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SYSTEMATIC REVIEW

Short versus standard implants for single-crown restorations in the posterior region: A systematic review and meta-analysis

Xinxin Xu, MSD,[a] Bo Hu, MSD, DMD,[b] Yun Xu, MSD,[c] Qin Liu, MM, PhD,[d] Huifen Ding, DMD, PhD,[e] and Ling Xu, DMD, PhD[f]

ABSTRACT

Statement of problem. Whether implant-supported crowns on short or standard implants have similar clinical outcomes in the posterior alveolar bone is unclear.

Purpose. The purpose of this systematic review and meta-analysis was to compare clinical outcomes, including survival rates, marginal bone loss (MBL), and complications associated with short implants and standard implants supporting a single crown in the posterior alveolar bone.

Material and methods. This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) principles and was registered with PROSPERO (CRD42018112978). The authors identified eligible trials published before August 2019 by searching PubMed, EMBASE, and the Cochrane Library. Only randomized controlled trials (RCTs) were included in the study, and quality assessment was performed by using the Cochrane Collaboration Risk of Bias tool. Relevant information was extracted by using a standardized form, and a meta-analysis was performed by using a software program.

Results. A total of 1954 references were identified. Five eligible trials were included in the quantitative synthesis. The survival rate of the short implants (≤6 mm) was similar to that of longer implants (>6 mm) in the short term (*P*=.72; RR: 0.99; 95% CI: 0.97-1.02); however, long-term follow-up showed that short implants had a poorer survival rate than standard implants (*P*=.01; RR: 0.94; 95% CI: 0.90-0.99). There was no significant difference in the MBL (*P*=.94; MD: 0.00; 95% CI: −0.10 to 0.11).

Conclusions. The present study suggested that, although short implants have a higher crown-to-implant (C/I) ratio, they do not affect MBL. However, long-term follow-up comparisons indicated that short implants (≤6 mm) have a poorer survival rate than standard implants (>6 mm) (*P*=.01). Nonsplinted crowns supported by short implants should be used with caution in the posterior alveolar bone. (J Prosthet Dent 2020;124:530-8)

Initially, the dental implant literature suggested longer implants were preferred when allowed by bone height because longer implants provide better primary stability and larger bone-to-implant contact (BIC).[1] However, the alveolar ridge undergoes a resorption process after tooth loss.[2] Therefore, many patients do not have adequate bone volume to receive a standard dental implant. However, with treatment to modify the surface topography and surface energy of implants, short implants with rough surfaces have demonstrated superior clinical outcomes to those with smooth surfaces.[3] Although the definition of short implants varies in the literature,[2,4-11] recent studies[12-14] have focused mainly on implants with lengths ≤6 mm. Therefore, the present study adopted the definition of a short implant as that with a length ≤6 mm.[15-17]

Short implants can alleviate the need for additional surgical bone augmentation, reduce postoperative complications and morbidities, and reduce treatment time and

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[a]Graduate student, Chongqing Key Laboratory of Oral Diseases and Biomedical Sciences, Chongqing Municipal Key Laboratory of Oral Biomedical Engineering of Higher Education, College of Stomatology, Chongqing Medical University, Chongqing, PR China.
[b]Lecturer, Department of Prosthodontics, Stomatological Hospital of Chongqing Medical University, Chongqing, PR China.
[c]Graduate student, College of Stomatology, Chongqing Medical University, Chongqing, PR China.
[d]Professor, School of Public Health and Management, Chongqing Medical University, Chongqing, PR China.
[e]Lecturer, Department of Prosthodontics, Stomatological Hospital of Chongqing Medical University, Chongqing, PR China.
[f]Associate Professor, Chongqing Key Laboratory of Oral Diseases and Biomedical Sciences, Chongqing Municipal Key Laboratory of Oral Biomedical Engineering of Higher Education, College of Stomatology, Chongqing Medical University, Chongqing, PR China.

Clinical Implications

Numerous clinical trials have indicated that short implants and standard implants have similar survival rates. The present study focused on short implants (≤6 mm) used for the prosthetic rehabilitation of single-teeth or nonsplinted crowns in the posterior alveolar bone and indicated that compared with longer implants, short implants had a lower survival rate. Nonsplinted crowns supported by short implants should be used with caution in the posterior alveolar bone.

cost. Therefore, the use of these implants is a valid option for patients who have insufficient bone volume,[18] and short dental implants have become widely used. However, controversial clinical outcomes have been reported regarding the use of short implants in the posterior alveolar bone. Some authors have noted that short implants achieve a similar survival rate to standard implants,[12,19] while others have reported that short implants have lower survival rates than standard implants.[20,21] Previous meta-analyses and systematic reviews have been performed to clarify this controversy, but most of these studies[5,6,8,9,11] combined both nonsplinted crown and splinted crown restorations, which may influence the results as splinting implants can disperse the stress on single implants and may reduce the incidence of mechanical complications and implant overload.[22,23] Therefore, it is necessary to conduct a meta-analysis to determine whether short implants can achieve similar survival rates for single crown restorations.

The purpose of this meta-analysis was to compare clinical outcomes, including survival rate, marginal bone loss (MBL), technical complications, and biological complications, of short implants (≤6 mm) and standard implants (>6 mm), with a single crown placed in the posterior alveolar bone. The first null hypothesis was that there is no difference between short and standard implants regarding the implant survival rate, and the second null hypothesis was that there is no difference in MBL.

MATERIAL AND METHODS

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) principles and was registered with PROSPERO (CRD42018112978). According to the patient, intervention, comparison, and outcome (PICO) scheme, the focused research question was whether short implants and standard implants have similar clinical outcomes supporting single crowns in the posterior alveolar

Table 1. Search strategy

Element	Contents
Population	Tooth extraction[MeSH Terms] OR Alveolar bone loss[MeSH Terms] OR Jaw, edentulous, partially[MeSH Terms] OR Dental implants[MeSH Terms] OR Tooth loss jaw[MeSH Terms] OR Posterior jaw OR Partially edentulous OR Single tooth loss OR Posterior implant OR Single crown OR Nonsplinted crown
AND	
Intervention and comparison	Bone substitutes[MeSH Terms] OR Alveolar bone grafting [MeSH Terms] OR Vertical ridge augmentation OR Sinus lift OR Longer implant OR Standard implant OR Long implant OR Short implant OR Short dental implant OR Bone augmentation OR Sinus floor elevation
AND	
Outcome	Dental restoration failure[MeSH Terms] OR Survival rate [MeSH Terms] OR Implant survival OR Implant failure OR Cumulative survival rate OR Marginal bone loss OR Peri-implant bone loss OR Marginal bone level OR Complication
AND	
Study design	Randomized Controlled Trial[Publication Type] OR Controlled clinical trial[Publication Type] OR Randomized [Title/Abstract] OR Randomly[Title/Abstract] OR Clinical trials as topic[MeSH Terms]

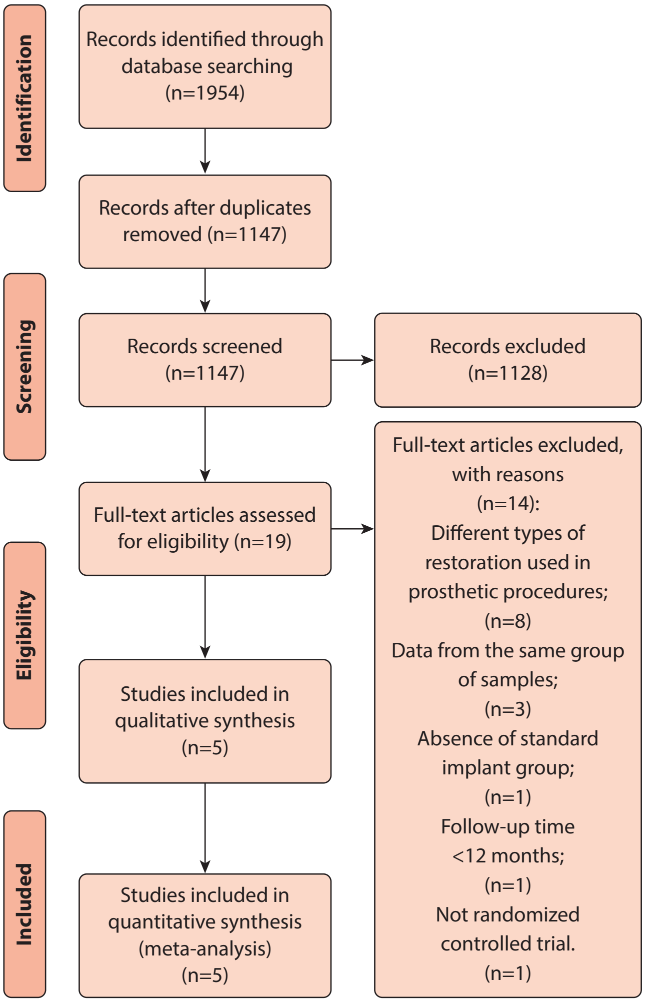

Figure 1. Search strategy according to PRISMA statement.

Table 2. Characteristics of studies included (*n*=5)

Author	Year	Country	Number of Participants (Participants Dropped out)	Number of Implants	Arch	Test and Control Group (mm Long × mm Wide Implants)	Crown-To-Implant Ratio
Gulje, F. L.	2014	Netherlands	Short: 21 (0) Long: 20 (1)	Short: 21 Long: 20	Maxilla	Test: 6×4 Control: 11×4	Short: NR Long: NR
Rossi, F.	2015	Italy	Short: 30 (0) Long: 30 (0)	Short: 30 Long: 30	Maxilla and Mandible	Test: 6×4.1 Control: 10×4.1	Short: 1.49 (SD, 0.36) Long: 0.95 (SD, 0.21)
Naenni, N.	2018	Switzerland	Short: 47 (3) Long: 47 (1)	Short: 47 Long: 47	Maxilla and Mandible	Test: 6×4.1 Control: 10×4.1	Short: 1.75 (IQR, 1.50 to 1.90) Long: 1.04 (IQR, 0.95 to 1.15)
Thoma, D. S.	2018	Switzerland	Short: 50 (6) Long: 51 (5)	Short: 63 Long: 70	Maxilla	Test: 6×4 Control: (11, 13, or 15)×4	Short: 1.86 (SD, 0.23) Long: 0.99 (SD, 0.17)
Weerapong, K.	2019	Thailand	Short: 23 (0) Long: 23 (0)	Short: 23 Long: 23	Mandible	Test: Long: 6 Wide: Not report Control: Long: 10 Wide: Not report	Short: NR Long: NR

IQR, interquartile range; MBL, Marginal bone loss; NR, not reported; SD, standard deviation.

bone. The patients included people who had lost teeth in the posterior alveolar region. The intervention group consisted of patients who received short implants to replace the missing teeth. The comparison group consisted of patients who received standard implants with or without bone augmentation. The primary outcome was the survival rates of the implants. The secondary outcomes were MBL, technical complications, and biological complications.

The eligible studies were required to meet the following criteria: RCTs comparing short implants (≤6 mm) and standard implants (>6 mm) supporting single crowns in the posterior region of the maxilla or mandible of partially edentulous patients in the same study, with a minimum of 10 implants per group and at least 1-year follow-up period after loading. Given multiple publications involving the same group of participants, only the article with the longest follow-up period was included. Non-English language articles were discarded.

The detailed search strategy is shown in Table 1. Literature screening was conducted in 3 databases (MEDLINE via PubMed, EMBASE, and Cochrane Library) by 2 independent reviewers (X.X., Y.X.) for articles published before August 2, 2019. Disagreements were resolved by discussion or by involvement of a third reviewer (L.X.).

The relevant information about publication year, participants, interventions, and outcomes was extracted by 2 reviewers (X.X., Y.X.) by using a standardized form. The corresponding authors of the article were contacted for relevant missing, unclear, or unpublished data.

Two independent reviewers (B.H., Q.L.) performed the quality assessments of the selected trials by using the Cochrane Collaboration Risk of Bias tool. When there was a major disagreement, a third reviewer (L.X.) participated in the discussion until consensus was reached.

Statistical analyses were performed by using a meta-analysis software program (RevMan 5.3; Cochrane). Dichotomous variables were compared by using the Mantel-Haenszel (MH) method, and continuous variables were compared by using the inverse variance (IV) method.[24] The outcomes were aggregated and analyzed by using a random-effects model or a fixed-effects model. When I^2>50%, the random-effects model was used to merge data; otherwise, the fixed-effects model was used. The survival rates and complications were assessed by the risk ratio (RR), and MBL was assessed by the mean difference (MD) with corresponding 95% confidence intervals (CIs). The chi-square test and the I^2 statistic were used to assess heterogeneity.

RESULTS

In total, 1954 references (MEDLINE via PubMed: 723; EMBASE: 794; Cochrane Library: 437) were identified.

Table 2. *(Continued)* Characteristics of studies included (*n*=5)

Implant Systems	Mean Age	Loading Protocol	Bone Graft	Follow-up	Outcomes Measures: Standard Implants	Outcomes Measures: Short Implants
Astra Tech OsseoSpeed	49	Conventional	Standard implants with maxillary sinus floor augmentation	1 y	Survival rate: 100% Fail implants: 0 Biological complications: 0 Technical complications: 0 MBL (mean and SD): 0.1 (0.3)	Survival rate: 100% Fail implants: 0 Biological complications: 0 Technical complications: 0 MBL (mean and SD): 0.1 (0.2)
Straumann	48	Early	Bone augmentation not performed	5 y	Survival rate: 96.7% Fail implants: 1 Biological complications: NR Technical complications: 0 MBL (mean and SD): 0.18 (0.57)	Survival rate: 86.7% Fail implants: 4 Biological complications: NR Technical complications: 0 MBL (mean and SD): 0.14 (0.49)
Straumann	58	Early	Standard implants with maxillary sinus floor augmentation	5 y	Survival rate: 100% Fail implants: 0 Biological complications: NR Technical complications: NR MBL (mean and SD): 0.12 (0.8)	Survival rate: 91% Fail implants: 4 Biological complications: NR Technical complications: NR MBL (mean and SD): 0.13 (0.77)
Astra Tech OsseoSpeed	51	Delay	Standard implants with maxillary sinus floor augmentation	5 y	Survival rate: 100% Fail implants: 0 Biological complications: 9 Technical complications: 14 MBL (mean and SD): 0.18 (0.96)	Survival rate: 98% Fail implants: 1 Biological complications: 5 Technical complications: 21 MBL (mean and SD): 0.12 (0.54)
PW+	51	Immediate	Bone augmentation not performed	1 y	Survival rate: 95.65% Fail implants: 1 Biological complications: NR Technical complications: 2 (interim restoration) MBL (mean and SD): 0.26 (0.27)	Survival rate: 91.30% Fail implants: 2 Biological complications: NR Technical complications: 3 (interim restoration) MBL (mean and SD): 0.33 (0.47)

After removing the duplicate references, 1147 references were selected for title and abstract screening, and 19 articles were selected for full-text review. After applying the inclusion or exclusion criteria, 5 RCTs[19,20,25-27] were included in this study (Fig. 1).

Studies were excluded for the following reasons: 8 studies[12-14,28-32] used different types of restoration in the prosthetic procedures; 3 studies[33-35] reported data from the same group of participants; 1 study[36] contained only 2 implants with a length ≤6 mm; 1 study[37] had a follow-up time <12 months; and 1 study[38] was not an RCT.

Table 2 shows the characteristics of the 5 included studies. In total, 372 implants (group short: 184; group standard: 188) were installed in 281 participants with a mean age of 52 years. In all 5 studies, participants who received 6-mm-long implants were divided into the test group. The control groups contained a variety of implant lengths ranging from 10 to 15 mm.

Table 3 shows the quality assessment of the included studies. The Cochrane criteria indicated a low risk of bias for the random sequence generation and allocation concealment. However, it is difficult to blind the surgeon and participants during bone augmentation or the dental implant placement procedure even though the blinding of participants was attempted. All studies reported complete results without selective outcome reporting (Figs. 2, 3).

Three studies[19,20,26] were followed up to 5 years. Gulje et al[27] reported 1-year follow-up data in a manuscript published in 2014; therefore, the reviewer contacted the corresponding author and learned that the 5-year report of the trial was under revision and the number of surviving implants at the 5-year follow-up was obtained. One participant (11-mm group) died before the 12-month evaluation, 1 participant (6-mm group) moved without leaving an address, 1 participant (6-mm group) lost an implant at 4 years, and the remaining 38 participants completed 60 months of follow-up. To minimize bias, the unpublished data were included in the meta-analysis.[39]

The meta-analysis indicated that short implants (≤6 mm) had a survival rate similar to that of standard implants (>6 mm) at the 1-year follow-up (*P*=.72; RR: 0.99; 95% CI: 0.97-1.02) (Fig. 4); however, long-term follow-up showed that short implants had a poorer survival rate than standard implants (*P*=.01; RR: 0.94; 95% CI: 0.90-0.99) (Fig. 5). The heterogeneity test did not reach statistical significance, suggesting low between-study heterogeneity.

Four studies[19,20,25,27] reported no significant difference in the MBL between the test group and the control group. Only Rossi et al[26] reported significant differences. However, the marginal bone resorption between the time of prosthesis implantation and after 5 years of function was only 0.14 mm in the short group and 0.18 mm in the standard group, with limited clinical significance. Naenni et al[20] reported the interquartile range of MBL; therefore,

Table 3. Risk of bias assessment of included studies

Bias	Gulje, F.L.	Rossi, F.
Random sequence generation	Low risk: A block randomization sequence was used.	Unclear risk: no information provided
Allocation concealment	Low risk: The information of treatment allocation was enclosed in a sealed envelope.	Low risk: Sealed numbered envelopes were prepared from the monitor.
Blinding of participants and personnel	High risk: difficulty of blinding the surgeon and participants during bone augmentation or procedure of placement dental implants	High risk: difficulty of blinding the surgeon during the procedure of placement dental implants
Blinding of outcomes assessment	Unclear risk: no information provided	Unclear risk: no information provided
Incomplete outcome data	Low risk: drop-out or lost to follow information provided	Low risk: drop-out/lost to follow information provided
Selective reporting	Low risk: reported all the intended outcomes described in the methodology of this study	Low risk: reported all the intended outcomes described in the methodology of this study
Other bias	Low risk: The study appears to be free of other sources of bias.	Low risk: The study appears to be free of other sources of bias.

Naenni, N.	Thoma, D.S.	Weerapong, K.
Low risk: Randomization was performed according to a computer-generated randomization list.	Low risk: A block randomization sequence was used.	Low risk: Randomization was performed according to a computer-generated randomization list.
Unclear risk: no information provided	Low risk: The randomization was performed at the day of surgery after flap elevation by using a sealed envelope.	Unclear risk: no information provided
High risk: difficulty of blinding the surgeon and participants during bone augmentation or procedure of placement dental implants	High risk: difficulty of blinding the surgeon and participants during bone augmentation or procedure of placement dental implants	High risk: difficulty of blinding the surgeon during the procedure of placement dental implants
Low risk: Statistical analyses were performed with the average values of 2 independent examiners' measurements.	Low risk: Clinical evaluation of the outcome was performed by an independent examiner without the knowledge of the group allocation.	Low risk: Clinical evaluation of the outcome was performed by 2 independent examiners.
Low risk: drop-out/lost to follow information provided	Low risk: drop-out/lost to follow information provided	Low risk: drop-out/lost to follow information provided
Low risk: reported all the intended outcomes described in the methodology of this study	Low risk: reported all the intended outcomes described in the methodology of this study	Low risk: reported all the intended outcomes described in the methodology of this study
Low risk: The study appears to be free of other sources of bias.	High risk: Eleven participants dropped out for various reasons that may affect the outcome.	Low risk: The study appears to be free of other sources of bias.

the corresponding author was contacted for the mean values and standard deviations of MBL. In general, the MBL stabilized after the first year of function.[40] It was impossible to extract 1-year follow-up MBL data for 1 study.[20] Therefore, only the final follow-up data for MBL were used for the meta-analysis. Figure 6 shows the MBL forest plot. The fixed-effects model did not show a statistically significant difference (P=.94; MD: 0.00; 95% CI: −0.10 to 0.11).

Thoma et al[19] reported the exact number of biological complications (group short: 5; group standard: 9) and technical complications (group short: 21; group standard: 14) that occurred on the implant level during the entire study period. Naenni et al[20] reported a few technical complications that occurred but did not report an exact number of events. Weerapong et al[25] reported that 5 interim crowns fractured (group short: 3; group standard: 2), but no restoration failure occurred with the definitive restorations. Because of various complications reported with different definitions, a meta-analysis of complications could not be performed in the present study.

DISCUSSION

The present study reviewed the evidence regarding nonsplinted crowns supported by short implants in the posterior alveolar bone. The first null hypothesis was rejected because long-term follow-up comparisons indicated that short implants (≤6 mm) have a poorer survival rate than standard implants (>6 mm). The second hypothesis was accepted because no significant differences were found in MBL.

Over the last decades, chemical, electrochemical, and laser treatments have been used to modify implant surfaces, and these treatments have resulted in more rapid formation of new bone, increased BIC area, and improved bone anchorage.[3] Hence, short implants with a rough surface have been viewed as a favorable, straightforward alternative in atrophic jaws.[18] However, studies[6,10,16] have not reported consistent results regarding the survival rate of short implants compared with standard implants.

Lemos et al[6] reported that implants with lengths <8 mm have a significantly higher implant failure rate than longer implants. Papaspyridakos et al[16] reported that short implants (≤6 mm) demonstrated a 29% higher risk of failure than implants longer than 6 mm. Similarly, the present meta-analysis found a significant difference in the 5-year survival rate. In addition to the aforementioned studies,[6,16] numerous systematic reviews and meta-analyses have claimed that short implants can

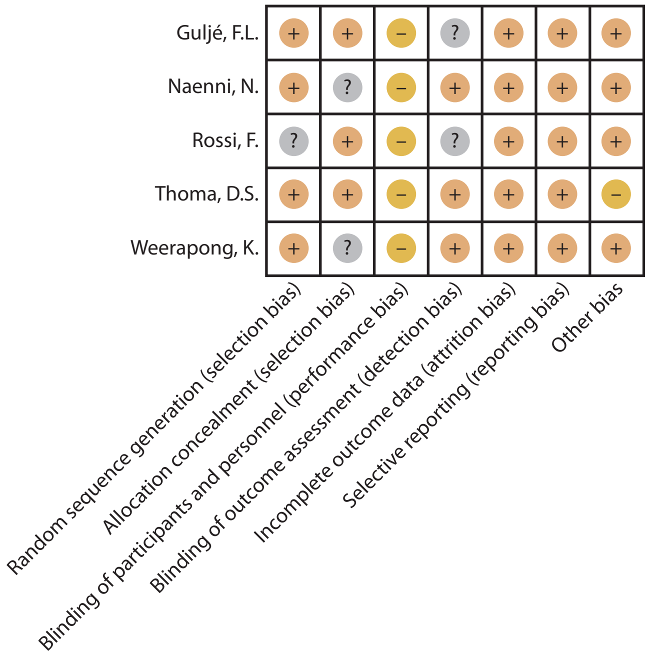

Figure 2. Risk of bias summary.

achieve a survival rate similar to that of standard implants.[5,7-10,15]

Several factors may affect the results. First, different types of prosthetics were combined for analysis in previous studies,[5,6,8-10,16] making interpreting the results and drawing firm conclusions difficult. Nonsplinted implant-supported crowns are easier to clean, have a passively fitting framework, and typically have better esthetics. However, splinting implant crowns leads to less stress transmitted to each bone-implant interface.[22,23] Mendonca et al[23] suggested that single restorations in the posterior region could be more susceptible to high masticatory forces. Notably, both Rossi et al[26] and Naenni et al[20] reported unexpected loss of stability of the implant without detection of bone loss in a 6-mm implant group. The authors believed that this finding may be related to overload,[41] which requires further investigation and analysis to clarify.

Some meta-analyses[5,9,10] combined studies with different follow-up durations; studies that follow up participants for only 1 year after loading are insufficient to recommend the use of short implants because both treatments are effective and achieve high survival rates in the short term.[15] Nevertheless, recent studies have found that the survival rate of short implants decreases to a greater degree than that of longer implants as a function of time,[17,20] which was confirmed by the results of the present study.

Most implants included in the 5-year comparison were inserted in the posterior maxillary region with a poorer survival rate than mandibular implants.[11,18] This difference could be attributed to the generally higher bone density of the mandible,[42] improved mechanical properties of the bone-implant interface, and reduced stress concentration in bone, thereby facilitating primary stability and early osseointegration and compensating for the reduction in implant length.[4] Given the limited number of participants included in the study, further analysis of the influence of bone density was not performed. Future studies should determine whether the alveolar bone density affects the survival rate of short implants supporting single crowns.

MBL has been reported to be a factor contributing to implant failure; clear clinical evidence has suggested that the implant design, clinical handling, and patient characteristics can cause MBL.[43] However, the relationship between mechanical force and MBL is unclear. A biomechanical study reported that a higher C/I ratio may increase stress around the implant shoulders and induce bone loss.[44] In a prospective study, Malchiodi et al[45] reported greater MBL with increased C/I ratios. However, other studies have indicated that a higher C/I ratio does not increase MBL.[2,6,16] The present study, which eliminated the interference of different types of dental implant restoration, suggested that although short implants have a higher C/I ratio, they do not affect MBL.

The incidence of technical and biological complications is considered a critical element in choosing the treatment strategy. Short implants offer a valid method that can alleviate the need for additional surgical bone augmentation and reduce treatment time and cost,[5,19] which can increase the patient's overall satisfaction and acceptance of treatment. These aspects were not reported in most included studies. Future studies should pay more attention to patient-centered outcomes such as patient satisfaction.

In the present systematic review, a structured search strategy was used to ensure that all relevant studies were included. To accommodate the highest level of evidence, only RCTs were included in the meta-analysis. All 5 included articles were published within the last 5 years and therefore had good timeliness. Nonetheless, all meta-analyses, including the present analysis, have limitations. A low number of participants and a low number of implant insertions were included; it is difficult to blind the surgeon and participants during bone augmentation or placement of dental implants, contributing to a higher risk of performance bias, although the blinding of participants was attempted. One study[19] reported a 10% patient dropout for various reasons and that these participants could not be contacted, which may have affected the survival rate and could account for the mild heterogeneity found in the meta-analysis. These factors could impact the outcomes and thereby influence the

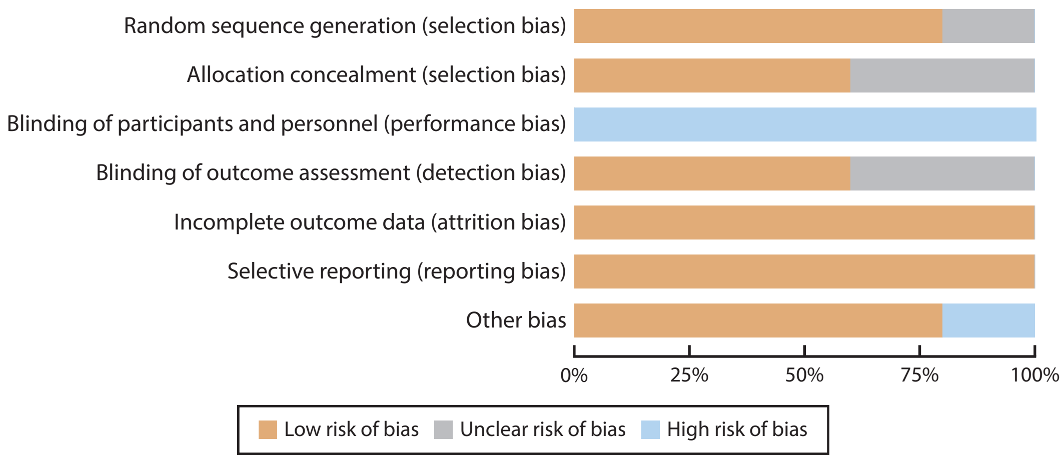

Figure 3. Risk of bias graph.

Study or Subgroup	Short Events	Short Total	Standard Events	Standard Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Guljé, F. L.	21	21	19	19	11.0%	1.00 (0.91, 1.10)
Naenni, N.	47	47	47	47	25.6%	1.00 (0.96, 1.04)
Rossi, F.	29	30	29	30	15.6%	1.00 (0.91, 1.10)
Thoma, D. S.	63	63	69	69	35.8%	1.00 (0.97, 1.03)
Weerapong, K.	21	23	22	23	11.9%	0.95 (0.82, 1.11)
Total (95% CI)		**184**		**188**	**100.0%**	**0.99 (0.97, 1.02)**
Total events	181		186			

Heterogeneity: χ^2=0.50; df=4 (*P*=.97); I^2=0%
Test for overall effect: Z=0.36 (*P*=.72)

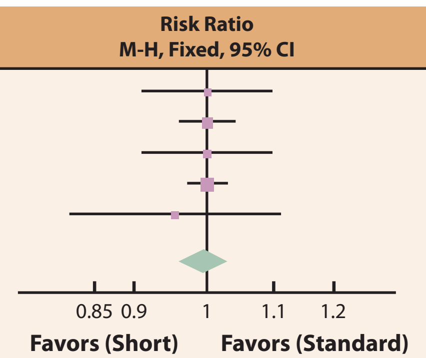

Figure 4. Forest plot of survival rate comparing short implants with standard implants in 1 year. CI, confidence interval.

Study or Subgroup	Short Events	Short Total	Standard Events	Standard Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Guljé, F. L.	20	21	19	19	12.9%	0.96 (0.84, 1.09)
Naenni, N.	40	44	46	46	28.8%	0.91 (0.82, 1.01)
Rossi, F.	26	30	29	30	18.4%	0.90 (0.77, 1.05)
Thoma, D. S.	60	61	64	64	39.9%	0.98 (0.94, 1.03)
Total (95% CI)		**156**		**159**	**100.0%**	**0.94 (0.90, 0.99)**
Total events	146		158			

Heterogeneity: χ^2=4.36; df=3 (*P*=.23); I^2=31%
Test for overall effect: Z=2.45 (*P*=.01)

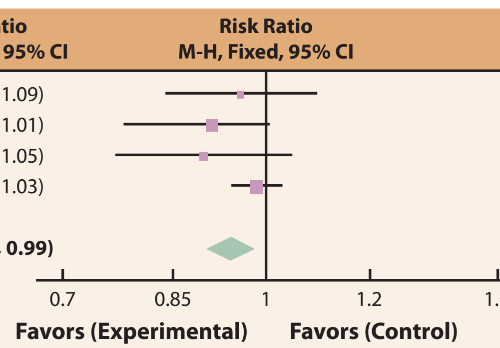

Figure 5. Forest plot of survival rate comparing short implants with standard implants in 5 year. CI, confidence interval.

results of the present study. More long-term clinical studies are needed to confirm these results.

CONCLUSIONS

Based on the findings of this systematic review and meta-analysis, the following conclusions were drawn:

1. Although short implants have a higher C/I ratio, they do not affect MBL.
2. Long-term follow-up comparisons indicated that short implants (≤6 mm) have a poorer survival rate than standard implants (>6 mm).
3. Nonsplinted crowns supported by short implants should be used with caution in the posterior alveolar bone.
4. Additional long-term follow-up studies are required to further confirm the findings presented in this review.

Study or Subgroup	Short implant Mean	SD	Total	Standard implant Mean	SD	Total	Weight	Mean Difference IV, Random 95% CI	Mean Difference IV, Random, 95% CI
Guljé, F. L.	0.1	0.2	21	0.1	0.3	19	42.3%	0.00 (−0.16, 0.16)	
Naenni, N.	0.13	0.77	40	0.12	0.8	46	9.8%	0.01 (−0.32, 0.34)	
Rossi, F.	0.14	0.49	30	0.18	0.57	30	14.9%	−0.04 (−0.31, 0.23)	
Thoma, D. S.	0.12	0.54	44	0.18	0.96	49	11.0%	−0.06 (−0.37, 0.25)	
Weerapong, K.	0.33	0.47	23	0.26	0.27	23	22.0%	0.07 (−0.15, 0.29)	
Total (95% CI)			**158**			**167**	**100.0%**	**0.00 (−0.10, 0.11)**	

Heterogeneity: τ^2=0.00; χ^2=0.61; df=4 (*P*=.96); I^2=0%
Test for overall effect: Z=0.07 (*P*=.94)

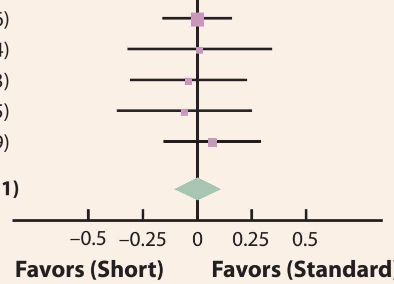

Figure 6. Forest plot of marginal bone loss comparing short implants with standard implants at final follow-up measurement. CI, confidence interval.

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Corresponding author:
Dr Ling Xu
Department of Prosthodontics
Stomatological Hospital of Chongqing Medical University
426# Songshibei Road
Yubei District, Chongqing 401147
PR CHINA
Email: 500203@hospital.cqmu.edu.cn

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Noteworthy Abstracts of the Current Literature

Treatment outcomes of implant-supported maxillary obturator prostheses in patients with maxillary defects: A systematic review

Pedro Molinero-Mourelle, Alexandra Helm, Carlos Cobo-Vázquez, Walter Yh Lam, Luís Azevedo, Edmond Hn Pow, Miguel Gómez-Polo

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Purpose. To systematically review the current evidence on clinical and patient-reported outcomes of implant-supported palatal obturator prostheses.

Material and methods. An electronic search of the PubMed, Web of Science, and Cochrane databases was carried out in June 2019. The titles and abstracts of all articles were screened by two independent reviewers. The references of the subsequently selected studies were further screened for potential articles. Assessment of the selected full texts was performed independently according to established inclusion and exclusion criteria. The quality of the selected studies was determined using the Newcastle-Ottawa scale. Interrater agreement on study selection was calculated using Cohen kappa statistic.

Results. The search yielded a total of 2,797 records. Ten studies were selected for data extraction, with a Cohen kappa value of 0.856. Five studies were prospective, and five were retrospective. The survival rates for conventional implants ranged from 21.42% to 100%, whereas for zygomatic implants, the survival rates varied from 30% to 100%. Four studies reported prosthodontic complications, with screw loosening being the most common. Patient quality of life (QoL) was analyzed in six studies.

Conclusions. In spite of the limitations of the present review, it can be concluded that the clinical outcomes are acceptable in terms of survival rates, implant and prosthodontic complications, and QoL associated with implant-supported maxillary obturator prostheses. QoL of implant-supported prostheses in these patients are acceptable. The general study design was not homogenous between studies.