after implant insertion, with a high success rate (96.3%) [23].

Another study, a review of the literature, presented results from clinical studies with protocols of immediate and early loading. Studies from 1975 to 2004 were reviewed to identify results of treatments with these protocols. Patients were treated with fixed prostheses and overdentures. Within the limitations of the study, they concluded that "only treatment protocols in the anterior mandible have predictable results, regardless of implant type, surface topography and prosthesis design" (success rates 90.0% -100.0%). The evidence was limited for the edentulous and partially edentulous patients. The need for further long-term studies has been suggested through research reporting treatment protocols with separate clinical situations, in order to allow for comparisons and conclusions [24].

Another study evaluated the survival and clinical success of Straumann Implants after immediate loading. A new method for manufacturing effective definitive prostheses was presented to immediately implant the implant in total edentulous patients. Nine patients received 4 implants each and metalloplastic prostheses were installed less than 48 hours after implant placement. The mobility was evaluated through the periotest, immediately after the surgical procedures and after 3 months [25].

Clinical evaluation of peri-implant soft tissues was performed monthly after sutures were removed and radiographs were obtained 6, 12 and 24 months after surgery [26-29]. The periotest revealed stable values without mobility [30-34]. No signs of inflammation and / or bleeding were observed. The radiographs did not reveal any continuous radiolucency area, besides the first line of the 36 implants, after 24 months. None of the implants failed and the TPS was 100.0%. It was possible to submit implants to IL without compromising IO, because some parameters were followed, such as the appropriate quality and quantity of bone, absence of systemic and psychological factors, absence of parafunctional habits, maintenance of prosthetic requirements, minimization of micromovement and use of an appropriate surgical protocol. It was concluded that under IL, OI is possible [35].

## Edentulous Unitary and Partial - Results Reported

In order to evaluate the immediate loading (IL) in molars using TiUnite Brånemark system (Nobel Biocare AB, Gothenburg, Sweden) in the posterior mandible, a study included 44 patients where 50 implants were placed. All implants were followed up for 6 months and 24 were followed for 1 year. All were given temporary crowns in occlusion at the time of surgery. No implant was lost. The marginal bone levels were found according to normal biological width requirements [36].

Showed increased stability of the implant. No biomechanical problem was found associated with the use of wide implants and the potential physiological problem of the slightly dense posterior mandibular bone was eliminated [37]. They concluded that, although with limited follow-up time, the results encourage the immediate loading of TiUnite Brånemark system wide-angle unit implants placed in mandibular molar regions [37].

The following study reports that the surface treatment of the TiUnite Brånemark system (Nobel Biocare AB, Gothenburg, Sweden) improves both primary and secondary stability compared to the smooth surface. To test his hypothesis, he compared the systems by applying immediate loading by means of partial fixed bridges in the posterior mandible. Forty-four randomized patients were divided into two groups: (i) test group: 22 patients received 66 TiUnite implants that supported 24 partial bridges connected to the implant on the day of insertion; (ii) control group: 22 patients received 55 implants with a smooth surface of the Brånemark system supporting 22 partial bridges connected on the day of implant insertion. The bone quality and quantity were evaluated [38]. Radiographic examinations were performed on the day of surgery/loading with follow-up for 1 year [39]. Three TiUnite and eight flat implants failed during the first 7 weeks of loading. This led to a 95.5% TPS for TiUnite surface implants and 85.5% for smooth implants after 1 year of prosthetic loading. When using flat implants, the number of implants that failed was significantly higher in smokers and sites of bone grade type IV. Such results were not considered with the use of TiUnite implants, despite the fact that there were more smokers and more implants placed in type IV bone in this group [39]. The marginal bone resorption after 1 year of loading was 0.9mm on average with TiUnite implants and 1.0mm with smooth implants. The study demonstrated a 10.0% higher success rate with immediate loading rehabilitated through partial fixed bridges in the posterior mandible, supported by TiUnite implants. In the control group, the number of failed implants was significantly higher in smokers and in sites with poor bone quality [40].

The same author, in another report, evaluated an immediate loading protocol with flapless surgery using implants with smooth surface and IL. The implants were placed in predetermined positions and connected to prefabricated prefabricated restorations with clinical results of 3 years. A total of 97 implants of the Mk IV Brånemark system (Nobel Biocare AB, Gothenburg, Sweden) with a smooth surface were introduced into jaws of 46 patients. A pre-surgical three-dimensional model of soft tissue and underlying alveolar bone was created allowing the clinician to place the implants in predetermined positions and connect them to prefabricated prefabricated restorations. The patients received 25 partial dentures and 27 unitary restorations [41].

The bone quality and quantity were evaluated. Radiographic examinations were performed on the day of surgery/loading and follow-up visits of 1, 2 and 3 years. All implants were placed inside the vestibular and lingual walls, which remained intact during the surgery, confirming the correctness of the procedure. Prefabricated prefabricated restorations have adapted, meaning that the implants have been positioned correctly, in the same way as on the three-dimensional model. Nine implants in eight patients failed during the first 8 weeks of loading. This led to a TSC of 91.0% after 3 years of prosthetic loading [42].

In a study on IL in both archways, 94 of the 96 implants placed (98.0%) in mandibles with IC remained IO during the period of 8-24 months. Similar favorable results were also presented for maxilla, where 42 of the 44 implants placed (96.0%) after the same follow-up period. The authors reached the guidelines for IL application

successfully: IC can be done in selected patients, looking for bilateral splint with a minimum of 5 implants for mandibles and 8 implants for maxilla, optimally distributed; a passive, screw-retained, temporary prosthesis with a rigid metal is more successful; cantilevers should be avoided in temporary prostheses; the provisional prosthesis should not be removed during the healing period (4 months for mandibular and 6 months for maxilla); the minimum height of the implant should be 8.5mm (wide platform) or 10.0mm for narrow platform; heights smaller or associated with bone graft, should be submerged; implants with good primary stability (torque greater than 40Ncm) can be loaded immediately [25].

Prosthetic constructions can be based on only three implants if placed in a position of tripodism; during the initial functional period it is important to avoid removal of the prosthesis because the movement of the implants can prevent osseointegration; the implants introduced must be rigidly splined as soon as possible within a rigid temporary or definitive prosthesis, providing a passive fit to the implants; in locations of poor bone density, an adapted surgical technique should be applied to achieve optimum initial stability of the implant; the longer and/or wider the implants are, the better the results; however, short implants may also be used; No information was given on overdentures and treatment for unit edentulosis [26,27].

## Discussion

Over the 10-year period, immediate loading of dental implants with fixed mandibular prosthesis proved cost similar to the conventional loading protocol, underlining the feasibility and reliability of this protocol from a patient perspective [1-3].

Didactically, the present review had subdivisions related to the regions and conditions under which the IL technique can be performed: jaws and jaws; edentados unitarios, total and partial, since it is known that there are particularities for each of these isolated or interrelated situations [2-5]. It was also done, chronological subdivisions being the first studies from 1986 to 1999 and the most recent until 2017, demonstrating results and indexes of success of the technique. In a second part, reports were presented regarding the criteria necessary for the IC technique to have favorable results, compatible with the late load [6].

Most of the initial studies reported that the best results would be in the anterior jaw region, suggesting that the chosen region should be "strictly between the foramen mentonians" [7-10]. However, it was also demonstrated that the technique is predictable in both arches [11], as well as in the posterior region and concluded that the best results would be related to the regions with the best bone qualities [12-15]. The follow-up times, with their respective success rates, were high and ranged from 18 months, with 100.0% to 8.6 years, with 96.7% success this factor influenced the results.

The use of dental implants with immediate loading has been performed quite frequently in Implantology. The procedure for loaded protocol installation is well documented and predictable in edentulous mandibles [13-16]. However, in the maxilla, the same type of indication is not routine, due to the possibility of failure [17]. We agree with the authors, because due to the lower bone strength of the maxilla, obtaining adequate blocking and excellent scarring in front of the immediate loading facility is more difficult, we consider the

correct indication only for the mandibular protocols [18].

Post extraction regions is another quite discussed topic among the dental community [1,2]. Despite being much studied, there is still no unanimity of opinions [3]. The determining factor in the immediate load definition is initial stability. Implants with no mobility measured by the peritoneum and with good distribution in the arch can be submitted to immediate loading. Also, other authors consider stability not as a numerical value, but rather the absence of mobility and clinical resistance to rotation [6,7].

## Conclusion

The high success rate is a consequence of correct surgical and prosthetic planning, harmony between implant system, patient and dentist surgeon. Regarding the region, it can now be said that IL in total rehabilitation of jaws is a procedure with high success rates that should and can be applied in all cases where the technique is efficient to provide adequate primary stability to the implants. Thus, the technical improvement of the dental surgeon becomes the main condition for this philosophy to be applied.

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