

REVIEW ARTICLE

Immediate Vs Conventional Loading of Implants in Edentulous Patients – A Comparison

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Abstract

Background: Fixed dentures on dental implants are probably the best prosthesis for edentulous patients, which restores esthetics and function in the best way. While inserting and loading implants, we encounter multiple protocols to follow: not so many years ago it was suggested that in order to avoid failure of osseointegration it was mandatory to wait at least several months before loading them. Nowadays more and more articles show that with modern implantation possibilities it is possible to load them way earlier than before. **Objectives:** The objective of this review was to compare immediate and conventional loading of implants in several areas. **Methods:** A systematic literature review was carried out using PubMed and Google Scholar search engines looking for these keywords: edentulous, dental, implant, prosthetics. All reviewed publications were published in the English language. We have filtered the articles according to PRISMA criteria. **Results:** Out of 201 articles we included 14 in our review. Immediate and conventional loading protocols were evaluated and compared in several areas including patients' satisfaction level, marginal bone loss and quality of prosthesis. **Conclusions:** We found no significant difference in loss of marginal bone between our compared protocols. A higher patients' satisfaction level was reached using immediate loading protocol. A standardized clinical prospective trial is required in order to compare these loading protocols objectively.

Keywords: Edentulous, dental, implant, prosthetics.

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Introduction

One of the most common problems of the patients is the loss of teeth – it might be caused due to many factors: traumas, periodontal diseases, apical periodontitis, fractures or when alternative treatment besides extraction is not possible. Traditionally these defects are repaired by producing a bridge, making a removable denture or inserting single dental implants. The situation becomes a lot more difficult when the whole jaw is edentulous –vertical dimension of occlusion is changes, atrophy of alveolar bone starts, the anatomical retention for removable denture is reduced to the minimum. While removable complete denture is a cheap way to restore occlusion, many patients are not satisfied

with the retention, function, and comfort of the appliance.

In 1977 Branemark has introduced a revolutionary device – the modern titanium implant which reassembled the root of natural tooth. After those terms like osseointegration, osseoinduction were introduced. ⁽²⁾ A healing period of 3-4 (6-8) months for mandible and maxilla respectively were recommended and any force applied to the implant was considered harmful.

The duration period of healing was less and less acceptable through the years, especially for edentulous patients considering the efficiency of their mastication was extremely low. In 1990 it was proposed by Schnitman et al. ⁽³⁾ that it was not necessary to wait through all the osseointegration period for loading of the

implant – it could also be loaded instantly or earlier than thought before. In 2002, Barcelona, indications and protocol for immediate implant loading were introduced. This led to 3 basic methods: immediate loading, early loading, and late (conventional) loading.

The purpose of this review was to compare the implant loading methods in edentulous patients.

Methods

A systematic literature review was conducted according to PRISMA criteria in MEDLINE (PubMed) e-database: out of 201 articles, we included 14 after removing single case reports, systematic literature reviews, duplicates and studies older than our chosen period of time. Evaluated publications were published between 2012 and 2017. We searched for these keywords in articles abstracts and titles: edentulous, dental, implant, prosthesis. An additional search was conducted using Google Scholar search engine. PRISMA Flowchart was created (*Table N.1*).

Criteria for studies:

1. Studies no older than 5 years.
2. Surgical interventions were performed on a human.
3. One or both jaws were edentulous prior to implantation.
4. Fixed orthodontic appliances were used.

Filtered articles:

1. Animal studies
2. Patients weren't fully edentulous in jaw, which was used for implantation
3. Inappropriate topic

Results

9 publications were added from PubMed search and additional 5 were included after conducting a search in Google Scholar search engine. We divided results into several comparison groups in order to compare them in different fields.

Level of satisfaction of patients

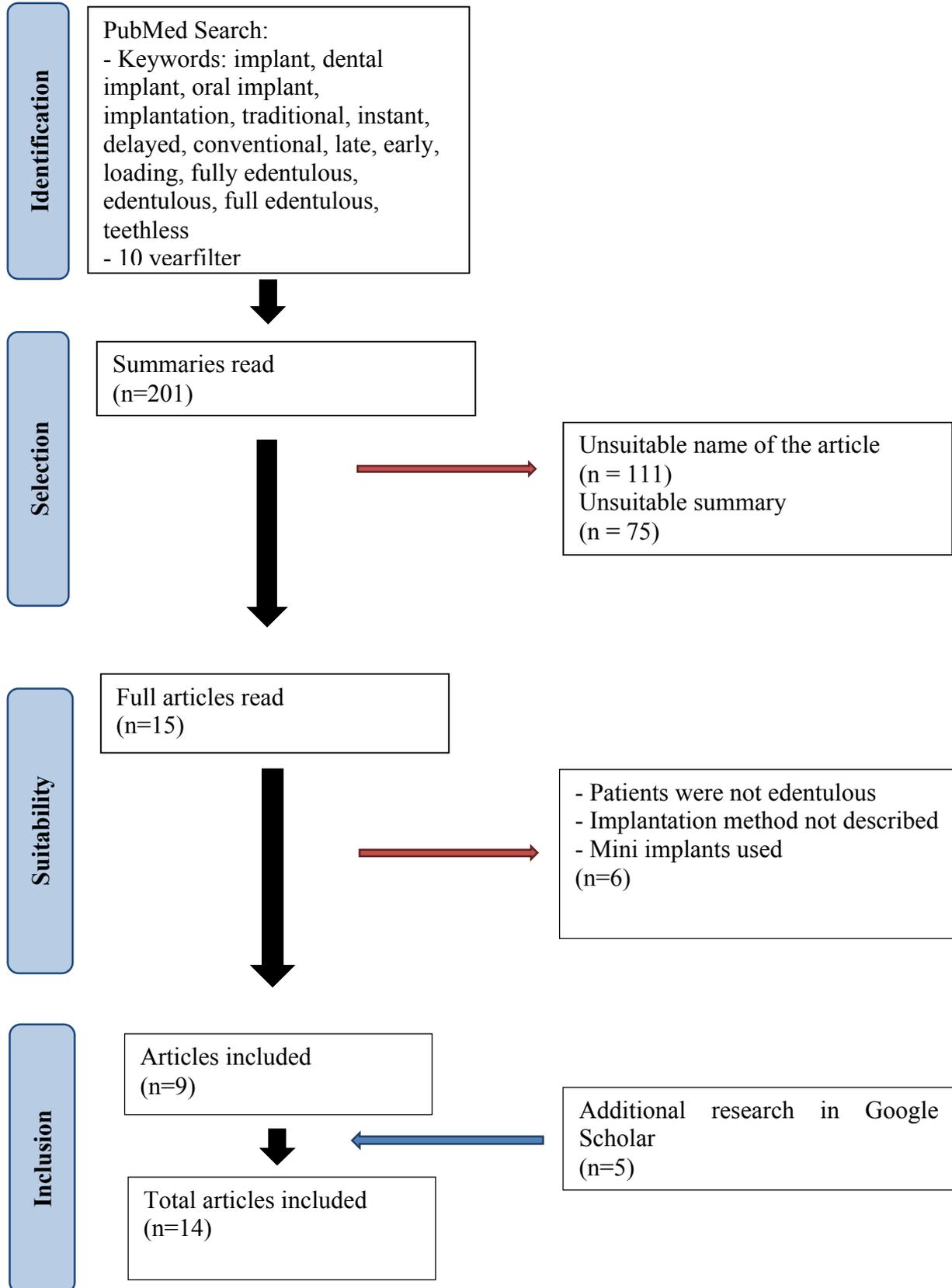
Traditional protocol of implant loading has a huge probability of success, however, a traditional protocol could make a lot of inconveniences. The main reason for it is a healing period, when patients have to use only provisional removable dentures.

Patient's oral health has a huge impact on the quality of life. Teeth are one of the most important factors of facial aesthetics, therefore it is only natural that a toothless person will feel uncomfortable in some kind of situations. To alleviate this feeling, provisional full removable dentures are made during the osseointegration process. However, to patients, especially those who are not used to removable dentures, it could feel very unnatural and disappointing. During the adaptation period, patient could feel increased salivation, gag reflex could appear. Moreover, main functions such as mastication, swallowing, speech could be disturbed. Not only they can fall from the alveolar ridge, but also they need some special care.

Immediate implant loading helps to solve many of those problems because provisional prosthesis is fixed at the same day in this way helping to restore function.

D. Penarrocha – Oltra et al. (2014) made a research measuring patient's satisfaction level of traditional and immediate loading. They studied 29 patients, where 14 were put to an experimental group with immediate implant loading technique and 15 to a control group with traditional loading. Patients had to have partially edentulous maxilla, where remaining teeth were indicated to be extracted. In an experimental group provisional fixed acrylic prostheses with a metal frame were made and fixed within the same week. In a control group, implants were left under the flap until the bone was healed. Criteria that measured patients satisfaction levels were: aesthetics, mastication, self-esteem, comfort, cleaning, speech and healing period. They were investigated before treatment, 3 months after implantation (before fixing permanent prostheses) and after 12 months after implantation in a scale from 0 to 10. After first evaluation results varied from 3,5 to 5,0 in both groups, except speech which was 8,0 and 7,6 in experimental and control groups respectively. After second evaluation results of all criteria in experimental group varied from 7.4 to 8.9. In the meantime, in control group only easy cleaning was 7.9 and aesthetics 6.4, while all other stats dropped below 5.0. After 12 months in both groups stats varied from 8.2 to 9.4 once again ⁽⁶⁾.

Table No. 1: (PRISMA Flowchart)



From this research, it was clear that overall satisfaction level was better of those patients, who had fixed provisional prostheses. However, this difference was not only statistically significant but also clinically visible only in a period up to fixating permanent prostheses (3 months) ⁽⁶⁾. This research also evaluated postoperative pain and swelling within the first week of the procedure, however there we no statistically significant difference ⁽⁶⁾.

Another aspect that increases overall satisfaction for the patients is the treatment time and amount of procedures needed. While loading implants with a conventional method, at least 2 interventions are required, when the flap is lifted. On the other hand, with immediate implant loading, only 1 intervention is needed. R. Marra et al; (2013) evaluated the satisfaction of patients who had a minimally invasive immediate implantation and immediate implant loading. During the procedure, flap was not lifted before implantation and the quality of the bone was evaluated with CBCT, gutta-percha markers, silicon index and prosthetic guides. Temporary metal-acrylic prostheses were fixed on the spot. After 4-6 months provisional prostheses were suggested to change to permanent metal-acrylic or metal-ceramic fixed prostheses, however, only 9 out 30 patients decided to do that because of aesthetics. Others were satisfied with the first one. During a 3 years period, patients were evaluated and had to

complete OHIP-EDENT (Oral health influence to the edentulous adult) questionnaire. Conclusions showed that patients were highly satisfied with the treatment, its duration, healing period and postoperative discomfort. Although, it is necessary to keep in mind, that this kind of treatment requires more funds, preparation time and special training for a doctor ⁽⁷⁾.

Loss of bone

Loss of bone around implants was also in our interest – to the best to our knowledge marginal bone is lost and the alveolar ridge descends no matter if what protocol is used. It is nearly impossible to compare results of studies we found the methods are very different: frequency of recall visits, study period and interpretations vary. Despite this, Tealdo et al; have found a significant difference between control and experimental groups after comparing them. 6 years after loading the implants, the experimental group with immediate loading lost less marginal bone (1.62 mm) while the control group lost 2,44 mm ⁽¹¹⁾.

Opposite results were found in Pennarrocha-Oltra et al; (2014) study – experimental group with immediate loaded implants lost slightly more marginal bone (0.61 mm) than control group with traditional loading protocol (0.53 mm), though results were not statistically significant and study period was rather short – only 12 months ⁽¹²⁾.

Table No. 2: Average height of lost marginal bone

Author (Year)	Method used	Height of lost marginal bone
M. Mozzati (2014)	Immediate	1.4mm
R. Marra (2013)	Immediate	1.9mm
T. Tealdo (2014)	Immediate	1.62mm
	Late	2.44mm
D. Penarrocha-Oltra (2014)	Immediate	0.61mm
	Late	0.53mm
S. Shigehara (2015)	Immediate	Not investigated
P. Andersson (2013)	Immediate	0.8mm
A. Jokstad (2013)	Immediate	1.2mm
	Late	1.2mm
R. Scala (2012) [14]	Immediate	Not investigated

Osseointegration of the implants

It was mentioned before that according to the conventional implantation procedure, implants are being left under the flap for at least 2 months. It was said, that micromovements of the implants during the osseointegration period

make them more unstable and harder to integrate. However, in this review results did not show a significant difference of the success rates of osseointegration in both, traditional and immediate loading groups (*Table N.3*). Researches that used immediate loading

protocol mentioned success rate of 93.3%-100% of implants osseointegration, although static occlusion was restored at the same day. Meanwhile, success rates of the control groups that used conventional loading protocol varied from 95.9% to 99.0%. However, it must be kept in mind that all researches, except for one, that used immediate implant loading protocol made all surgical intervention to a bone where insertion torque was higher than recommended for edentulous jaws (>30Ncm). Only in one research by A. Jokstad (2013), had totally random study groups, only in the experimental group insertion torque had to be above 20Ncm. In spite of that, there was no statistically significant difference between implants osseointegration between two groups⁽⁸⁾.

Implantation in the maxilla could be more complicated not only because of its anatomical structures (Ex: sinus, sinus septum), but also for its bone density because maxilla is less dense and has lower quality of the bone needed for the implantation⁽⁹⁾. P. Andersson et al; (2013) mentioned that treatment methods of edentulous maxilla using conventional or immediate loading protocol is poorly researched, comparing to a mandible. That is why in his research he evaluated a success rate of osseointegration comparing mandible and maxillae. Results showed that all implants (8) that did not completely osseointegrate and were counted as a failure were precisely in the maxilla, however this difference was not statistically significant⁽¹⁰⁾.

Table No. 3: Success rates

Author/ Year	Method used	Number of patients	Implants inserted	Torque (Ncm)	Successful implants	Rate of success
M. Mozzati (2014)	Immediate	65	334	>40	327	97.9%
R. Marra (2013)	Immediate	30	312	35-50	305	97.9%
T. Tealdo (2014)	Immediate	33	163	>40	153	93.9%
	Late	14	97	>25	93	95.9%
D. Penarrocha-Oltra (2014)	Immediate	14	94	>35	91	96.8%
	Late	15	99	>35	98	99.0%
S. Ohba (2015)	Immediate	27	189	>35	189	100%
P. Andersson (2013)	Immediate	55	284	>40	266	93.7%
A. Jokstad (2013)	Immediate	13	52	>20	49	94.2%
	Late	18	72	-	71	98.6%
R. Scala (2012) [14]	Immediate	79	205	35-45	200	97.6%

Quality of prosthesis

While comparing different approaches for loading the implants most of the authors choose to evaluate the quality of temporary and permanent crowns. While temporary fixed crowns partially restore function and esthetics, many problems may arise, such as fractures, loosening of screw and etc. – that is the reason why we also wanted to evaluate and compare the quality of crowns.

In one of the studies, Tealdo et al; prosthetics, which didn't require replacement and could still be used daily, considered to be successful and the ones which required only minor corrections were not considered a failure but only a complication of prosthetics. Based on these criteria, the success of prosthetics reached 100% in immediate and conventional groups. During 6 year follow-up 10 complications in total have

occurred: 6 of them in the experimental group (82.4%) and 4 in control group (73.3%). Any other complications were related to loosening of connecting screws and they were easily repaired during annual check-ups⁽¹¹⁾. Similar results were found in other studies – permanent dentures had 100% success rate^(12, 13). Usually fractures appeared in temporary acrylic prosthesis with or without metallic frame – especially in areas where layer of acrylic resin was thinner. The author seems to think the reason for that is shrinkage of resin during polymerization⁽⁹⁾. A fact that most of the complications appeared in patients with severe bruxism must be brought to attention⁽⁷⁾.

Discussion

Nowadays immediate implant loading is getting more and more popular for obvious reasons – patients, who are not satisfied with their current dentures or don't want to use removable dentures this is a perfect choice. The mostly used argument against immediate loading is better implant stability using conventional loading protocol but according to our reviewed articles – no significant differences were observed comparing immediate and conventional loading protocols. In addition, satisfaction levels are extremely different – using immediate implant loading both patients and doctors benefit from this protocol because it's less time consuming, function and esthetics are restored faster, less recall visits are required. The only obvious disadvantages of the immediate loading are the price and potential fractures of provisional dentures.

In terms of marginal bone loss – we found no significant differences in the literature comparing immediate and conventional loading, while one of the articles showed even better results in immediate protocol group⁽¹¹⁾.

However, this review has some limitations. One of them is that there was no statistical analysis that compares the works of different authors. Although, it is impossible to do that, because results of different researches are given in a different period of observation. That is why conclusions of this review should be accepted subjectively, despite the fact that results are given objectively. Another disadvantage is that there was not reflected to the implant company, their models, forms, surface covering material, in spite of that it is known that there is the difference of osseointegration between different implant companies⁽¹³⁾. Moreover, it was not take in mind whether it was immediate implantation technique or to a fully healed bone. A standardized study using same implants in a controlled environment is needed to compare the protocols objectively.

Conclusion

We found no significant difference in loss of marginal bone between our compared protocols. A higher patients' satisfaction level was reached using immediate loading protocol. A standardized clinical prospective trial is required

in order to compare these loading protocols objectively.

Conflict of Interest: *None declared*

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