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EVALUATE IMPLANT SUCCESS AND CRESTAL BONE LOSS IN IMMEDIATE AND DELAYED LOADING: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract :

Although extensive studies have been performed on immediate and delayed loading protocols and reported high success rates in the mandible, the effect of variables such as splinting, number of implants, is still unknown. The gap in the literature, the absence of a control group in most studies can make this comparison difficult. Therefore the aim of current study was evaluate implant success and crestal bone loss in immediate and delayed loading.

From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature over the last ten years between 2011 and September 2021. Odds ratio and mean differences with 95% confidence interval, fixed effect model and Inverse-variance or Mantel-Haenszel method were calculated. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

361 studies were selected to review the abstracts, the full text of 42 studies was reviewed. Finally, seven studies were selected. Odds ratio of Implant loss between immediate loading and delayed loading was -1.30 (OR, -1.30 95 % CI -2.17, -0.43; p=0.00) with low heterogeneity (I^2 <0%; p=0.68). Mean differences of Crestal bone loss between immediate loading and delayed loading was -0.24 mm (MD, 0.24mm 95 % CI 0.21mm, 0.26mm; p=0.00).

immediate loading significantly increased the risk of implant loss before one year. Evidence shows that delayed loading preferred and is better than immediately loaded implants.

Keywords: immediate loading, delayed loading, implant success, crestal bone loss

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Introduction :

An implant-retained overdenture is a removable dental prosthesis supported by the residual oral tissues and retained by dental implants. This concept has been successfully used for over 30 years(1). Fixed implant supported prostheses are an alternative for implant rehabilitation treatment that allow patients to have new fixed teeth(2). Both improved retention and stability when compared to conventional dentures and improve performance and the patient's quality of life(3). In a study, a period without implant loading was set at 3 to 4 months for the mandible and 6 to 8 months for the maxilla, thus preventing micro movements that could cause fibro fusion and subsequent implant loss(4). The initial stability of the implant and the absence of small movements are important and key factors in the success rate of the implant(5). The period from tooth loss to implant-supported restorations can be debilitating and detrimental, compromising patients' performance, beauty, and quality of life, so treatment time with implant-supported restorations should be reduced(6). Since 1990, studies on implant loading protocols have reported that osseointegration can be sufficiently achieved using immediate and early loading protocols (7-9). According to the ITI Consensus Conference, implant loading protocols were categorized as follows: for conventional or delayed loading for more than two months, for dearly loading between one week to two months, and for immediate loading in the first week after implant placement(10). Although extensive studies have been performed on immediate and delayed loading protocols and reported high success rates in the mandible, the effect of variables such as splinting, number of implants, is still unknown. The gap in the literature, the absence of a control group in most studies can make this comparison difficult. Therefore the aim of current study was evaluate implant success and crestal bone loss in immediate and delayed loading.

Methods :

Search strategy :

From the electronic databases, PubMed, Scopus, LILACS, Web of Science, EBSCO, LIVIVO, and Embase have been used to perform a systematic literature over the last ten years between 2011 and September 2021. The reason for choosing studies in the last ten years is to be able to provide sufficient evidence in this area and use newer studies. Therefore, a software program (Endnote X8) has been utilized for managing the electronic titles.
Searches were performed with mesh terms:

("Immediate Dental Implant Loading"[Mesh] OR “Dental Implants"[Mesh]) AND "Survival"[Mesh]) AND ("Bone and Bones"[Mesh] OR "Alveolar Bone Grafting"[Mesh] OR "Bone Retroversion"[Mesh])) AND ("Mandible"[Mesh] OR "Mandibular Prosthesis Implantation"[Mesh] OR "Mandibular Advancement"[Mesh] OR "Mandibular Prosthesis"[Mesh])) AND ("Dental Porcelain"[Mesh] OR "Metal Ceramic Alloys"[Mesh])) AND ("Randomized Controlled Trials as Topic"[Mesh] OR "Randomized Controlled Trial" [Publication Type])) AND "Healthy Volunteers"[Mesh]) AND ("Mouth, Edentulous"[Mesh] OR "Jaw, Edentulous"[Mesh]).

This systematic review has been conducted on the basis of the key consideration of the PRISMA Statement– Perfumed Reporting Items for the Systematic Review and Meta-analysis(11), and PICO strategy (Table1).

Selection criteria :

Inclusion criteria: Randomized controlled trials studies, controlled clinical trials; in human; edentulous mandible; in English. Prospective and retrospective cohort studies, in vitro studies, case studies, case reports and reviews; maxillary arch were excluded from the study.

Table 1. PICO OR PECO strategy.

PICO strategy	Description
P	Population/ Patient: human participants with mandibular edentulous
E	Intervention: fixed or removable prosthesis
C	Comparison: immediate loading versus delayed loading
O	Outcome: implant loss, Crestal bone loss

Data Extraction and analysis method :

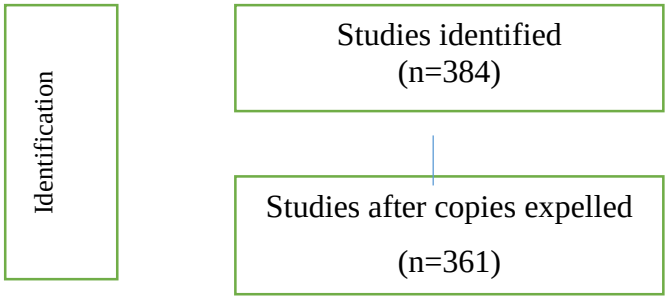
The data were extracted from the research included years, study design, type of prosthesis, Number of implants per patient, sample size and Measure.

The quality of randomized studies included was assessed using Collaboration's tool(12). The scale scores for low risk was 1 and for High and unclear risk was 0. Scale scores range from 0 to 6. A higher score means higher quality. For Data extraction, two reviewers blind and independently extracted data from abstract and full text of studies that included. Prior to the screening, kappa statistics was carried out in order to verify the agreement level between the reviewers. The kappa values were higher than 0.80.

Odds ratio and mean differences with 95% confidence interval (CI), fixed effect model and Mantel-Haenszel or Inverse-variance method were calculated. Random effects were used to deal with potential heterogeneity and I^2 showed heterogeneity. I^2 values above 50% signified moderate-to-high heterogeneity. The Meta analysis have been evaluated with the statistical software Stata/MP v.16 (The fastest version of Stata).

Results :

In the review of the existing literature using the studied keywords, 384 studies were found. In the initial review, duplicate studies were eliminated and abstracts of 361 studies were reviewed. At this stage, 319 studies did not meet the inclusion criteria, so they were excluded, and in the second stage, the full text of 42 studies was reviewed by two authors. At this stage, 35 studies were excluded from the study due to incomplete data, inconsistency of results in a study, poor studies, lack of access to full text, inconsistent data with the purpose of the study. Finally, seven studies were selected (Figure1).



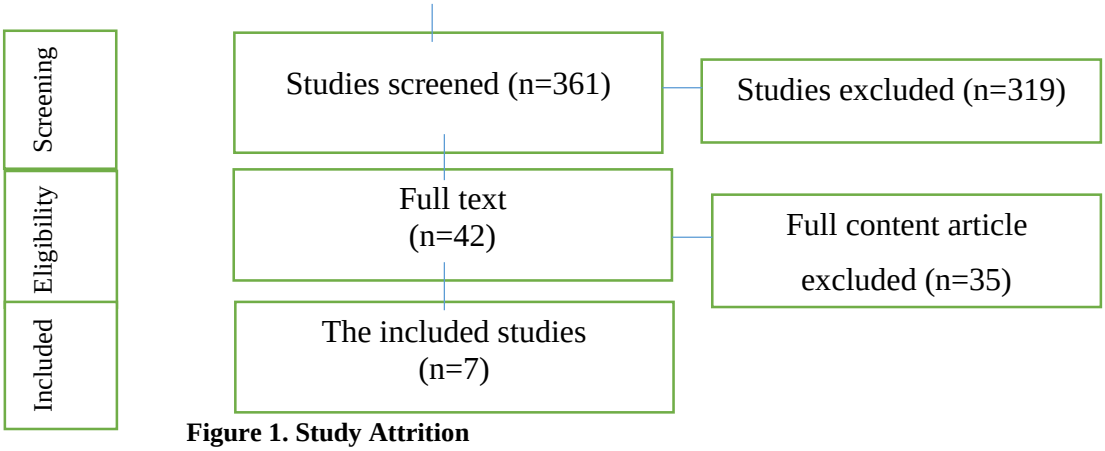


Figure 1. Study Attrition

Characteristics :

Seven studies (Randomized clinical trials) have been included in present article. The number of implants in delayed loading and immediate loading was 401 and 381, respectively. The number of implants a total was 782, the range of implants per patient was between 1-4. In all studies moment of immediate loading was Same-Day and the type of prosthesis was overdenture, except two studies (Fixed). The range of tracing was between 12 to 60 months (Table2).

Table 2. Studies were selected for systematic review and meta-analysis.

Studies. Years	Study design	Type of Prosthesis	Number of implants		Moment of immediate loading	Tracing (month)
			delayed loading	immediate loading		
Kern et al., 2018 (13)	RCT	overdenture	77	81	Same-Day	24
Acham et al., 2017 (14)	RCT	overdenture	48	32	Same-Day	32
Schincaglia et al., 2016 (15)	RCT	overdenture	32	32	Same-Day	12
Jokstad et al., 2014 (16)	RCT	Fixed	84	84	Same-Day	60
Alfadda et al., 2014 (17)	RCT	Fixed	88	80	Same-Day	12
Elsyad et al., 2014 (18)	RCT	overdenture	36	36	Same-Day	12
Elsyad et al., 2012 (19)	RCT	overdenture	36	36	Same-Day	36

Table 3. Risk of bias assessment (Randomized clinical trials).

Study	Random generation of sequences	Concealment of Allocation	Blinding of participants and	Blinding of outcome assessment	Incomplete data on outcomes	Selective reporting	Total score
Kern et al., 2018 (13)	+	+	-	-	+	-	3
Acham et al., 2017 (14)	+	-	-	+	+	-	3

Schincaglia et al., 2016 (15)	+	+	+	+	?	+	5
Jokstad et al., 2014 (16)	+	+	-	+	+	?	4
Alfadda et al., 2014 (17)	+	?	+	+	-	+	4
Elsyad et al., 2014 (18)	+	+	+	-	+	+	5
Elsyad et al., 2012 (19)	+	+	+	+	+	+	6

Low (+), unclear (?), high (-)

Bias assessment :

According to Collaboration's tool, two studies had a total score of 3/6; two studies had a total score of 4/6; two studies had a total score of 4/6; and one studies had a total score of 6/6. Two studies had a moderate risk of bias and five studies had low risk of bias or high quality (Table 3).

Implant loss :

Odds ratio of Implant loss between immediate loading and delayed loading was -1.30 (OR, -1.30 95 % CI -2.17, -0.43; p=0.00) with low heterogeneity (I^2 <0%; p=0.68) (Figure2). This result shows statistically significant difference of Implant loss between immediate loading and delayed loading; immediate loading significantly increased the risk of implant loss. In immediate loading and delayed loading group the number of implant loss was 20 and 5, respectively (Figure2).

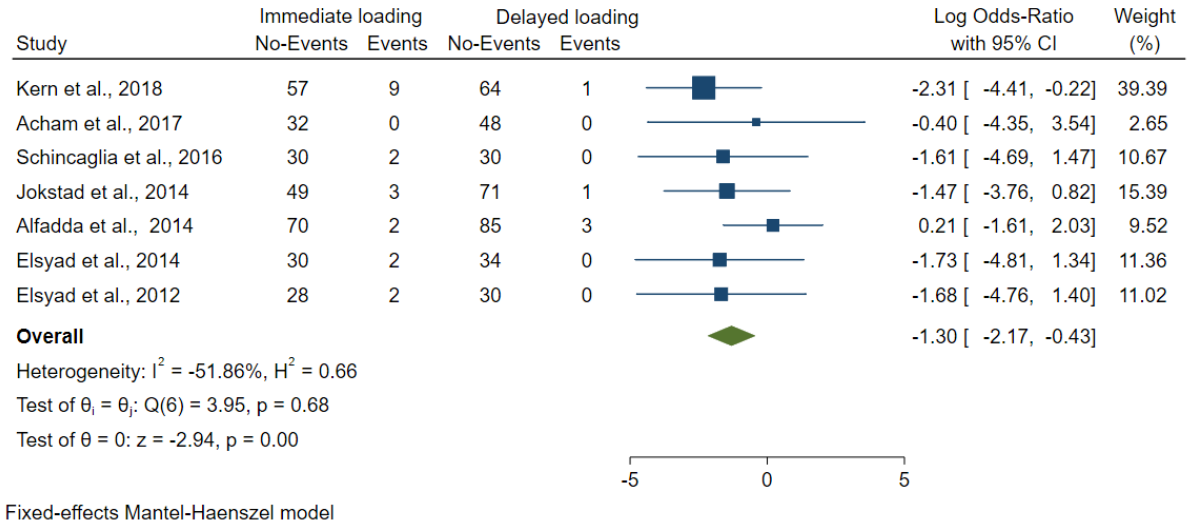


Figure 2. The Forest plot showed Implant loss between two loading protocols

Crestal bone loss :

Mean differences of Crestal bone loss between immediate loading and delayed loading was -0.24 mm (MD, 0.24mm 95 % CI 0.21mm, 0.26mm; p=0.00) with high heterogeneity (I^2 =85.69%; p=0.00) (Figure2). There was statistically significant difference of Crestal bone loss between immediate loading and delayed loading.

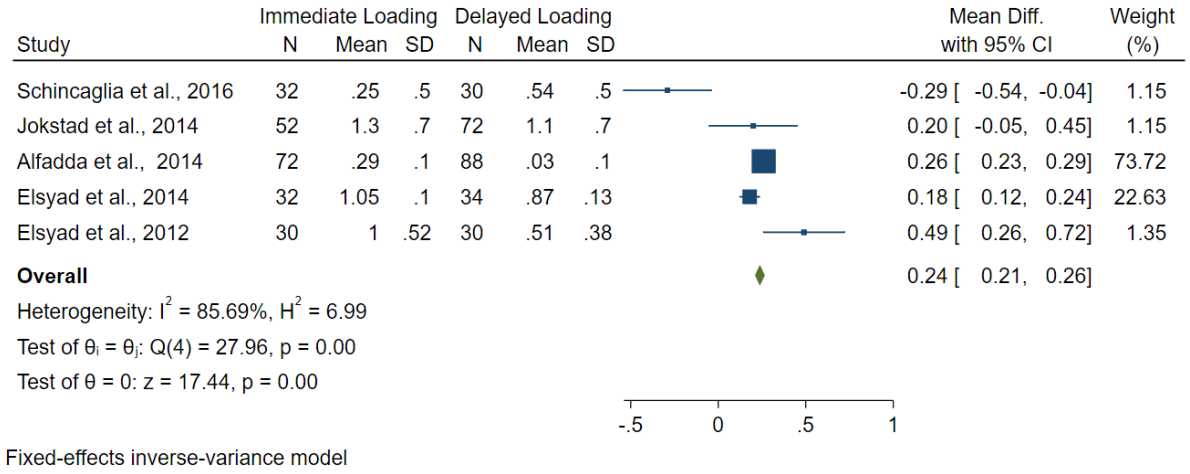


Figure 3. The Forest plot showed Crestal bone loss between two loading protocols

Discussion :

The aim of current systematic review and meta-analysis study was evaluate implant success and crestal bone loss in immediate and delayed loading. All selected studies had high quality and low risk of bias, except two studies that had moderate risk of bias (13, 14). In most studies Blinding of participants and personnel was not done, in studies blinding of operators and observers should be done because this action can affect the results, if the operator is not blind, the action can be arranged to achieve more initial stability in Instant download group changed. As a result, blinding of participants and personnel is suggested and recommended in future studies. The range of tracing was between 12 to 60 months, however implant loss occurs in the first year after implantation. However, the observation period in studies can affect the results of crestal bone loss. According to the meta-analysis performed, delayed loading showed better results than immediate loading in terms of premature implant loss before 1 year. Most studies have reported Crestal bone loss as an important and key variable in determining whether or not implants are successful, however differences in the timing of Crestal bone loss evaluation can affect study results(17, 19).

Meta-analysis of current study showed the mean differences of Crestal bone loss between immediate loading and delayed loading was -0.24 mm. just in two studies, Crestal bone loss of more than 1 mm was reported (16, 18). Walton et al.,2018 reported crestal bone loss measurements showing a difference of 1 mm or less can be attributed to limitations in measurement rather than biological factors(20). Placing implants in one phase does not appear to affect implant or crystal bone loss (16-18). The presence of a removable prosthesis with soft materials within 3 months after placement does not seem to be harmful to the underlying implants. Meta-analysis showed that, in general, delayed loading has better results for removable prostheses. With regard to the comparison of implant loss with or without splinting, it appears that when the implants are not splinted, delayed loading is preferable

because more losses occurred with immediate loading (13, 15, 18, 19). The present study had limitations such as the small number of randomized clinical trial studies during the last ten years with the control group, defects in the design and method of studies, inconsistencies in the time of implant observation and failure to evaluate crestal bone loss in some from the studies, patient satisfaction was not assessed.

Conclusion :

Current systematic review and meta-analysis study showed immediate loading significantly increased the risk of implant loss before one year. Evidence shows that delayed loading preferred and is better than immediately loaded implants. There was statistically significant difference of Crestal bone loss between immediate loading and delayed loading. Randomized clinical trials on fixed prostheses are needed to confirm the evidence and provide sufficient and stronger evidence.

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