Review Article

Success Rate of Immediately Loaded Implants in the Posterior Zone

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Abstract

Dental implants are considered an ideal treatment for a missing single tooth. Immediate loading of implants can hasten the procedure, providing comfort to the patients. Recently, immediate loading of implants has gained much importance as it helps hasten the procedure and provides more comfort to patients. A previous systematic review published 5 years ago compared the success rates between immediate and conventional loading. There are several factors that influence the success rate of implants that were not discussed in detail in the previous review. Hence, the present systematic review is done to report differences in the outcomes from single implant restorations of missing teeth in the posterior region in patients who were subjected to immediate loading and conventional loading. A follow up for 1 year was done. Electronic databases of Medline, Scopus, and Web of Science were searched for publications in the English Language during May 2021. The search results yielded 306 articles, out of which 225 were excluded based on title and abstract screening. Screening of the remaining 81 full text articles yielded 14 original research articles that satisfied the predefined inclusion criteria. Meta analysis was not possible due to the heterogeneity of the data. The overall success rate of the immediate loading of a single implant is 94.31%. Implants in the maxillary region had a higher survival rate than those in the mandibular region. The age range between 18 and 80 years showed good prognosis and outcomes in older individuals. Good oral hygiene was emphasized for all patients to prevent any secondary conditions or delays in healing.

Keywords: *Immediate loading, posterior zone, single implant*

Introduction

Dental implants are the ideal treatment of choice for missing single tooth owing to their superior

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success rate.[1,2] The major function of the dental implant is to transmit occlusal load to the adjacent organic tissues, dispersing and distributing biomechanical force. Immediate loading is characterized as embedding the apparatus, projection, and provisional functionality restoration in a single surgical procedure. It is a non-submerged surgical procedure that provides the patient with a provisional restoration.[3] The restoration and abutment within the initial 2 days are placed into "limited" function, and during the subsequent months, they are allowed to Osseo integrate.[4] Following the implant placement, osseous remodeling starts on the implant–bone interface, accelerated by the force that instigates the bone cells.[5] Furthermore, the patient's diet plays a significant role during bone osteointegration and remodeling after the immediate loading technique. A soft diet should be taken in smaller portions throughout the initial timeframe of 3–4 months of the recuperating cycle and deposition of bone.[6]

Some advantages of immediate loading include improved clinical efficiency, decreased treatment time, improved comfort for patients, a comparatively lesser traumatic experience for patients, and the instant development of an emergence profile around the transmucosal component. Due to a single surgery, there are fewer chances to be exposed to infections and increased chances to maintain gingival contours. Overall, this provides psychological, physical, and monetary benefits to patients. For its success, good implant stability and support of the bone are required. The absence of good bon support would be a major disadvantage. It requires more strict compliance from the patient, and the crown should have centric occlusion without eccentric contact. It is because more pressure on the prosthesis will cause more force on the bone–implant interface and lead to bone strain and possible failure.

To lessen this microstrain, it is important to enhance the interface surface.[7] It can be enhanced by implant surface treatment, number of threads, implant size, implant number, bone mechanical properties, and direction of occlusal load. The embedded body configuration ought to be more explicit for immediate loading because the bone has not had the opportunity to develop recesses. The support for the surface area can be increased by 20% for each increase of 3 mm in length.[8] However, at the trans-osteal region, there is a very small effect of decreasing this strain by increasing length, as the crestal bone has the majority of the load at the bone–implant interface.[9] The quantity of threads additionally influences the measure of the region accessible to oppose the immediate loading force. With the minute separation between the threads, the thread number and related surface area will be more prominent.[10] It is also important to monitor factors such as parafunctional movements, teeth clenching, or bruxism, as they can also cause strain on the implant and have a higher chance of leading to subsequent failure.[11] Additionally, these can also lead to the fracture of temporary restorations or abutments.[6] For a successful implant treatment, various factors have an impact on its restoration and prevention of bone loss. Although Moraschini *et al.*[12] conducted a systematic review comparing the success rates of immediate and conventional loading, the review was published five years ago, and the factors influencing the success rate of implants were not discussed in detail. Therefore, this systematic review study aims to determine the differences in the outcomes of single implants for the restoration of missing tooth in the posterior region. Patients were subjected to immediate loading and conventional loading with a minimum of 1 year follow-up and a brief note on the factors affecting the success of immediate loading of single implants in the posterior zone was added.

Materials and Methods

This systematic review was conducted based on Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines.

Focus question

The focus question is based on the PICOS criteria:

Population (P): patients who require replacement of a single missing tooth or teeth in the posterior region with single implants; Intervention (I): Immediate loading of implants; Comparison (C): Comparison with patients who received conventional or delayed loading of implants; Outcome (O): implant survival and marginal bone loss; Study design (S): Randomized Control trial

"Does immediate loading of single implants in the posterior region show better outcomes than delayed or conventional loading?"

Eligibility Criteria:

Inclusion criteria:

- Randomized controlled trials with >10 patients in each group
- Studies with the procedure of single immediately loaded implants with single crowns only
- A minimum follow-up of 1 year
- The diameter of endosseous implants is between 3 and 6 mm

Exclusion criteria:

- Animal or in-vitro studies

- Placement of implants leads to immediate and severe complications
- Data retrieved from questionnaires and chart reviews
- Studies with improper information about the implant placement and loading protocols
- Studies with insufficient information related to implant success and survival rates
- Case studies, editorials, and blogs

Search strategy

The electronic databases of Medline, Scopus, and Web of Science were searched for publications in the English Language using specific keyword combinations: "Immediate loading of single implants" and "posterior." A manual search of the references to the included studies was done to identify additional papers.

Study selection

Two authors independently removed duplicates from the search results. The titles and abstracts of the remaining articles were examined, and they were assessed for eligibility based on predefined inclusion and exclusion criteria. Any disagreement was resolved through discussion with a third author until a consensus was reached.

Data extraction

Two authors independently conducted data extraction on a customized template. An additional expert evaluator was consulted in case of any disagreement. Data on study design, functional loading, implant characteristics, implant stability assessments, final prosthesis, success criteria, implant survival rate, time of failure, and prosthesis success rate were extracted from the included studies.

Risk of bias

The Cochrane Collaboration Risk of Bias (RoB) tool was used to determine the RoB of the selected studies.[13] To determine the quality of the Randomised control trials (RCTs) the SIGN 50 scoring criteria were applied.[14]

Results

Study selection and screening

The database search yielded 306 articles (PubMed = 98; Scopus: 97; Web of Science 106; cross-reference 5). 225 articles that were duplicated and determined to be ineligible based on titles and abstracts were removed. The full text of the remaining 81 articles was screened to select articles based on predefined inclusion and exclusion criteria. A total of 14 articles[15-28] were selected for inclusion in this review. The PRISMA flow diagram is depicted in Figure 1 and the data extraction results are shown in Table 1.

Risk of bias

Thirteen studies had a moderate-to-high RoB due to a lack of clear information on randomization and concealment.[15-28] Only one study had a low RoB as it fulfilled the criteria of randomization, blinding, and free of selective reporting.[22] A summary of the RoB is shown in Table 2.

The quality of the randomized control trials based on SIGN 50 was low to moderate in the included studies and most of the studies did not provide information on randomization, allocation concealment, and blinding. The summary of the SIGN50 is presented in Table 3.

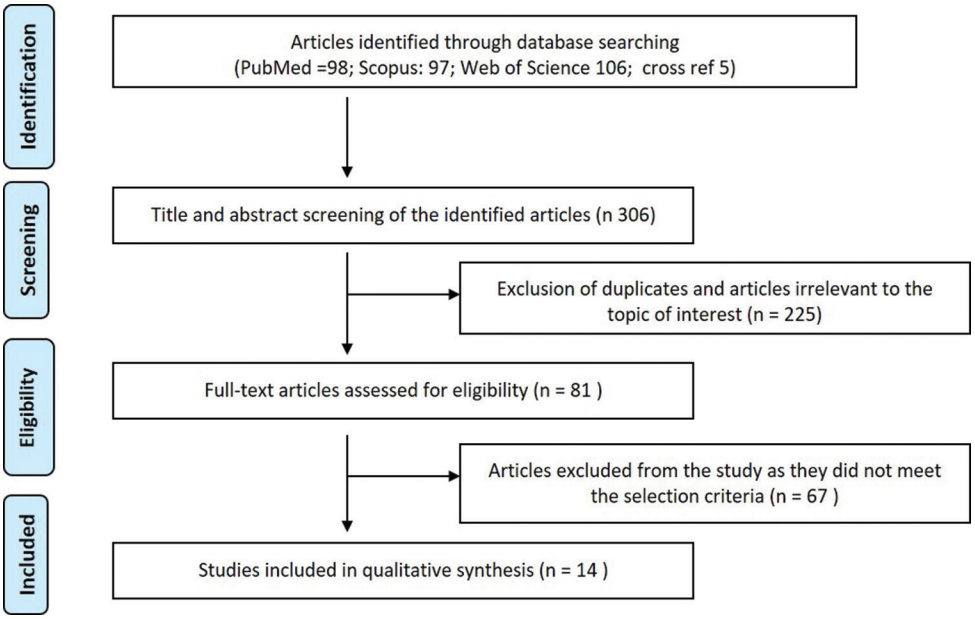

Figure 1: Represents the PRISMA flowchart

Table 1: Overall results of the included studies

Study	Study design	Study group and sample size	No. of implants in each group	Implant type/description	Mean age	Systemic conditions/other confounding factors
Weerapong *et al.* /2019/Thailand	Randomized control trial	*n*=46 Case Short implants Control : Conventional implants (*n*=23 in each group)	23	PW + Dental Implant system Case : 6 mm short implant Control 10 mm conventional implant	Case: 50.5 years Control 51.5 years	Nil
Atieh *et al.*/2013/ New Zealand	Randomized control trial	*n*=24 Control group: immediate loading of implants in healed sockets Case: immediate loading of implants following immediate placement	12	8- or 9-mm wide diameter implant (MAX Southern Implants Length 7 to 9 mm	Case : 51.5 years Control : 53.6 years	Nil
Akoğlan *et al.* (2017)/Turkey	Prospective clinical study	*n*=39 Group 1:immediate loading Group 2 early loading Group 3: delayed loading	13	(Implantium; Dentium, Seoul, Korea	total mean age 41.3 years	Nil
Gunncu *et al.*/2007/ Turkey	Randomized control study with Split mouth Design	*n*=12 Case side: immediate loaded Control side: d=conventional loading	12	4 x 11.5 mm Branemark System, TiUnite, Mk III Nobel Biocare, Goteborg, Sweden). Easy Abutmentt (Nobel BiocareAB	41.09 8.46 years	Nil
Schincaglia *et al.*/2009/Italy	Randomized control study	*n*=30 Case group: immediate loading Control: Delayed loading	15	Nobel Biocare Mk III WP Ti Unite implant 5 8.5, 10, 11.5	Case: 35–68 (49.2) years Control: 31–75 (51.8) years	Nil
Kokovic *et al.*/2014/Serbia	Randomized control trial	*n*=12 Split mouth design Case group: immediate loading Control group: early loading	36	SLA Straumann® TE; Straumann AG, Basel, Switzerland 4.1 mm and length 8,10 mm	49 years	Nil
Ayna *et al.*/ Germany/2018	Prospective Randomized control trial	*n*=63 Case : immediate loading 48 Control group: conventional loadig 15	Case 48 Control 15	short implant (6 mm)	54.68±8.63	Nil
Baek *et al*. 2019/ Korea	Randomized control trial	*n*=52 Case: Short implant Control: Long implant	Case: 27 and control each 19	Control: CMI IS-III active® long implant 5.0×10 mm Case: CMI IS-III active® short implant5.5×6.6, 7.3, 8.5 mm	Case: 52.06±11.05 years Control: 55.42±11.75	Not clear
Wang *et al.*/2020/ USA	Randomized control trial	*n*=52 Case: Immediate loading group Control: Delayed loading	Case *n*=27 Control *n*=25 s	NobelParallel Conical Connection, Nobel Biocare AB 93.75 mm, 4.3 mm, 5 mm)	46.8±10.7 yeas	In some patients controlled systemic diseases in some patients

Contd...

Table 1: Contd...

Study	Study design	Study group and sample size	No. of implants in each group	Implant type/description	Mean age	Systemic conditions/other confounding factors
Prosper *et al.*/2010/Italy	Randomized control trial	Patients=71 Case immediate loading after immediate placement Control: Delayed lading after immediate placement	120 implants (60 in each group)	Wider diameter implants sandblasted commercially pure titanium (Bioactive Covering, Winsix) in the form of a self-threading cylindrical screw (Magnum Implants, Winsix), with a length of 9, 11, or 13 mm and a diameter of 6.5 or 7.5 mm.	58.3 years	Nil
Meloni/2012/Italy	Randomized split moth control trial	20 patients Case: immediate loading Control : Conventional loading	20 implants for each group	Nobel Replace Tapered Groovy; Nobel Biocare, Goteborg, Sweden, 4.3 or 5.0 mm and lengths of 10 or 8 mm.	46 years	Uncontrolled conditions were excluded, controlled systemic conditions were included
Barewal *et al.*/2012/ Oregon/USA	Randomized control trial	*n*=40 Group: Immediate (8) Group II early (17), Group III delayed (15)	Group I=8 Group II 17 Group III 15	4 mm diameter, Osseo Speed Astra Tech	Between 20 and 82 years	Uncontrolled conditions were excluded, controlled systemic conditions were included
Kim/2013/ Phildelphia USA	Randomized Control Trial	*n*=46 split mouth design	Case 22 Control 24	46 SLActive Straumann implants 4.ot 4.8 x10 or 12 mm	18 to 80 years	Only significant conditions that affect bone healing were excluded
Zarrabi *et al.*/2018/Iran	Single-blind randomized clinical trial	39 implants in 32 patients Control 19 implants delayed loading Case: 20 implants immediate loading	Case: 20 Control 19	Dio Implants)	18-80 years	Only significant conditions that affect bone healing were excluded

Study	Immediate placement after extraction	Site	Restoration Details	Follow up (years)	No of the implants failed in each group	Implant survival in each group (%)	Marginal bone level change, Mean±s.d. (mm)	Statistical significance between the groups
Weerapong *et al.* /2019/Thailand	No	Mandibular first and second molar	Provisional computer-aided design/computer-aided manufacturing (CAD/CAM) ceramic crowns Centric occlusion	1 year	Case: 2 Control: 1	Case : 91.7% Control:: 95.8%	Case group: 0.33±0.47 mm Control: group: 0.26±0.27 mm	*P*=0.554
Atieh *et al.*/2013/ New Zealand	Yes	Mandibular first or second molar	Acrylic provisional restoration Full ceramic permanent restoration	1 year	Case: 4 Control: 2	Case : 66.7% Control: 83.3%	Case group: 0.41 (0.57) Control group (0.04)	0.14 Implant stability quotient higher in delayed placement group after 1 year (significant) Prosthetic outcome better in delayed placement group)
Akoğlan *et al.* (2017)/Turkey	No	Maxillary premolar and molar	permanent screw-retained Centric occlusion	1 year	0	100%	Immediate: 71.74 6 18.71 Early: 83.11 6 11.33 Delayed loading: 62.08 615.44	0.009

Contd...

Table 1: Contd...

Study	Immediate placement after extraction	Site	Restoration Details	Follow up (years)	No of the implants failed in each group	Implant survival in each group (%)	Marginal bone level change, Mean±s.d. (mm)	Statistical significance between the groups
Gunncu *et al.*/2007/ Turkey	No	Mandibular molar	Provisional restoration Permanent Metal ceramic crown Centric occlusion	I year	Case group : 1 Control group: 0	Case 91.67% Control 100%	Case group 0.45±0.39 Control group 0.68±0.3	No significant difference
Schincaglia *et al.*/2009/Italy	No	Mandibular molar	Provisional restoration porecelain fused to meral or cemented or screw retained permanent restorations. Centric occlusion	1 year	Case group: 1 Control group: 0	Case 93.5% control 100%	Case group 0.77±0.38 mmControl group 1.2±0.55 mm	*P*=0.02
Kokovic *et al.*/2014/Serbia	No	Mandibular molar	Provisional Restoration Permanent restoration type not mentioend	5 years	0 in both groups	100% both groups	Case group: 0.4 (0.24) Control group 0.8 (0.19)	*P*=0.118 (significant at 1 year) self-tapping implants can provide better stability
Ayna *et al.*/ Germany/2018	No	Maxillary posterior	provisional superstructures of bis-methacrylatecomposite resin were (Luxatemp DMG Chemisch-Pahrmazeutische Fabrik GmbH, Hamburg—Germany) Centric occlusion	5 years	Case group : 3 Control: nil	Case: 93.7% Control 100%	Exact measurements were not reported but in both groups was well within the limits	Statistically significant decreased bone loss in the control group than case group *P*<005
Baek *et al*. 2019/ Korea	No	Mandibular molar	provisional and definitive monolithic zirconia prostheses at 1 week and 12 weeks after implant surgery, adjusted occlusion to prevent eccentric contact.	1 year	Nil	Case and Control 100%	Control group: −0.07 12 weeks 0.06 mm I year Case: and 0.03 mm after 12 weeks 0.05 mm after 48 weeks.	*P*>0.05 No difference with the length of implants
Wang *et al.*/2020/ USA	No	Maxillary/ Mandibular/ premolar to molar region	Temporary restoration followed by monolithic zirconia screw-retained implant crown	1 year	Nil	Case and Control 100%	Case: mean bone level change 1.2 mm (SD 1.3 mm Control: 1.6 mm (SD 1.0 mm)	*P*>0,05
Prosper *et al.*/2010/Italy	Yes	Maxillary or mandibular molars	prefabricated provisional acrylic resin crowns followed by single porcelain metal crowns centric occlusion	5 years	Case 2 implant Contr0 1 2 implants	96.67% in each group	At 5 years Case: –1.31±0.44 mm Control –1.01±0.59 mm	*P*>0.05
Meloni/2012/ Italy	No	bilaterally missing first mandibular molars	Provisional restoration followed by zirconia-ceramic or metal-ceramic crowns	1 year	Nil	100%	Case : 0.83±0.16 mm (95% CI 0.75 to 0.91) Control: 0.86±0.16 mm (95% CI 0.78 to 0.94)	*P*=0.530

Contd...

Table 1: Contd...

Study	Immediate placement after extraction	Site	Restoration Details	Follow up (years)	No of the implants failed in each group	Implant survival in each group (%)	Marginal bone level change, Mean±s.d. (mm)	Statistical significance between the groups
Barewal *et al.*/2012/ Oregon/USA	No	Maxillary or mandibular posterior region	Provisional, Permanent cement retailer all-ceramic crown (Titanium or zirconia abutment)	3 years	Group I and Group II nil Group III=1	Group I and II 100% Group III 93%	Mean bone loss was 0.22 mm	Not significant with the three groups
Kim/2013/ Phildelphia USA	No	Maxillary posterior	Provisional followed by PFM	1 year	Case 3 Control nil	Case 86.4% Control 100%	Not mentioned	No significant difference between both groups
Zarrabi *et al.*/2018/Iran	No	Maxillary posterior	Provisional acrylic crown. Permanent prosthesis not mentioned Centric	1 year	Case: Nil Control 1	Case 100% Control 95%	Case : 1.17±0.58 Control: 1.09±0.49	No significant difference

Data synthesis

Due to the heterogeneity of the studies, a meta-analysis could not be conducted. Therefore, the best evidence synthesis was done. All the included studies were randomized control trials.

Follow-up varied in the included studies, with 10 articles having a 1-year follow-up.[15,16,18,19,21,23-27] One study had a 3-year follow-up,[22] and three studies had a 5-year follow-up.[17,20,28]

The patient's age range was between 18 and 80 years. The sample size of each study varied considerably, from the highest being 120 implants to the lowest examining only 17 implants.

The implants showed a good survival rate of 94.31%, with only sixteen implants failing in seven of the included studies. Six implants failed in the delayed loading group in five of the included studies, accounting for a mean survival rate of 97.37%.

No significant difference was reported in the marginal bone level change in eleven studies[15-22,24-26] on delayed loading. Three studies reported a change in marginal bone level on immediate loading [Table 1].

Seven studies used the mandibular posterior region for the placement of implants. Four studies used the maxillary posteriors as the site of placement. Three studies used the maxillary or mandibular posterior region. In the maxillary posterior site, immediate implants had a mean success rate of 95.025%, which declined to 91.93% in the mandibular region. Delayed implants showed greater success, with 98.75% in the maxillary posterior site and 97.61% in the mandibular region. The success rate was 98.9%. Studies where both maxillary and mandibular sites were higher than the delayed loading group. Of the 14 included studies, only had placed implants immediately after extraction.[16,20] The success rate was greater for immediate loading in a healed socket (83.3%) compared to immediate loading following extraction (66.7%).[16] Prosper *et al*.[20] reported 96.67% for both immediate and delayed loading of freshly extracted sockets.

The implant material varied across the studies, leading to heterogeneous data. MAX Southern Implants titanium implants showed the lowest survival rate following immediate placement after extraction.

Considering restoration-related factors, temporary CAD/CAM was used in one study with a 91.7% survival rate.[15] All others had permanent restorations, ranging from porcelain fused to metal crowns to all-ceramic zirconia monolithic crowns. A few studies did not mention the type of permanent restoration. The survival

Table 2: Cochrane Risk of Bias of the included studies

First author name/ year of publication/ country of origin	Random sequence generation	Allocation concealment	Blinding of participants & personnel	Blinding of outcome assessment	Incomplete outcome data addressed	Free of selective reporting	Free from other bias	Overall Risk of Bias
Weerapong *et al*. /2019/Thailand	Yes	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	Moderate
Akoğlan *et al*./2017/ Turkey	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	High
Atieh *et al*./2013/ New Zealand	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	High
Gunncu *et al*./2007/ Turkey	Yes	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	Moderate
Schincaglia *et al*./2009/Italy	Yes	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	Moderate
Kokovic *et al*./2014/ Serbia	Yes	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	Moderate
Ayna *et al*./ Germany/2018	Unclear as to the method of randomization not mentioned	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	High
Baek *et al*. 2019/ Korea	Yes	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	Moderate
Wang *et al*./2020/ USA	Yes	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	Moderate
Prosper *et al*./2010/ Italy	Yes	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	Moderate
Meloni/2012/Itay	Yes	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	Moderate
Barewal *et al*./2012/ Oregon/USA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Kim/2013/ Philadelphia USA	Yes	Unclear/not mentioned	Unclear/not mentioned	Unclear/not mentioned	Yes	Yes	Yes	Moderate
Zarrabi *et al*./2018/ Iran	Unclear/technique not mentioned	Unclear	Yes	Unclear/not mentioned	Yes	Yes	Yes	Moderate

rate of the ceramic implant varied widely, from 66.7%[16] in one study to 100%.[22,21]

Most studies opted for full-centric occlusion and a non-functional immediate loading protocol. Almost all the patients included had good oral hygiene, no reports of parafunctional habits, and a healthy physique. Six studies excluded conditions that interfere with osseointegration, whereas controlled systemic conditions that did not affect implant placement were included.

Discussion

Dental implants are the most popular treatment choice for replacing missing teeth. The last systematic review examining survival rates of immediately loaded implants was published half a decade ago and focused solely on the mandibular region. Considering several recent randomized control trials, there is a need to analyze new evidence on the success rates of both immediate loading and conventional loading of implants in the posterior region. The present systematic review assessed differences in the outcomes of single implants for restoration of missing teeth in the posterior region in patients who were subjected to immediate loading and conventional loading with a minimum follow-up of 1 year.

Fourteen studies included in the review compared the survival rate of immediate loading of single implants in the posterior zone with a delayed loading protocol. All studies provided follow-up for 1 or more years. The overall success rate of immediate loading was 94.31%. Although the success rate of immediate loading implants was high, it was less than the 99–100% success rate in previous studies.[27,29] This higher failure rate could be due to the lower sample size or the implant used. Atieh *et al*.[16] used a wide diameter MAX Southern Implants titanium implants were placed immediately after extraction. They reported no statistically significant differences in the success rates of immediate placement and delayed placement. However, a study with a larger sample size by Prosper *et al*.[20] reported a success rate

Table 3: Quality of the Randomized Control Trials by the SIGN 50 scoring criteria

First Author name/ year of publication/ country of origin	Clear focus question	Randomization performed adequately	Allocation concealment	Blinding of patients and personnel	Homogeneity of cases and controls	The difference between the groups is only the treatment in concern	Outcome measures standardized	Dropouts assessed if present	Intention treat analysis (all subjects analyzed in the group where they belong to)	The similarity of data, if the study is multicentric	Score
Weerapong *et al.*/2019/Thailand	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Not applicable	Low
Akoğlan *et al*. (2017)/Turkey	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Moderate
Atieh *et al*./2013/ New Zealand	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Moderate
Gunncu *et al.*/2007/ Turkey	Yes	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Low
Schincaglia *et al.*/2009/Italy	Yes	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Low
Kokovic *et al*./2014/ Serbia	Yes	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Low
Ayna *et al*./ Germany/2018	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Moderate
Baek *et al*. 2019/ Korea	Yes	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Low
Wang *et al*./2020/ USA	Yes	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Low
Prosper *et al*./2010/ Italy	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Moderate
Meloni/2012/Itay	Yes	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Low
Barewal *et al*./2012/ Oregon/USA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not applicable	Low
Kim/2013/ Philadelphia USA	Yes	Unclear/Not mentioned	Unclear/Not mentioned	Unclear/Not mentioned	Yes	Yes	Yes	Yes	Yes	Not applicable	Moderate
Zarrabi *et al*./2018/ Iran	Yes	Unclear/not explained	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Not applicable	Low

of 96.7% following immediate placement. Thus, it can be inferred that immediate placement of the implant following extraction in the posterior region could be a possible reason for implant failure. The duration of edentulism before extraction may be a major factor influencing the success rate of immediately loaded single implants.[16]

The included studies revealed no statistical difference in implant survival with immediate and conventional loading, which is consistent with the previous systematic review.[12] Few studies reported statistically significant changes in the marginal bone levels, which may be due to factors such as the site of placement, systemic conditions, type of implant, bone levels before the study, and the periodontal and oral hygiene status of the study participants.

Immediately loaded implants in the maxillary posterior region had a better success rate (95.025%) compared to the mandibular region (91.93%). The increased masticatory forces in the posterior mandibular region could affect the survival rate of the implant.[12]

In most of the studies, the inclusion criteria were adequate bone height. This could be another factor that led to the successful outcome, as an optimum level of abundant bone is needed for hosting an implant.[30] Occlusal contact is another factor that affects the success of implants. Most of the studies opted for full centric. The studies provided little information on the implant surface characteristics, which can influence the success rate of implants. Rough surfaces have five times higher survival rates than smooth surfaces.[31]

The age of the patients varied between 18 and 80 years of age, which suggests that dental implants are a compatible treatment and can be successful even in a geriatric population.[32] All studies excluded patients with systemic conditions that affect osseointegration. This patient-related factor could be the reason for the higher success rates reported.[33] In the studies included in this review, the success rate was high because most of the patient-related factors were controlled. In most of the studies, smokers were excluded, which is concurrent with the findings of Tawse-Smith *et al*.[34] who found smoking to be a significant factor in implant failure.

The RoB was moderate to high in most studies due to a lack of information on randomization, allocation concealment, and blinding. The quality of the randomized control trials based on SIGN 50 was low to moderate in the included studies, and most of the studies did not provide information on randomization, allocation concealment, or blinding.

The follow-up periods and sample sizes were low for most studies. Also, 13 out of 14 studies had a moderate-to-high RoB. The results of this review must be interpreted with caution, as many studies did not report the effects of pain and psychosomatic factors that can affect implant success. Future studies with larger sample sizes and longer follow-ups examining the pain and psychosomatic factors and their correlation with the success rates should be carried out, and measures to reduce bias must be taken. This will help to expand the knowledge base regarding factors that influence the long-term success rate of immediate loaded single implants in the posterior region.

Conclusions

Based on the limited evidence available, no significant differences were observed between conventional loading and immediate loading. The overall success rate of the immediate loading of a single implant in the posterior region was found to be 94.31%. The age of the participants ranged between 18 and 80 years, demonstrating a good prognosis and outcome in geriatrics. The maxillary region had a higher survival rate in comparison with the mandibular region. Most of the studies reported permanent restorations and full centric occlusal contact. This centric contact minimizes the pressure on the bone–implant interface, making the success rate high. Good oral hygiene was emphasized for all patients to prevent any secondary conditions or delays in healing. Further research with increased sample sizes and increased follow-up periods is recommended.

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Data availability statement

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Conflicts of interest

There are no conflicts of interest.

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