AUTHOR QUERY FORM

Dear Author,
During the preparation of your manuscript for publication, the questions listed below have arisen. Please attend to these matters and return this form with your proof.
Many thanks for your assistance.

Query References	**Query**	**Remarks**
Q1	Please confirm that given names (blue) and surnames/family names (vermilion) have been identified and spelled correctly.	
Q2	References [15,88,96] and [76,94,105] were identical, hence the latter has been deleted from the reference list and sequenced in the text and list.	
Q3	Please note that a page charge of $100 per each additional page will be applied if the proof exceeds the allowed free page limit (first 7 pages, including tables and figures). Please refer to the Author Guidelines (https://onlinelibrary.wiley.com/page/journal/17088208/homepage/forauthors.html). Kindly download the page charge form located at the upper left corner of the proofing site (under Reviewing Options), and upload the completed form back to the system or email it to the PE.	

SPi	Journal Code	Article ID	Dispatch: 25-AUG-20	CE: Aruna.R
	CID	12946	No. of Pages: 15	ME:

Received: 17 June 2020 | Revised: 8 August 2020 | Accepted: 12 August 2020

DOI: 10.1111/cid.12946

SYSTEMATIC REVIEWS AND META-ANALYSIS

WILEY

Are <7-mm long implants in native bone as effective as longer implants in augmented bone for the rehabilitation of posterior atrophic jaws? A systematic review and meta-analysis

Q1
Giovanna Iezzi DDS, PhD[1]† | Vittoria Perrotti DDS, PhD[1]† | Pietro Felice MD, DDS, PhD[2] | Carlo Barausse DDS, PhD[2] | Adriano Piattelli MD, DDS, DrHC, DrHC[1,3,4] | Massimo Del Fabbro MSc, PhD[5,6]

[1]Department of Medical, Oral and Biotechnological Sciences, University of Chieti-Pescara "Gabriele D'Annunzio", Chieti, Italy

[2]Oral Surgery, Department of Biomedical and Neuromotor Sciences, University of Bologna, Bologna, Italy

[3]Biomaterials Engineering, Catholic University of San Antonio de Murcia (UCAM), Murcia, Spain

[4]Fondazione Villaserena per la Ricerca, Città Sant'Angelo, Pescara, Italy

[5]Department of Biomedical, Surgical and Dental Sciences, University of Milan, Milan, Italy

[6]Dental Clinic, IRCCS Orthopedic Institute Galeazzi, Milan, Italy

Correspondence
Massimo Del Fabbro, Department of Biomedical, Surgical and Dental Sciences, University of Milan, IRCCS Orthopedic Institute Galeazzi, Via R. Galeazzi 4, 20161 Milan, Italy.
Email: massimo.delfabbro@unimi.it

Abstract

Purpose: To compare clinical and radiographic outcomes of <7 mm short (SH) implants inserted in native bone vs longer (ST) implants placed in vertically augmented partially edentulous posterior jaws. A further aim was to evaluate if the residual bone dimension plays a role in the outcomes of SH and extra-SH implants.

Materials and Methods: This review was registered with PROSPERO. An electronic literature search was performed on PubMed, Scopus and Web of Science. Randomized controlled trials (RCTs) with at least 1-year follow-up, comparing fixed prostheses supported by SH vs ST implants in augmented sites were included. Marginal bone level (MBL) changes, implant survival rate, and complications were evaluated through a meta-analysis. Subgroup analysis was performed dividing the SH implants according to length at each follow-up (1-, 3-, 5-year of function).

Results: Twenty-five articles fulfilled the inclusion criteria, featuring a total of 650 SH implants placed in 415 patients and 685 ST implants placed in 403 patients. There was a trend for a significantly lower MBL associated with SH implants respect to ST implants at each follow-up, whilst there was no evidence of a difference in failure rates between SH and ST implants, for any SH length considered and at any follow-up. There was evidence for a lower incidence of complications in favor of SH implants at both 1-year ($P < .0001$) and 3-year follow-up ($P = .01$), while at 5-year follow-up there was no evidence of a difference between SH and ST groups ($P = .30$).

Conclusion: SH implants supporting partial fixed rehabilitations represent a valuable alternative to augmentation procedures in the medium term. While the performance of implants at least 5-mm long is well documented, more studies with at least 5-year follow-up are needed to confirm the promising outcomes observed with <5 mm-long fixtures.

KEYWORDS

complications, dental implants, extra-short implants, marginal bone loss, short implants, survival rate

† These authors share the first position.

1 | INTRODUCTION

Often in atrophic jaws it is not possible to place standard length (ST) dental implants due to the limited residual vertical height. Clinicians are faced with the dilemma, especially in partially edentulous posterior jaws, whether to augment bone or to place short (SH) implants. Indeed, following tooth extraction, the bony socket undergoes a series of adaptive, both vertical and horizontal, modifications.[1,2] These morphological changes reduce bone height[3] and often lead clinicians to opt for more complex and time-consuming techniques. Indeed, to achieve sufficient vertical bone volume in cases of atrophic arches, invasive surgical procedures, such as maxillary sinus floor elevation (SFE), guided bone regeneration (GBR), onlay bone grafts, distraction osteogenesis, and inferior alveolar nerve transpositioning have been employed over the past 40 years.[4,5] Using these techniques with or without bone grafting, conventional implants can be placed in the augmented sites, achieving success and survival rates typically greater than 90% in long-term evaluations.[6,7] However, despite the well-documented efficacy of these techniques, some drawbacks exist, such as increased cost and duration of the treatment, risk of infections, graft failure, post-operative sinusitis, limited amount of bone gain.[8-11] Furthermore, high skills of the operators are required because augmentation procedures are technically demanding.[12]

At present, less invasive approaches are advocated and encouraged by the advances in technology and by the enhanced knowledge of implant microstructure as well as by the related refinements of implant design and surface topography.[5,13] For these reasons, implants of reduced length (<10 mm) have evolved into a clinically feasible option to regenerative procedures and ST implant placement.[14-16] Indeed, their use has been claimed to avoid the disadvantages of ST implants in conjunction with augmentation procedures and has been positively correlated with a decrease of biologic complications, overall chair time, total cost,[8] and favorable patient-reported outcomes.[10] Their upsides can be attributed to their ease of placement as they require a less complicated surgical approach; to the greater likelihood of avoiding advanced bone grafting procedures; to the possibility to use them in cases when SFE surgery is not applicable due to maxillary sinusitis, maxillary cyst, and other conditions involving abnormal sinus anatomy.[4] However, due to the reduced length, implant site preparation can be difficult because it has to be very precise without possibilities of corrections. Augmentation procedures are also related to better esthetic results due to long prosthetic crowns rehabilitations associated with SH implants placed in atrophic jaws.

Besides, the definition of SH implants has been variable throughout the last decade, gradually evolving to decreased lengths. Standardization and consistency are needed for a proper assessment of data drawn from comparative studies over the years. In 2018, Palacios et al defined a SH implant as being ≤10 mm in length.[17] At present, a clear definition for SH implant length has not emerged in the literature, and there are authors determining it to be ≤6 mm,[18] ≤8 mm,[19] or ≤ 10 mm.[20] Nevertheless, the current tendency is to classify implants ≤6 mm as either a SH[21] or extra-SH[22,23] implants.

Recent clinical trials have shown positive outcomes in the short and long-term use of SH and extra-SH implants, reporting survival rates comparable to those of ST implants.[13,17,24-27] These promising results are currently leading clinicians toward placing shorter implants, even where native bone is a potentially adequate recipient of longer counterparts.[28,29] However, there is not enough evidence on the performance of restorations supported by SH implants on atrophic jaws. The global shift in the dental field toward minimally invasive approaches demands for evidence-based data to enable patient care with decreased postoperative pain and healing duration.

Thus, the main aim of the present systematic review was to evaluate the current evidence on the efficacy of SH and extra-SH implants inserted in native bone of partially edentulous and atrophic posterior jaws as compared to ST implants in augmented sites, based on meta-analysis of randomized controlled trials (RCTs). Our null hypothesis was that the peri-implant marginal bone level (MBL) changes, implant survival rate, biological, technical complications of SH implants (<7 mm long) were comparable to longer implants placed in combination with augmentation procedures, in atrophic alveolar bone. A further aim was to evaluate if the residual bone dimension plays a role in the outcomes of SH and extra-SH implants.

2 | MATERIAL AND METHODS

This systematic review was prepared according to the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement.[30] The focused PICO question of the search[31,32] (Population, Intervention, Comparison, Outcomes) was: "Does residual bone height (4-7 mm) before implant placement impact on the outcomes of SH implants (<7 mm) placed in native bone compared to ST implants (≥ 7 mm) inserted in regenerated bone?" The review record has been registered by the International prospective register of systematic reviews PROSPERO under the identification number CRD42020166446.

2.1 | Search strategy

An electronic search on scientific databases (PubMed/Medline, Scopus, Web of Science) was performed for identifying clinical studies starting from 2006 using the following terms and keywords alone or in combination: (short implants OR extra short implants OR ultra-short implants OR super short implants OR short dental implants OR 5 mm dental implants OR 6 mm implants OR 7 mm implants OR reduced implants length OR regular implants OR long implants OR regular length implants OR standard implants) AND (maxillary sinus OR sinus floor elevation OR sinus lift OR maxillary sinus augmentation OR antrum OR crestal approach OR lateral approach OR OSFE OR BAOSFE OR Summers technique OR interpositional bone graft OR sandwich graft OR vertical augmentation OR osteotome sinus floor elevation OR transcrestal sinus floor elevation OR inlay OR onlay OR bone graft OR bone substitute) AND (maxilla OR maxillae OR mandible OR jaws OR dental arches OR partially edentulous OR atrophic maxilla OR atrophic mandible). Appropriate syntaxis was used for each database.

The search was limited to studies published in English language. The last electronic search was performed on 1 May 2020. In addition to the electronic search, a hand search was undertaken on the main Journals in the field of dental implants: *Clinical Implant Dentistry and Related Research*, *Clinical Oral Implants Research*, *European Journal of Oral Implantology*, *International Journal of Oral Implantology*, *Implant Dentistry*, *International Journal of Periodontics and Restorative Dentistry*, *Journal of Clinical Periodontology*, *Journal of Oral Implantology*, *Journal of Oral and Maxillofacial Implants*, *Journal of Oral and Maxillofacial Surgery*, *British Journal of Oral and Maxillofacial Surgery*, *Journal of Periodontology*.

Furthermore, the reference lists of the selected studies and of the main systematic reviews on short implants were manually screened in order to identify further eligible studies. A reference manager software program (Endnote X9.3.2, Clarivate Analytics) was used and the duplicates were discarded electronically.

2.2 | Eligibility criteria

2.2.1 | Inclusion criteria

RCTs and prospective controlled trials with at least 1-year follow-up, that compared dental implants <7 mm-long (SH) inserted in native bone vs implants ≥7 mm-long (ST). All implants had to be inserted in posterior and partially edentulous mandibular and/or maxillary sites having a residual bone height of 4-8 mm. In the ST group, edentulous sites intended for implant placement had to be reconstructed by grafting procedures, such as maxillary sinus augmentation (either transcrestal or lateral approach) and/or inlay technique. Studies with both parallel and split-mouth design, with at least 10 patients per group, were included. Patients had to be at least 18 years old. No limitation regarding prosthesis type, number of implants per patient, loading protocol (immediate, early or delayed), and timing of implant insertion respect to augmentation in the ST group (simultaneous or delayed).

2.2.2 | Exclusion criteria

In vitro and preclinical studies (animal and computer simulations); case reports or case series; retrospective observational studies; articles in which ST implants were inserted in native bone; articles assessing SH implants in regenerated bone; articles assessing only SH implants; implants inserted in fresh post-extraction sites; studies in which SH implants were splinted with ST implants; comparative studies with less than 10 patients in each group. Studies were also excluded in case of insufficient information regarding number of patients, number of implants in the two groups, implant length, follow-up duration, MBL and/or implant survival separated for each group, and residual bone height.

2.3 | Focused PICO question

2.3.1 | Participants

Patients with atrophic edentulous ridge of 4 to 8 mm residual height, candidate for fixed prosthesis supported by dental implants.

Intervention: placement of SH implants (<7 mm-long) in atrophic edentulous ridges.

2.3.2 | Comparison

ST implants (≥7 mm-long) inserted in atrophic edentulous ridges regenerated through augmentation procedures.

2.3.3 | Outcomes

Peri-implant MBL and implant survival rate, in different follow-up periods (1 year, >1 to 3 years, >3 to 5 years, >5 years) were the primary outcomes; secondary outcomes were biological or technical complications at the same follow-up periods.

2.4 | Selection of studies

The retrieved citations were independently screened by two authors (VP and GI), and the relevant studies were identified based on title and abstract. If title and abstract did not provide sufficient information with regards to the inclusion criteria, the full text was obtained as well. For all eligible studies, the full text was obtained and evaluated to assess if the study met the inclusion criteria. Any disagreements on the selection of studies were resolved by discussion, and a third reviewer was consulted to make a final decision (MDF). During full-text assessment, the reasons for excluding articles were reported.

In case of multiple publications of the same patient population, only the one with the longest follow-up period was referred to in the text, and the others were considered for data analysis.

2.5 | Data extraction and method of analysis

Two reviewers (VP and GI) independently extracted the data of all included studies using a predesigned extraction form. The software Microsoft Excel 2016 (Microsoft Office, Microsoft Corporation, Redmond, Washington) was used for data collection and for descriptive analysis. The following data were collected: author(s), study design, language of publication, year of publication, study design, duration of the study, residual bone height at the intended implant site, augmentation technique, patients general characteristics (number, mean age, age range, gender) and local features (residual bone height (RBH), residual bone width (RBW)), implant characteristics (number, length, diameter, location, company, surface, loading), prosthetic characteristics (abutment connection, type of retention, crown to implant ratio, rehabilitation method), drop-out/lost to follow-up, follow-up duration, number and timing of implant failures, implant and prosthesis survival rates, MBL at different follow-ups, number and timing of biologic, technical/mechanical complications, and patient-centered outcomes. The primary outcomes included MBL and survival rate of dental implants. Secondary outcomes were biological or technical complications. Outcomes were evaluated at 1-year follow-up and at any subsequent follow-up reported by the studies.

2.6 | Risk of bias assessment

The risk of bias of the included studies was assessed independently by two reviewers (VP and GI), as part of data extraction procedure, using a modified Cochrane Collaboration's tool for RCTs. As it was practically unfeasible to keep patients and operators blinded to treatment, the related performance bias (blinding of participants and personnel) was not accounted for. Each item was answered as yes (low risk of bias), no (high risk of bias), or unclear. Based on the domains, the studies were categorized at low risk of bias if all domains were at low risk; moderate risk of bias if one or more domains were at unclear risk, and high risk of bias if one or more domains were at high risk. The ROBINS-I tool was used for non-randomized studies.[33] Any disagreement was resolved by discussion or consulting a third reviewer (MDF) until consensus was achieved.

2.7 | Statistical analysis

For quantitative continuous outcomes like MBL changes, weighted mean values and weighted mean differences (WMDs) were calculated at each follow-up considered. For these outcomes, mean differences and 95% confidence interval (CI) were used to summarize the results for each included study. The effect size for quantitative primary outcome was estimated using the WMD. For quantitative dichotomous outcomes (implant survival, complications) the effect size was estimated using risk ratio (RR). Meta-analysis was performed using Review Manager 5.3 software (RevMan 5.3, Version 5.3.5 Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014), using the fixed or random effects models, as appropriate. The heterogeneity was evaluated by Q Cochrane test, the related *P* values, and I^2.Fixed effects meta-analysis was used when the heterogeneity was small (i^2 < 60%, P > .05). When the heterogeneity was large (i^2 > 60%, P < .05), a random-effects model analysis was undertaken. Parallel group and split mouth studies were combined in the meta-analysis of treatment effects. Subgroup analysis was performed categorizing the SH implants according to length (<5 mm; 5 to <6 mm, 6 to <7 mm). Meta-analysis was performed if the data of at least two studies could be combined. The patient, or the patient's side for split-mouth studies, was considered as the unit of analysis. Data from split-mouth studies were combined with data from trials of parallel groups design by using the generic inverse variance method in RevMan, as indicated by Elbourne et al.[34] Significance level was set at P = 0.05. Correlation analysis was also undertaken by using the implant length, the implant diameter, the residual bone height or the residual bone width as independent variable, and MBL or implant survival rate as the dependent variable. This analysis was conducted only on the SH implants at each follow-up. As the individual patients' data were not available, the mean values of these variables for each study were used for correlation analysis. The linear correlation coefficient r^2 was estimated using the appropriate function of Microsoft Excel. Finally, the quality of evidence for each meta-analysis undertaken was estimated by using GRADEprofiler software (Version 3.6.1, https://gradepro.org/). The quality of evidence was downgraded considering risk of bias, inconsistency, indirectness, imprecision, and publication bias, and upgraded considering the effect magnitude. Quality was expressed as high, moderate, low, and very low.

3 | RESULTS

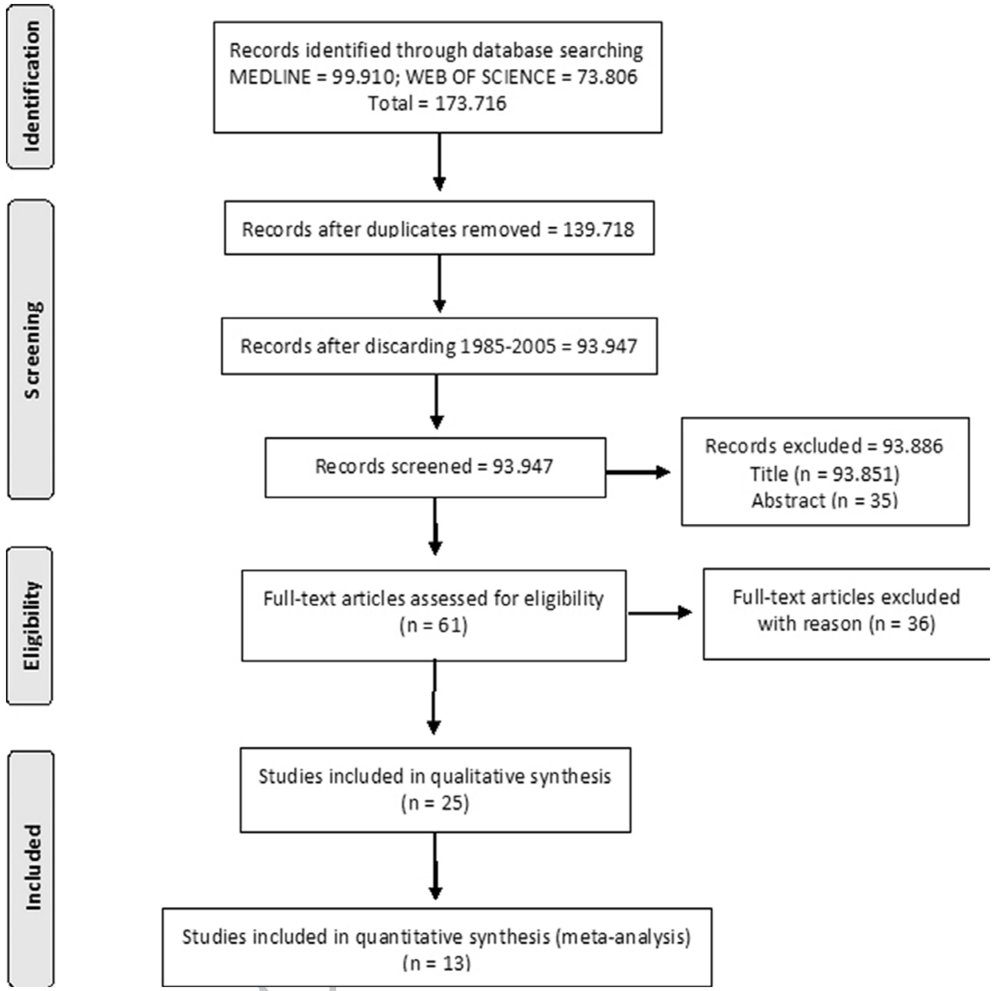
3.1 | Study characteristics

Figure 1 is a flowchart of the screening process. In total, 13 studies[8,35-46] were included in this systematic review. For five of them[35-37,41,44] the results were reported in multiple publications, so that a total of 25 articles[8,10,35-57] were considered in the analysis. Thirty-six articles[15,58-92] were excluded after full-text evaluation. Table 1 reports the list of excluded studies with the main reasons for exclusion. Table 2 reports the main characteristics of the included studies. In total, 650 implants shorter than 7 mm were placed in 415 patients and 685 implants of ST were placed in 403 patients that underwent an augmentation procedure. There were 293 maxillary sinus augmentations, and 110 mandibular ridge augmentation procedures. As there were three studies with a split-mouth design, that recruited a total of 80 patients, the total number of patients enrolled in the 13 studies was 738. Four studies had a follow-up of 1 year,[38-40,43] one of 2 years,[46] three of 3 years,[8,42,45] four of 5 years,[35-37,44] and one of 8 years[41] (Table 2). Six studies have been performed in Italy,[35-37,40,41,45] two in China,[39,46] one each in Brazil,[8] Iran,[43] Poland,[42] United States,[38] and a multicenter study in Austria, Spain, Switzerland, and United States.[44] Five studies treated patients in both maxilla and mandible,[35-38,40] six studies only in the maxilla,[8,39,42,44-46] and two only in the mandible.[41,43]

3.2 | Study risk-of-bias

The results of the risk-of-bias assessment for the 13 studies included is shown in Table 3. Eleven studies were judged at moderate risk of bias, and two studies at high risk.[38,42] Most studies performed a correct randomization procedure. One of them did not specify the method for obtaining the randomized sequence,[46] though allocation concealment was appropriate. One study did not provide any detail

FIGURE 1 Flowchart representing the screening process of the studies



on randomization nor on allocation concealment, though there was a statement that "The patients were randomly divided into 2 groups."[42] In most cases, sufficient details were provided for dropouts and withdrawals, and all outcomes were duly reported.

3.3 | Marginal bone level changes

In general, there was a trend for a lower marginal bone loss associated with SH implants, especially those shorter than 6 mm, respect to ST implants at each follow-up (Table 4 and Online Supplementary Figure S1 a-c). At all follow-ups the overall effect considering the mean difference (MD) was statistically significant: *P* = .0009 at 1-year (MD: −0.11 mm), *P* = .003 at 3-year (MD: −0.18 mm), and *P* < 0.0001 at 5-year (MD: −0.18). Only at the 1-year follow-up there was a significant difference among subgroups that disappeared at 3- and 5-year follow-up. Meta-analysis for implants shorter than 5 mm could be undertaken only for 1-year follow-up, as no included study reported a longer follow-up for such SH subgroup. The test for subgroup differences in effects showed a significant difference at 1-year follow-up (<0.00001), and no significance at 3-year and 5-year follow-up (*P* = .08 and *P* = .95, respectively). Figure 2 shows the weighted mean values and standard deviations of the MBL in the three subgroups of SH implants, and in the ST implants, at each follow-up. The lower bone level change at 1 year appears to be related with the shortest implants, though it is derived only from two studies, both with only a 1-year follow-up.[40,43] The data of the longest follow-up (8-year) belong to a single study.[41] The quality of evidence was estimated as moderate at 1-year and 3-year, and low at 5-year follow-up (reasons for downgrading: risk of bias, inconsistency (heterogeneity among studies), and imprecision (low sample size) at 5-year; reason for upgrading: large effect).

3.4 | Implant survival rates

There was no evidence of a difference in survival rates between SH and ST implants, for any SH length considered and at any follow-up (Table 5 and Online Supplementary Figure S2a-c). The *P*-value for the overall effect was 0.58 at 1 year, 0.80 at 3-year, and 0.28 at 5-year follow-up. Heterogeneity among studies was moderate and did not reach significance in any case. The test for subgroup differences in effects showed no significance at any follow-up (*P* = .95, *P* = .22, and *P* = .74 at 1-year, 3-year, and 5-year, respectively). The quality of

TABLE 1 List of excluded studies (#36) and reasons for exclusion

Study & Year	Reason for exclusion
Barausse et al 2019[58]	Long implants in not regenerated sites
Guarnieri et al 2019[59]	Long implants in not regenerated sites
Guida et al 2019[60]	Long implants in not regenerated sites
Gurlek et al 2019[61]	Long implants in not regenerated
Martinolli et al 2019[62]	Long implants in not regenerated sites
Nedir et al 2019[76]	Less than 10 patients per group
Weerapong et al 2019 [64]	Long implants in not regenerated sites
Alonso et al 2018 [65]	Long implants in not regenerated sites
Benlidayi et al 2018 [66]	Long implants in not regenerated sites
Cannizzaro et al 2018 [67]	Long implants in not regenerated sites
Han et al 2018 [68]	Observational study
Naenni et al 2018 [69]	Long implants in not regenerated sites
Storelli et al 2018 [70]	Long implants in not regenerated sites
Svezia et al 2018 [71]	Long implants in not regenerated sites
Taschieri et al 2018 [73]	Long implants in not regenerated sites
Taschieri et al 2018 [72]	No data on short implants
Zadeh et al 2018 [74]	Long implants in not regenerated sites
Makowiecki et al 2017 [75]	Short implants ≥8 mm
Malchiodi et al 2017 [15]	Long implants in not regenerated sites
Nedir et al 2017 [76]	Less than 10 patients per group
Tabrizi et al 2016 [92]	Less than 10 patients per group
Anitua et al 2015 [77]	Short implants in regenerated sites
Cannizzaro et al 2015 [78]	Long implants in not regenerated sites
De Sanctis et al 2015 [79]	No data on short implants
Shi et al 2015 [80]	Trial registration
Brizuela et al 2014 [81]	No detailed data on short implants
Romeo et al 2014 [91]	Long implants in not regenerated sites
Cannizzaro et al 2013 [83]	Short implants ≥8 mm
Kennedy et al 2013 [84]	Less than 10 patients per group
Le et al 2013 [85]	Retrospective study
Telleman et al 2012 [86]	Short implants ≥8 mm
Cannizzaro et al 2009 [87]	Short implants ≥8 mm
Pjetursson et al 2009 [88]	No detailed data on short implants
Strietzel et al 2007 [89]	Short implants ≥8 mm
Ferrigno et al 2006 [90]	Short implants ≥8 mm
Romeo et al 2006 [91]	Short implants ≥8 mm

evidence was estimated as moderate at 1-year and 3-year, and low at 5-year follow-up (reasons for downgrading: risk of bias, and imprecision at 5-year).

3.5 | Complications

Overall, there was evidence for a lower incidence of complications in favor of SH implants at both 1-year ($P = .002$) and 3-year follow-up ($P = .05$), while there was no evidence of a difference between SH and ST groups at 5-year follow-up ($P = .30$) (Table 6 and Online Supplementary Figure S3a-c). At the 1-year follow-up, only in the subgroup 5 to <6 mm-long the difference in complication rate was not statistically significant ($P = .40$). Heterogeneity among studies was significant in the subgroup 6 to <7 mm-long at all follow-ups. In particular, the study by Thoma et al[44] consistently showed a trend in favor of ST implants, as opposed to the other studies. The test for subgroup differences in effects showed no significance at any follow-up ($P = .41$, $P = .69$, and $P = .87$ at 1-year, 3-year, and 5-year, respectively). The quality of evidence was estimated as moderate at 1-year, low at 3-year, and very low at 5-year follow-up (reasons for downgrading: risk of bias, inconsistency, and imprecision at 5-year; reason for upgrading: large effect at 1-year).

3.6 | Correlation analysis

Figure 3A-D shows the results of the correlation analysis. No significant correlation was found between implant length and MBL ($r^2 = 0.00003$), implant length and survival ($r^2 = 0.0025$), implant diameter and MBL ($r^2 = 0.064$), and implant diameter and survival ($r^2 = 0.04$). It was not possible to attempt correlations using the residual bone height or residual bone width as the independent variable. In fact, most studies just used RBH and RBW as inclusion criteria, only reporting the range for inclusion, but very few studies provided actual mean values for these parameters.

4 | DISCUSSION

This up-to-date review found that implants shorter than 7 mm can be as effective as standard-length implants in augmented sites for the rehabilitation of partially edentulous and posterior atrophic jaws. As compared to previous reviews that investigated the performance of SH implants,[3,4,6,7,12,17,23,24,26,27,93-97] the present one counted on a wider database and a longer follow-up, and only focused on RCTs comparing SH implants inserted in edentulous atrophic jaws and ST implants in reconstructed atrophic jaws, of comparable residual bone dimension. In fact, several studies were excluded because the residual bone dimension differed between test and control group (eg, SH implants in atrophic jaws vs ST implants in non-atrophic edentulous jaws), or ST implants were inserted without augmentation procedures, or SH implants were inserted with concomitant augmentation procedures. All these different protocols may contribute to increase the variability of the outcomes and make difficult to evaluate the actual performance and the true purpose of SH implants.

This concept was represented in a systematic review published in 2018, that evaluated implant survival and complications of implants ≤6 mm long vs implants longer than 6 mm in the posterior jaws.[21] That review included 10 RCTs in which implants were placed in healed sites, grafted sites, or fresh extraction sockets, irrespective of the residual bone dimension. The main conclusion of that review was that SH implants displayed “higher variability and lower predictability

TABLE 2 Characteristics of the included studies. In the first column, multiple publications of the same study are grouped in a single cell

Author/Year	Study design	Number of patients	Number of implants	Jaw	Follow-up	Country	Test and control group (length × diameter, mm) implants	Placement protocol	Implant system	Setting
Felice et al 2019 A [35] Felice et al 2018[47]; Pistilli et al 2013 [55]	RCT (sm)	Short: 40 Long: 40	Short: 80 Long: 91	Max Mand	5 y	Italy	Short: 6 × 4 Long: 10/11.5/13/15 × 4	Short: healed sites Long: grafted sites	Southern Implants, Irene, South Africa	University Clinic/ Hospital/Private practice
Felice et al 2019 B [36] Esposito et al 2014 [52]	RCT (sm)	Short: 30 Long: 30	Short: 60 Long: 68	Max Mand	5 y	Italy	Short: 5 × 6 Long: 10/11.5/13 × 4	Short: healed sites Long: grafted sites	Rescue, MegaGen with internal connection EZ PLUS, MegaGen	Hospital/Private practice
Esposito et al 2019 [37] Gastaldi et al 2018[48]; Pistilli et al 2013 [54]	RCT	Short: 40 Long: 40	Short: 68 Long: 68	Max Mand	5 y	Italy	Short: 5 × 5 Long: 10/11.5/13/15 × 5	Short: healed sites Long: grafted sites	ExFeel, MegaGen Implant, Gyeongbuk	University Clinic/ Hospital/Private practice
Shi et al 2019 [39]	RCT	Short: 75 Long: 75	Short: 75 Long: 75	Max	1 y	China	Short: 6 × 4.1/4.8 Long: 10 × 4.1/4.8	Short: healed sites Long: grafted sites	Straumann, Standard plus	University Clinic
Felice et al 2018 [41] Felice et al 2014[53]; Esposito et al 2011 [56] Felice et ##al.[57]	RCT (sm)	Short: 30 Long: 60	Short: 60 Long: 60	Mand	8 y	Italy	Short: 6.6 × 4 Long: 9.6 × 4	Short: healed sites Long: grafted sites	Nanotite, External Hex, Zimmer-Biomet	University Clinic/ Hospital/Private practice
Hadzik et al 2018 [42]	RCT	Short: 15 Long: 15	Short: 15 Long: 15	Max	3 y	Poland	Short: 6 × 4 Long: 11/13 × 4	Short: healed sites Long: grafted sites	Astra, OsseoSpeed	University Clinic
Rokn et al 2018 [43]	RCT (sm)	Short: 10 Long: 10	Short: 25 Long: 22	Mand	1 y	Iran	Short: 4 × 4.1 Long: 8/10 × 4.1	Short: healed sites Long: grafted sites	Straumann Tissue level Standard Plus	Clinic
Thoma et al 2018 [44] Pohl et al 2017[49]; Thoma et al 2015[10]; Schincaglia et al 2015 [51]	RCT	Short: 47 Long: 50	Short: 63 Long: 69	Max	5 y	Switzerland; Austria; Spain; United States	Short: 6 × 4 Long: 11/13/15 × 4	Short: healed sites Long: grafted sites	Astra Tech Implant System OsseoSpeed™ 4.0S	University Clinic
Bolle et al 2018 [40]	RCT	Short: 40 Long: 40	Short: 80 Long: 87	Max Mand	1 y	Italy	Short: 4 × 4/4.5 Long: 10/11.5/13 × 4/4.5	Short: healed sites Long: grafted sites	Twinkon, Universal Sa2, Global-D	University Clinic/ Hospital/Private practice
Shah et al 2018 [38]	RCT	Short: 25 Long: 25	Short: 25 Long: 25	Max Mand	1 y	United States	Short: 6 × 4.2 Long: 10 × 4.2	Short: healed sites Long: grafted sites	Mis Seven	University Clinic
Bechara et al 2017 [8]	RCT	Short: 33 Long: 20	Short: 45 Long: 45	Max	3 y	Brazil	Short: 6 Long: 10/11.5/13/15 × 4–8	Short: healed sites Long: grafted sites	MegaGen,Any-Ridge	University Clinic

(Continues)

TABLE 2 (Continued)

Author/Year	Study design	Number of patients	Number of implants	Jaw	Follow-up	Country	Test and control group (length × diameter, mm) implants	Placement protocol	Implant system	Setting
Yu et al 2017[46]	RCT	Short: 20 Long: 18	Short: 38 Long: 41	Max	2 y	China	Short: 6.5 × 4/4.5/5 Long: 11/12.5 × 4/4.5/5	Short: healed sites Long: grafted sites	Inicell, Thommen medical AG Standard Implants Thommen Medical AG	University Clinic/Hospital
Gastaldi et al 2017[45] Felice et al 2015[50]	RCT	Short: 10 Long: 10	Short: 16 Long: 18	Max	3 y	Italy	Short: 5/6 × 5/6 Long: 10/11.5/13 × 5/6	Short: healed sites Long: grafted sites	NXFOS5/6xx, Zimmer Biomet Osseotite II, NXFOSS5/6xx, Zimmer Biomet	University Clinic/Hospital/Private Practice

Abbreviations: Max, maxilla; Mand, mandible; RCT, Randomized Clinical Trial; sm, split-mouth.

in survival rates compared to ST implants after periods of 1-5 years in function" (indeed only one included study reached 5 years follow-up). The heterogeneity in protocols might likely have played a role in such variability.

In the present study, a deeper analysis, undertaken by dividing SH implants into three subgroups according to the length, showed that the clinical and radiographic results is substantially independent of the length, in a range from 4 to 6.6 mm. The evidence regarding SH implants less than 5-mm long is still scarce as only two RCTs were included, and both of them only reported data up to 1-year follow-up. Therefore, a longer follow-up is mandatory to confirm in the medium-long-term the observed encouraging results for such SH implants as compared with ST implants in augmented sites. Indeed, two other RCTs dealing with 4-mm SH implants were found but had to be excluded from this review. In one study, 4-mm long implants were placed in non-atrophic edentulous sites (11.5 mm below maxillary sinus/12.5 mm above the mandibular canal), and ST implants were placed in sites with similar RBH without any augmentation procedure.[58] In another study, implants of 4, 5, and 6 mm-long were placed in sites of 4-7 mm RBH, while ST implants were placed in sites with a mean RBH of 10.17 mm, without regeneration.[61] In spite of the interesting results provided, these protocols are not comparable to that addressed in our review, because the main clinical indications for SH implant (being an alternative to demanding and invasive augmentation procedures) seems not to be met by these studies.

One of the initial aims of this review was to investigate if there was a correlation between the performance of SH implants in terms of MBL change, survival rate, and incidence of complications, and the residual alveolar bone height (RBH) and/or width (RBW). Indeed the alveolar bone is a tooth-dependent structure that undergoes resorption and dimensional changes after tooth extraction.[98] Even though the resorption is more evident in the first 6-month period, it continues throughout life. Several classifications on alveolar bone atrophies are performed according to anatomic aspects,[99] showing dimensional changes of the alveolar bone over time. Regarding residual alveolar bone height (RBH) and/or width (RBW), unfortunately, very few among the included studies provided detailed data,[41-43] while most studies just reported a range of RBH or a minimum value of RBW among the inclusion criteria. In addition, these values may differ between maxilla and mandible, being generally higher for the latter. A considerable variation in the range of RBH was found among studies, going from 3 to 4 mm in the maxilla[8] to 6 to 8.5 mm for both arches.[38] Rokn et al[43] which used SH implants 4-mm long, reported a mean RBH of 7.9 ± 1.4 mm in the mandible, suggesting that even patients with at least 9 mm RBH were included in the SH group. This may pose a question about the need for rehabilitating such patients by means of 4-mm long implants. RBW also proved to be quite variable among the studies, the lower limit being ≥5 mm in a few studies for both maxilla and mandible,[35,40] while the highest values were 8.46 ± 1.29 [42] (maxilla) and ≥ 8 mm[36] (mandible). These disparities imply that the biomechanical features and the healing potential of the residual alveolar bone may considerably vary among the different studies, even if the considered implant length is similar. Due to such heterogeneity and

TABLE 3 Results of the risk of bias assessment

Study	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (Attrition bias)	Selective reporting (reporting bias)	Other bias	Overall risk
Shi et al[39]	Low	Low	Unclear	Low	Unclear	Low	Moderate
Felice et al[35]	Low	Low	Unclear	Low	Low	Low	Moderate
Felice et al[36]	Low	Low	Unclear	Low	Low	Low	Moderate
Esposito et al [37]	Low	Low	Unclear	Low	Low	Low	Moderate
Thoma et al.[44]	Low	Low	Unclear	Low	Low	Low	Moderate
Shah et al[38]	Low	Low	High	Unclear	Low	Low	High
Rokn et al[43]	Low	Low	Unclear	Unclear	Low	Low	Moderate
Hadzik et al[42]	High	Unclear	High	Unclear	Low	Low	High
Felice et al[41]	Low	Low	Unclear	Low	Low	Low	Moderate
Bolle et al [40]	Low	Low	Unclear	Low	Low	Low	Moderate
Yu et al [46]	Unclear	Low	Low	Low	Low	Low	Moderate
Gastaldi et al[45]	Low	Low	Unclear	Low	Low	Low	Moderate
Bechara et al[8]	Low	Low	Unclear	Unclear	Low	Low	Moderate

TABLE 4 Synthetic results for meta-analysis on marginal bone level changes

Follow-up	SH implants length, mm	No. of studies	N. SH	N. ST	I^2 (*P*-value)	Mean difference* (95% CI), mm	Overall effect (*P*-value)	Quality of evidence
1 year	<5	2	49	44	0% (0.96)	−0.18 (−0.19, −0.17)	<0.00001	Moderate
	5 to <6	3	79	77	0% (0.99)	−0.18 (−0.29, −0.07	0.001	
	6 to <7	6	244	234	0% (0.60)	−0.05 (−0.09, −0.02)	0.006	
	Total	11	372	355	76% (<0.00001)	−0.11 (−0.17, −0.04)	0.0009	
3-year	<5	–	–	–	–	–	–	Moderate
	5 to <6	3	70	65	0% (<0.0001)	−0.29 (−0.43, −0.16)	<0.0001	
	6 to <7	6	171	162	68% (0.009)	−0.12 (−0.26, 0.02)	0.09	
	Total	9	241	227	67% (0.002)	−0.18 (−0.29, −0.06)	0.003	
5-year	<5	–	–	–	–	–	–	Low
	5 to <6	2	51	50	0% (0.81)	−0.46 (−0.66, −0.26)	<0.00001	
	6 to <7	3	97	99	83% (0.003)	−0.48 (−0.89, −0.06)	0.03	
	Total	5	148	149	65% (0.02)	−0.47 (−0.69, −0.24)	<0.0001	

Abbreviation: CI, confidence intervals.
[a]negative values indicate results favoring SH implants.

lack of detailed information on RBH and RBW, it was not possible to investigate the influence of such parameters on the SH implant performance.

Nevertheless, a fairly consistent trend was found for the outcome variables investigated. In spite of a claimed unfavorable crown-to-implant ratio, that could theoretically lead to biomechanical issues and excessive stress on the marginal bone,[17,27,93,94,100-102] there was evidence for a lower MBL change around SH implants, respect to ST implants, up to 5-year follow-up (Table 4). Regarding failure rate, the absence of a significant difference between groups (Table 5), suggested that the loss of an implant is independent of the implant length, and other factors can be responsible. Regarding the incidence of complications, there was a trend for less adverse events in the SH group respect to ST group (Table 6). This might be partly related to the fact that patients with ST implants underwent an additional surgery, consisting of the augmentation procedure, which could be related to an increased risk for postoperative complications. Few studies reported 5-year results for complications. Of these, only the study by Thoma et al, accounting for 35% of cases (90 patients out of 259), found a greater (though not significant) incidence of complications for SH implants.[44] Consequently, absence of significant difference in complication rate between SH and ST implants in the 5-year meta-analysis was found. The authors of that study attributed such drawback to the higher crown-implant ratio of the SH implants, that might cause some biomechanical disadvantage in the medium term, as compared to ST implants in grafted sinus.[44]

Regarding the methodological aspect, included studies had a rather homogeneous risk of bias, none of them being at low risk and only two studies[38,42] judged at high risk. Indeed, some of the standard items of the Cochrane tools for RCTs were very difficult to address in the present comparison between treatments. In fact, blinding of participants and operators was impossible during surgical procedures and radiographic assessment, and the surgeons had to know the type of implants during treatments. For this reason, this type of bias was not considered in the present review. Blinding of outcome assessment in some situations might be difficult, but it was decided to keep it among the items, in analogy with other similar systematic reviews.[12] The only two studies that were judged at overall high risk, were the studies which had a high-risk score for such item. Mainly due to methodological limits, heterogeneity of results among studies, and to limited cumulative sample size, especially at the 5-year follow-up, the quality of evidence was estimated to be moderate or low for most analyses, thereby limiting the strength of recommendations.

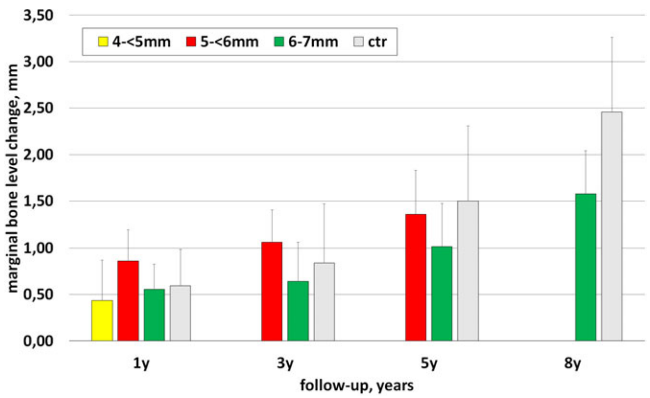


FIGURE 2 Weighted mean values and standard deviations of the marginal bone level change in the three subgroups of SH implants (4 to <5 mm, 5 to <6 mm, 6 to <7 mm), and in the ST implants. Significances of the between-group direct comparisons are shown in Table 4. The least 1-year bone level change appears to be related with the shortest implants, though it is derived only from two studies, both with a 1-year follow-up. The data of the longest follow-up (8-year) derive from a single study

The present results are in agreement with other recent systematic reviews and meta-analyses. In particular the review by Esposito et al[12] evaluated 5-year outcomes of SH implants vs ST implants in augmented sites in the mandible only. The authors included only four articles,[35-37,53] which were also included in the present review. In that review,[12] similar outcomes were presented, though there was no distinction between SH implants of different length, as opposed to the present study. Another systematic review and meta-analysis focused on the mandible, included the same four studies as the Esposito et al review,[12] but used a Bayesian approach to determine the density of probability associated to a better survival rate and a greater incidence of complications for SH and ST implants.[93,94] Though similar survival rates were reported for SH and ST implants, the probability of survival rate of SH implants being greater than ST implants was found to be 84%, and the probability of complications using SH implants being greater than ST implants was 15.7%. Therefore, the authors recommended the use of SH implants when there is sufficient residual bone for their placement. In a further systematic review, Bitaraf et al compared SH and ST implants, independent of augmentation procedures and residual bone dimension, and also included 8-mm long implants in the SH group.[93] In spite of these differences, their conclusions were in line with the findings of the present review. In particular, they found no significant difference in implant failure between groups, and significant better outcomes in favor of SH implants regarding complications. Mokcheh et al reported similar findings in a systematic review focused on the sinus augmentation procedure.[95] The studies

TABLE 5 Synthetic results for meta-analysis on implant survival rate

Follow-up	SH implants length, mm	No. of studies	N. SH	N. ST	I^2 (*P*-value)	Risk ratio* (95% CI)	Overall effect (*P*-value)	Quality of evidence
1 year	<5	2	45	43	N.A.	0.75 (0.22, 2.57)	0.65	Moderate
	5 to <6	3	78	75	0% (0.71)	0.64 (0.11, 3.81)	0.63	
	6 to <7	7	286	279	17% (0.30)	0.90 (0.27, 3.04)	0.87	
	Total	12	409	397	0% (0.61)	0.81 (0.39, 1.70)	0.58	
3-year	<5	–	–	–	–	–	–	Moderate
	5 to <6	3	70	71	0% (0.87)	1.70 (0.43, 6.75)	0.45	
	6 to <7	6	173	163	0% (0.86)	0.54 (0.16, 1.81)	0.32	
	Total	9	243	234	0% (0.81)	0.89 (0.36, 2.21)	0.80	
5-year	<5	–	–	–	–	–	–	Low
	5 to <6	2	54	52	0% (0.88)	1.62 (0.41, 6.38)	0.49	
	6 to <7	2	75	78	0% (0.84)	2.39 (0.36, 15.81)	0.37	
	Total	4	129	130	0% (0.98)	1.85 (0.61, 5.62)	0.28	

Abbreviations: CI, confidence intervals; N.A., non-applicable.
[a]values <1 indicate results favoring SH implants;

TABLE 6 Synthetic results for meta-analysis on complications rate

Follow-up	SH implants length, mm	n. of studies	N. SH	N. ST	I^2 (*P*-value)	Risk Ratio* (95% CI)	Overall effect (*P*-value)	Quality of evidence
1 year	<5	2	45	43	0% (0.40)	0.29 (0.13, 0.61)	0.001	moderate
	5 to <6	3	78	75	57% (0.13)	0.56 (0.15, 2.15)	0.40	
	6 to <7	5	223	213	71% (0.008)	0.12 (0.02, 0.82)	0.03	
	Total	10	346	331	54% (0.03)	0.29 (0.13, 0.63)	0.002	
3-year	<5	–	–	–	–	–	–	low
	5 to <6	3	70	71	0% (0.45)	0.55 (0.35, 0.85)	0.008	
	6 to <7	5	159	148	85% (<0.0001)	0.43 (0.15, 1.25)	0.12	
	Total	8	229	219	76% (0.0002)	0.53 (0.28, 1.01)	0.05	
5-year	<5	–	–	–	–	–	–	very low
	5 to <6	2	54	52	74% (0.05)	0.62 (0.30, 1.31)	0.21	
	6 to <7	2	75	78	88% (0.004)	0.72 (0.14, 3.68)	0.69	
	Total	4	129	130	81% (0.001)	0.69 (0.34, 1.40)	0.30	

Abbreviation: CI, confidence intervals.
[a]values <1 indicate results favoring SH implants.

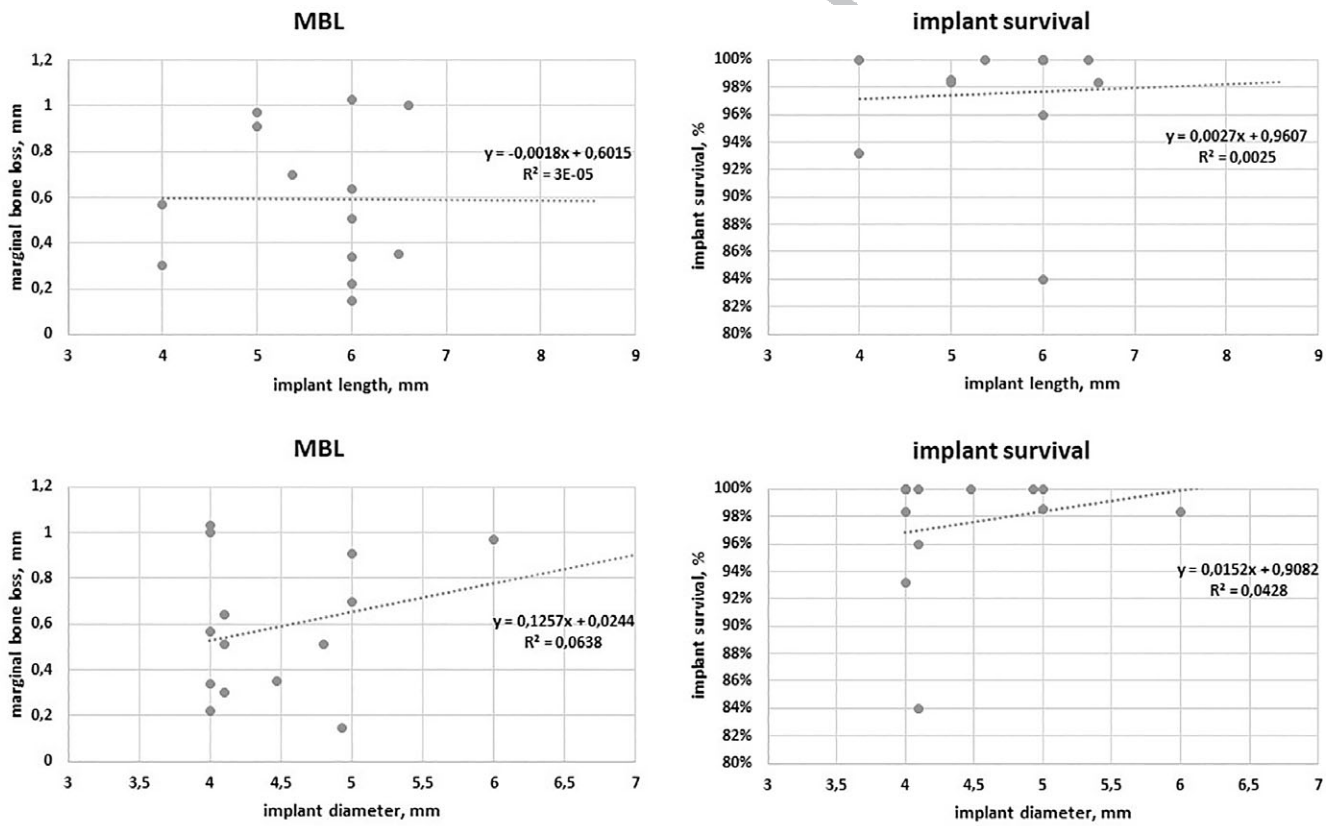


FIGURE 3 Correlation analysis between: A, implant length and marginal bone loss (MBL); B, implant length and implant survival; C, implant diameter and MBL; D, implant diameter and implant survival

were divided according to the follow-up duration into: short (<1 year), medium (1 year) and long term (>1 year). Based on 15 RCTs, they found no significant differences in survival rates between SH and ST implants at any follow-up, but fewer complications for SH implants in the short and medium term. Finally, a recent systematic review and meta-analysis,[22] similar to the present review, established a clear demarcation between SH (≤6 mm long) and long dental implants (≥10 mm long), stating that this was not done in all the previous systematic reviews, where the difference in length was in some cases very small. That review also applied a meta-regression approach to determine the effect of augmentation procedures and other clinical covariates on the results. The findings regarding the clinical aspects, complications and marginal bone remodeling, are in line with the findings of the present review. When evaluating separately the types of postoperative complications, the authors found significant ($P < .05$) advantages for SH implants regarding biological complications, and for ST implants regarding prosthetic complications.[22]

However, SH dental implants of course have possible drawbacks: augmentation procedures allow for more esthetics since SH implants placed in atrophic jaws are prosthetically characterized by long crowns; this even if posterior jaws are in most of the cases areas of low esthetic demanding. They also require, especially ultra-SH ones, technical skills and a learning curve. On the other hand, augmentation procedures are more complex to handle, requires several surgical steps, longer rehabilitative times and are more expensive biologically and economically. Reconstructive surgeries are nevertheless necessary when bone volumes are not sufficient even for placing the shortest available implants (4-mm-long).

In any comparison between two treatment options, in addition to objective clinical-related outcomes, also patient-reported outcomes, meaning quality of life and satisfaction associated to the two approaches under comparison, are of primary importance and should be considered. To date, this specific aspect has not yet been addressed systematically, also because patient-related outcomes are sparsely reported in the RCTs published so far on the present topic.

A randomized study by Taschieri et al,[73] which was focused on the comparison between maxillary sinus augmentation and SH implants in the upper jaw, specifically investigated patient-related outcomes. The authors found a significant reduction of postoperative discomfort associated with SH implants as compared to ST implants in augmented sites, and a similar level of patient satisfaction after 1 year. Based on their findings, the authors suggested that SH implants "may be preferred due to simplified protocol, less invasiveness, shorter treatment time, and reduced postoperative discomfort, as compared to sinus augmentation and ST implants."[73]

5 | CONCLUSION

SH implants represent today a valid alternative to more invasive augmentation procedures for fixed rehabilitations of partially edentulous and posterior atrophic jaws. The advantages of 5 to 6 mm-long implants over ST implants, especially in terms of reduced MBL, and equally effective survival rate, are well documented by studies with 5 years of function or longer. Conversely, studies with at least 5-year follow-up are urgently needed to confirm the promising outcomes observed with less than 5 mm-long fixtures.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Giovanna Iezzi https://orcid.org/0000-0002-2391-6594
Vittoria Perrotti https://orcid.org/0000-0001-7652-1660
Massimo Del Fabbro https://orcid.org/0000-0001-7144-0984

REFERENCES

1. Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. *Int J Periodontics Restorative Dent*. 2003;23(4):313-323.
2. Chappuis V, Araújo MG, Buser D. Clinical relevance of dimensional bone and soft tissue alterations post-extraction in esthetic sites. *Periodontol 2000*. 2017;73(1):73-83.
3. Ravida A, Wang IC, Sammartino G, et al. Prosthetic rehabilitation of the posterior atrophic maxilla, short (≤6 mm) or long (≥10 mm) dental implants? A systematic review, meta-analysis, and trial sequential analysis: Naples consensus report working group a. *Implant Dent*. 2019;28(6):590-602.
4. Yan Q, Wu X, Su M, Hua F, Shi B. Short implants (≤6 mm) versus longer implants with sinus floor elevation in atrophic posterior maxilla: a systematic review and meta-analysis. *BMJ Open*. 2019;9(10):e029826.
5. Ravidà AMJ, Alassadi M, Saleh MH, Askar H, Wang HL. Impact of implant length on survival of rough-surface implants in non-augmented posterior areas: a systematic review and meta-regression analysis. *J Oral Maxillofac Implants*. 2019;34:1359-1369.
6. Starch-Jensen T, Aludden H, Hallman M, Dahlin C, Christensen AE, Mordenfeld A. A systematic review and meta-analysis of long-term studies (five or more years) assessing maxillary sinus floor augmentation. *Int J Oral Maxillofac Surg*. 2018;47(1):103-116.
7. Lee SA, Lee CT, Fu MM, Elmisalati W, Chuang SK. Systematic review and meta-analysis of randomized controlled trials for the management of limited vertical height in the posterior region: short implants (5 to 8 mm) vs longer implants (> 8 mm) in vertically augmented sites. *Int J Oral Maxillofac Implants*. 2014;29(5):1085-1097.
8. Bechara S, Kubilius R, Veronesi G, Pires JT, Shibli JA, Mangano FG. Short (6-mm) dental implants versus sinus floor elevation and placement of longer (≥10-mm) dental implants: a randomized controlled trial with a 3-year follow-up. *Clin Oral Implants Res*. 2017;28(9):1097-1107.
9. Chirila L, Rotaru C, Filipov I, Sandulescu M. Management of acute maxillary sinusitis after sinus bone grafting procedures with simultaneous dental implants placement - a retrospective study. *BMC Infect Dis*. 2016;16(Suppl 1):94.
10. Thoma DS, Haas R, Tutak M, Garcia A, Schincaglia GP, Hammerle CHF. Randomized controlled multicentre study comparing short dental implants (6 mm) versus longer dental implants (11-15 mm) in combination with sinus floor elevation procedures. Part 1: demographics and patient-reported outcomes at 1 year of loading. *J Clin Periodontol*. 2015;42(1):72-80.
11. Hernandez-Alfaro F, Torradeflot MM, Marti C. Prevalence and management of Schneiderian membrane perforations during sinus-lift procedures. *Clin Oral Implants Res*. 2008;19(1):91-98.
12. Esposito M, Buti J, Barausse C, Gasparro R, Sammartino G, Felice P. Short implants versus longer implants in vertically augmented atrophic mandibles: a systematic review of randomised controlled trials with a 5-year post-loading follow-up. *Int J Oral Implantol (New Malden)*. 2019;12(3):267-280.

13. Uehara PN, Matsubara VH, Igai F, Sesma N, Mukai MK, Araujo MG. Short dental implants (</=7 mm) versus longer implants in augmented bone area: a meta-analysis of randomized controlled trials. *Open Dent J*. 2018;12:354-365.
14. Markose J, Eshwar S, Srinivas S, Jain V. Clinical outcomes of ultrashort sloping shoulder implant design: a survival analysis. *Clin Implant Dent Relat Res*. 2018;20(4):646-652.
15. Malchiodi L, Caricasulo R, Cucchi A, Vinci R, Agliardi E, Gherlone E. Evaluation of ultrashort and longer implants with microrough surfaces: results of a 24- to 36-month prospective study. *Int J Oral Maxillofac Implants*. 2017;32(1):171-179.
16. Urdaneta RA, Daher S, Leary J, Emanuel KM, Chuang SK. The survival of ultrashort locking-taper implants. *Int J Oral Maxillofac Implants*. 2012;27(3):644-654.
17. Palacios JAV, Garcia JJ, Carames JMM, Quirynen M, da Silva Marques DN. Short implants versus bone grafting and standard-length implants placement: a systematic review. *Clin Oral Investig*. 2018;22(1):69-80.
18. Friberg B, Grondahl K, Lekholm U, Branemark PI. Long-term follow-up of severely atrophic edentulous mandibles reconstructed with short Branemark implants. *Clin Implant Dent Relat Res*. 2000;2(4):184-189.
19. Renouard F, Nisand D. Impact of implant length and diameter on survival rates. *Clin Oral Implants Res*. 2006;17(Suppl 2):35-51.
20. das Neves FD, Fones D, Bernardes SR, do Prado CJ, Neto AJ. Short implants—an analysis of longitudinal studies. *Int J Oral Maxillofac Implants*. 2006;21(1):86-93.
21. Papaspyridakos P, De Souza A, Vazouras K, Gholami H, Pagni S, Weber H-P. Survival rates of short dental implants (≤6 mm) compared with implants longer than 6 mm in posterior jaw areas: a meta-analysis. *Clin Oral Implants Res*. 2018;29(Suppl 16):8-20.
22. Ravida A, Wang IC, Barootchi S, et al. Meta-analysis of randomized clinical trials comparing clinical and patient-reported outcomes between extra-short (<= 6 mm) and longer (>= 10 mm) implants. *J Clin Periodontol*. 2019;46(1):118-142.
23. Ravida A, Barootchi S, Askar H, Suarez-Lopez Del Amo F, Tavelli L, Wang HL. Long-term effectiveness of extra-short (≤ 6 mm) dental implants: a systematic review. *Int J Oral Maxillofac Implants*. 2019;34(1):68-84.
24. Nielsen HB, Schou S, Isidor F, Christensen AE, Starch-Jensen T. Short implants (</=8 mm) compared to standard length implants (>8 mm) in conjunction with maxillary sinus floor augmentation: a systematic review and meta-analysis. *Int J Oral Maxillofac Surg*. 2019;48(2):239-249.
25. Al Amri MD, Abduljabbar TS, Al-Johany SS, Al Rifaiy MQ, Alfarraj Aldosari AM, Al-Kheraif AA. Comparison of clinical and radiographic parameters around short (6 to 8 mm in length) and long (11 mm in length) dental implants placed in patients with and without type 2 diabetes mellitus: 3-year follow-up results. *Clin Oral Implants Res*. 2017;28(10):1182-1187.
26. Lemos CAA, Ferro-Alves ML, Okamoto R, Mendonaca MR, Pellizzer EP. Short dental implants versus standard dental implants placed in the posterior jaws: a systematic review and meta-analysis. *J Dent*. 2016;47:8-17.
27. Monje A, Suarez F, Galindo-Moreno P, Garcia-Nogales A, Fu JH, Wang HL. A systematic review on marginal bone loss around short dental implants (<10 mm) for implant-supported fixed prostheses. *Clin Oral Implants Res*. 2014;25(10):1119-1124.
28. Rossi F, Botticelli D, Cesaretti G, De Santis E, Storelli S, Lang NP. Use of short implants (6 mm) in a single-tooth replacement: a 5-year follow-up prospective randomized controlled multicenter clinical study. *Clin Oral Implants Res*. 2016;27(4):458-464.
29. Gulje F, Abrahamsson I, Chen S, Stanford C, Zadeh H, Palmer R. Implants of 6 mm vs. 11 mm lengths in the posterior maxilla and mandible: a 1-year multicenter randomized controlled trial. *Clin Oral Implants Res*. 2013;24(12):1325-1331.
30. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int J Surg*. 2010;8(5):336-341.
31. Miller SA, Forrest JL. Enhancing your practice through evidence based decision making: PICO, learning how to ask good questions. *J Evid Based Dent Pract*. 2001;1:136-141.
32. Richardson WS, Wilson MC, Nishikawa J, Hayward RS. The well-built clinical question: a key to evidence-based decisions. *ACP J Club*. 1995;123(3):A12-A13.
33. Sterne JA, Hernan MA, Reeves BC, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. *BMJ*. 2016;355:i4919.
34. Elbourne DR, Altman DG, Higgins JP, Curtin F, Worthington HV, Vail A. Meta-analyses involving cross-over trials: methodological issues. *Int J Epidemiol*. 2002;31(1):140-149.
35. Felice P, Pistilli R, Barausse C, Piattelli M, Buti J, Esposito M. Posterior atrophic jaws rehabilitated with prostheses supported by 6-mm-long 4-mm-wide implants or by longer implants in augmented bone. Five-year post-loading results from a within-person randomised controlled trial. *Int J Oral Implantol (New Malden)*. 2019;12(1):57-72.
36. Felice P, Barausse C, Pistilli R, Ippolito DR, Esposito M. Five-year results from a randomised controlled trial comparing prostheses supported by 5-mm long implants or by longer implants in augmented bone in posterior atrophic edentulous jaws. *Int J Oral Implantol (New Malden)*. 2019;12(1):25-37.
37. Esposito M, Barausse C, Pistilli R, et al. Posterior atrophic jaws rehabilitated with prostheses supported by 5 × 5 mm implants with a nanostructured calcium-incorporated titanium surface or by longer implants in augmented bone. Five-year results from a randomised controlled trial. *Eur J Oral Implantol*. 2019;12(1):39-54.
38. Shah SN, Chung J, Kim DM, Machtei EE. Can extra-short dental implants serve as alternatives to bone augmentation? A preliminary longitudinal randomized controlled clinical trial. *Quintessence Int*. 2018;49(8):635-643.
39. Shi JY, Li Y, Qiao SC, Gu YX, Xiong YY, Lai HC. Short versus longer implants with osteotome sinus floor elevation for moderately atrophic posterior maxillae: a 1-year randomized clinical trial. *J Clin Periodontol*. 2019;46(8):855-862.
40. Bolle C, Felice P, Barausse C, Pistilli V, Trullenque-Eriksson A, Esposito M. 4 mm long vs longer implants in augmented bone in posterior atrophic jaws: 1-year post-loading results from a multicentre randomised controlled trial. *Eur J Oral Implantol*. 2018;11(1):31-47.
41. Felice P, Barausse C, Pistilli R, Ippolito DR, Esposito M. Short implants versus longer implants in vertically augmented posterior mandibles: result at 8 years after loading from a randomised controlled trial. *Eur J Oral Implantol*. 2018;11(4):385-395.
42. Hadzik J, Krawiec M, Kubasiewicz-Ross P, Prylinska-Czyzewska A, Gedrange T, Dominiak M. Short implants and conventional implants in the residual maxillary alveolar ridge: a 36-month follow-up observation. *Med Sci Monit*. 2018;24:5645-5652.
43. Rokn AR, Monzavi A, Panjnoush M, Hashemi HM, Kharazifard MJ, Bitaraf T. Comparing 4-mm dental implants to longer implants placed in augmented bones in the atrophic posterior mandibles: one-year results of a randomized controlled trial. *Clin Implant Dent Relat Res*. 2018;20(6):997-1002.
44. Thoma DS, Haas R, Sporniak-Tutak K, Garcia A, Taylor TD, Hammerle CHF. Randomized controlled multicentre study comparing short dental implants (6 mm) versus longer dental implants (11-15 mm) in combination with sinus floor elevation procedures: 5-year data. *J Clin Periodontol*. 2018;45(12):1465-1474.
45. Gastaldi G, Felice P, Pistilli R, Barausse C, Trullenque-Eriksson A, Esposito M. Short implants as an alternative to crestal sinus lift: a

3-year multicentre randomised controlled trial. *Eur J Oral Implantol*. 2017;10(4):391-400.
46. Yu HJ, Wang X, Qiu LX. Outcomes of 6.5-mm hydrophilic implants and long implants placed with lateral sinus floor elevation in the atrophic posterior maxilla: a prospective, randomized controlled clinical comparison. *Clin Implant Dent Relat Res*. 2017;19(1):111-122.
47. Felice P, Barausse C, Pistilli V, Piattelli M, Ippolito DR, Esposito M. Posterior atrophic jaws rehabilitated with prostheses supported by 6 mm long × 4 mm wide implants or by longer implants in augmented bone. 3-Year post-loading results from a randomised controlled trial. *Eur J Oral Implantol*. 2018;11(2):175-187.
48. Gastaldi G, Felice P, Pistilli V, Barausse C, Ippolito DR, Esposito M. Posterior atrophic jaws rehabilitated with prostheses supported by 5 × 5 mm implants with a nanostructured calcium-incorporated titanium surface or by longer implants in augmented bone. 3-Year results from a randomised controlled trial. *Eur J Oral Implantol*. 2018; 11(1):49-61.
49. Pohl V, Thoma DS, Sporniak-Tutak K, et al. Short dental implants (6 mm) versus long dental implants (11-15 mm) in combination with sinus floor elevation procedures: 3-year results from a multicentre, randomized, controlled clinical trial. *J Clin Periodontol*. 2017;44(4): 438-445.
50. Felice P, Pistilli R, Barausse C, Bruno V, Trullenque-Eriksson A, Esposito M. Short implants as an alternative to crestal sinus lift: a 1-year multicentre randomised controlled trial. *Eur J Oral Implantol*. 2015;8(4):375-384.
51. Schincaglia GP, Thoma DS, Haas R, et al. Randomized controlled multicenter study comparing short dental implants (6 mm) versus longer dental implants (11-15 mm) in combination with sinus floor elevation procedures. Part 2: clinical and radiographic outcomes at 1 year of loading. *J Clin Periodontol*. 2015;42(11):1042-1051.
52. Esposito M, Pistilli R, Barausse C, Felice P. Three-year results from a randomised controlled trial comparing prostheses supported by 5-mm long implants or by longer implants in augmented bone in posterior atrophic edentulous jaws. *Eur J Oral Implantol*. 2014;7(4): 383-395.
53. Felice P, Cannizzaro G, Barausse C, Pistilli R, Esposito M. Short implants versus longer implants in vertically augmented posterior mandibles: a randomised controlled trial with 5-year after loading follow-up. *Eur J Oral Implantol*. 2014;7(4):359-369.
54. Pistilli R, Felice P, Piattelli M, et al. Posterior atrophic jaws rehabilitated with prostheses supported by 5 × 5 mm implants with a novel nanostructured calcium-incorporated titanium surface or by longer implants in augmented bone. One-year results from a randomised controlled trial. *Eur J Oral Implantol*. 2013;6(4):343-357.
55. Pistilli R, Felice P, Cannizzaro G, et al. Posterior atrophic jaws rehabilitated with prostheses supported by 6 mm long 4 mm wide implants or by longer implants in augmented bone. One-year post-loading results from a pilot randomised controlled trial. *Eur J Oral Implantol*. 2013;6(4):359-372.
56. Esposito M, Cannizzaro G, Soardi E, Pellegrino G, Pistilli R, Felice P. A 3-year post-loading report of a randomised controlled trial on the rehabilitation of posterior atrophic mandibles: short implants or longer implants in vertically augmented bone? *Eur J Oral Implantol*. 2011;4(4):301-311.
57. Felice P, Pellegrino G, Checchi L, Pistilli R, Esposito M. Vertical augmentation with interpositional blocks of anorganic bovine bone vs. 7-mm-long implants in posterior mandibles: 1-year results of a randomized clinical trial. *Clin Oral Implants Res*. 2010;21(12):1394-1403.
58. Barausse C, Felice P, Pistilli R, Buti J, Esposito M. Posterior jaw rehabilitation using partial prostheses supported by impants 4.0 × 4.0 mm or longer: three-year post-loading results of a multicentre randomised controlled trial. *Clin Trials Dent*. 2019;1(1):25-36.
59. Guarnieri R, Di Nardo D, Gaimari G, Miccoli G, Testarelli L. Short vs. standard laser-microgrooved implants supporting single and splinted crowns: a prospective study with 3 years follow-up. *J Prosthodont*. 2019;28(2):e771-e779.
60. Guida L, Annunziata M, Esposito U, Sirignano M, Torrisi P, Cecchinato D. 6-mm-short and 11-mm-long implants compared in the full-arch rehabilitation of the edentulous mandible: a 3-year multicenter randomized controlled trial. *Clin Oral Implants Res*. 2019;31 (1):64-73.
61. Gurlek O, Kaval ME, Buduneli N, Nizam N. Extra-short implants in the prosthetic rehabilitation of the posterior maxilla. *Aust Dent J*. 2019;64:353-358.
62. Martinolli M, Bortolini S, Natali A, et al. Long-term survival analysis of standard-length and short implants with multifunctional abutments. *J Oral Rehabil*. 2019;46(7):640-646.
63. Nedir RNN, Huynh-Ba G, Bischof M. Change in crown-to-implant ratio of implants placed in grafted and nongrafted posterior maxillary sites: a 5-year prospective randomized study. *Int J Oral Maxillofac Implants*. 2019;34(5):1231-1236.
64. Weerapong K, Sirimongkolwattana S, Sastraruji T, Khongkhunthian P. Comparative study of immediate loading on short dental implants and conventional dental implants in the posterior mandible: a randomized clinical trial. *Int J Oral Maxillofac Implants*. 2019;34(1):141-149.
65. Alonso FR, Triches DF, Mezzomo LAM, Teixeira ER, Shinkai RSA. Primary and secondary stability of single short implants. *J Craniofac Surg*. 2018;29(6):e548-e551.
66. Benlidayi ME, Ucar Y, Tatli U, et al. Short implants versus standard implants: midterm outcomes of a clinical study. *Implant Dent*. 2018; 27(1):95-100.
67. Cannizzaro G, Felice P, Ippolito DR, Velasco-Ortega E, Esposito M. Immediate loading of fixed cross-arch prostheses supported by flapless-placed 5 mm or 11.5 mm long implants: 5-year results from a randomised controlled trial. *Eur J Oral Implantol*. 2018;11(3): 295-306.
68. Han J, Tang Z, Zhang X, Meng H. A prospective, multi-center study assessing early loading with short implants in posterior regions. A 3-year post-loading follow-up study. *Clin Implant Dent Relat Res*. 2018;20(1):34-42.
69. Naenni N, Sahrmann P, Schmidlin PR, et al. Five-year survival of short single-tooth implants (6 mm): a randomized controlled clinical trial. *J Dent Res*. 2018;97(8):887-892.
70. Storelli S, Abba A, Scanferla M, Botticelli D, Romeo E. 6 mm vs 10 mm-long implants in the rehabilitation of posterior jaws: a 10-year follow-up of a randomised controlled trial. *Eur J Oral Implantol*. 2018;11(3):283-292.
71. Svezia L, Casotto F. Short dental implants (6 mm) versus standard dental implants (10 mm) supporting single crowns in the posterior maxilla and/or mandible: 2-year results from a prospective cohort comparative trial. *J Oral Maxillofac Res*. 2018;9(3):e4.
72. Taschieri S, Karanxha L, Francetti L, Weinstein R, Gianni AB, Del Fabbro M. Minimally-invasive osteotome sinus floor elevation combined with short implants and platelet-rich plasma for edentulous atrophic posterior maxilla: a five-year follow-up prospective study. *J Biol Regul Homeost Agents*. 2018;32(4):1015-1020.
73. Taschieri S, Lolato A, Testori T, Francetti L, Del Fabbro M. Short dental implants as compared to maxillary sinus augmentation procedure for the rehabilitation of edentulous posterior maxilla: three-year results of a randomized clinical study. *Clin Implant Dent Relat Res*. 2018;20(1):9-20.
74. Zadeh HH, Gulje F, Palmer PJ, et al. Marginal bone level and survival of short and standard-length implants after 3 years: an open multicenter randomized controlled clinical trial. *Clin Oral Implants Res*. 2018;29(8):894-906.

75. Makowiecki A, Botzenhart U, Seeliger J, Heinemann F, Biocev P, Dominiak M. A comparative study of the effectiveness of early and delayed loading of short tissue-level dental implants with hydrophilic surfaces placed in the posterior section of the mandible-a preliminary study. *Ann Anat*. 2017;212:61-68.
76. Nedir R, Nurdin N, Najm SA, El Hage M, Bischof M. Short implants placed with or without grafting into atrophic sinuses: the 5-year results of a prospective randomized controlled study. *Clin Oral Implants Res*. 2017;28(7):877-886.
77. Anitua E, Alkhraist MH, Pinas L, Orive G. Association of transalveolar sinus floor elevation, platelet rich plasma, and short implants for the treatment of atrophied posterior maxilla. *Clin Oral Implants Res*. 2015;26(1):69-76.
78. Cannizzaro G, Felice P, Buti J, Leone M, Ferri V, Esposito M. Immediate loading of fixed cross-arch prostheses supported by flapless-placed supershort or long implants: 1-year results from a randomised controlled trial. *Eur J Oral Implantol*. 2015;8(1):27-36.
79. De Santis D, Cucchi A, Rigoni G, Longhi C. Short implants with oxidized surface in posterior areas of atrophic jaws: 3- to 5-year results of a multicenter study. *Clin Implant Dent Relat Res*. 2015;17(3):442-452.
80. Shi JY, Gu YX, Qiao SC, Zhuang LF, Zhang XM, Lai HC. Clinical evaluation of short 6-mm implants alone, short 8-mm implants combined with osteotome sinus floor elevation and standard 10-mm implants combined with osteotome sinus floor elevation in posterior maxillae: study protocol for a randomized controlled trial. *Trials*. 2015;16:324.
81. Brizuela AMN, Fernández-Gonzalez FJ, Larrazábal C, Anta A. Osteotome sinus floor elevation without grafting material: results of a 2-year prospective study. *J Clin Exp Dent*. 2014;6(5):e479-e484.
82. Romeo E, Storelli S, Casano G, Scanferla M, Botticelli D. Six-mm versus 10-mm long implants in the rehabilitation of posterior edentulous jaws: a 5-year follow-up of a randomised controlled trial. *Eur J Oral Implantol*. 2014;7(4):371-381.
83. Cannizzaro G, Felice P, Minciarelli AF, Leone M, Viola P, Esposito M. Early implant loading in the atrophic posterior maxilla: 1-stage lateral versus crestal sinus lift and 8 mm hydroxyapatite-coated implants. A 5-year randomised controlled trial. *Eur J Oral Implantol*. 2013;6(1):13-25.
84. Kennedy KS, Jones EM, Kim DG, McGlumphy EA, Clelland NL. A prospective clinical study to evaluate early success of short implants. *Int J Oral Maxillofac Implants*. 2013;28(1):170-177.
85. Le BT, Follmar T, Borzabadi-Farahani A. Assessment of short dental implants restored with single-unit nonsplinted restorations. *Implant Dent*. 2013;22(5):499-502.
86. Telleman G, Raghoebar GM, Vissink A, Meijer HJA. Impact of platform switching on inter-proximal bone levels around short implants in the posterior region; 1-year results from a randomized clinical trial. *J Clin Periodontol*. 2012;39(7):688-697.
87. Cannizzaro GFP, Leone M, Viola P, Esposito M. Early loading of implants in the atrophic posterior maxilla: lateral sinus lift with autogenous bone and bio-Oss versus crestal mini sinus lift and 8-mm hydroxyapatite-coated implants. A randomised controlled clinical trial. *Eur J Oral Implantol*. 2009;2(1):25-38.
88. Pjetursson BE, Rast C, Brägger U, Schmidlin K, Zwahlen M, Lang NP. Maxillary sinus floor elevation using the (transalveolar) osteotome technique with or without grafting material. Part I: implant survival and patients' perception. *Clin Oral Implants Res*. 2009;20(7):667-676.
89. Strietzel FP, Reichart PA. Oral rehabilitation using Camlog ([R]) screw-cylinder implants with a particle-blasted and acid-etched microstructured surface - results from a prospective study with special consideration of short implants. *Clin Oral Implants Res*. 2007;18(5):591-600.
90. Ferrigno N, Laureti M, Fanali S. Dental implants placement in conjunction with osteotome sinus floor elevation: a 12-year life-table analysis from a prospective study on 588 ITI implants. *Clin Oral Implants Res*. 2006;17(2):194.205.
91. Romeo E, Ghisolfi M, Rozza R, Chiapasco M, Lops D. Short (8-mm) dental implants in the rehabilitation of partial and complete edentulism: a 3- to 14-year longitudinal study. *Int J Prosthodont*. 2006;19(6):586-592.
92. Tabrizi R, Arabion H, Aliabadi E, Hasanzadeh F. Does increasing the number of short implants reduce marginal bone loss in the posterior mandible? A prospective study. *Br J Oral Maxillofac Surg*. 2016;54(7):731-735.
93. Bitaraf T, Keshtkar A, Rokn AR, Monzavi A, Geramy A, Hashemi K. Comparing short dental implant and standard dental implant in terms of marginal bone level changes: a systematic review and meta-analysis of randomized controlled trials. *Clin Implant Dent Relat Res*. 2019;21(4):796-812.
94. de N Dias FJ, Pecorari VGA, Martins CB, Del Fabbro M, Casati MZ. Short implants versus bone augmentation in combination with standard-length implants in posterior atrophic partially edentulous mandibles: systematic review and meta-analysis with the Bayesian approach. *Int J Oral Maxillofac Surg*. 2019;48(1):90-96.
95. Mokcheh A, Jegham H, Turki S. Short implants as an alternative to sinus lift for the rehabilitation of posterior maxillary atrophies: systematic review and meta-analysis. *J Stomatol Oral Maxillofac Surg*. 2019;120(1):28-37.
96. Cruz RS, Lemos CAA, Batista VES, et al. Short implants versus longer implants with maxillary sinus lift. A systematic review and meta-analysis. *Braz Oral Res*. 2018;32:e86.
97. Starch-Jensen T, Nielsen HB. Prosthetic rehabilitation of the partially edentulous atrophic posterior mandible with short implants (≤ 8 mm) compared with the Sandwich osteotomy and delayed placement of standard length implants (> 8 mm): a systematic review. *J Oral Maxillofac Res*. 2018;9(2):e2.
98. Araújo MG, Lindhe J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. *J Clin Periodontol*. 2005;32(2):212-218.
99. Cawood JI, Howell RA. A classification of the edentulous jaws. *Int J Oral Maxillofac Surg*. 1988;17(4):232-236.
100. Nunes M, Almeida RF, Felino AC, Malo P, de Araújo Nobre M. The influence of crown-to-implant ratio on short implant marginal bone loss. *Int J Oral Maxillofac Implants*. 2016;31(5):1156-1163.
101. Di Fiore A, Vigolo P, Sivolella S, et al. Influence of crown-to-implant ratio on long-term marginal bone loss around short implants. *Int J Oral Maxillofac Implants*. 2019;34(4):992-998.
102. Tang Y, Yu H, Wang J, Gao M, Qiu L. Influence of crown-to-implant ratio and different prosthetic designs on the clinical conditions of short implants in posterior regions: a 4-year retrospective clinical and radiographic study. *Clin Implant Dent Relat Res*. 2020;22(1):119-127.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

How to cite this article: Iezzi G, Perrotti V, Felice P, Barausse C, Piattelli A, Del Fabbro M. Are <7-mm long implants in native bone as effective as longer implants in augmented bone for the rehabilitation of posterior atrophic jaws? A systematic review and meta-analysis. *Clin Implant Dent Relat Res*. 2020;1–15. https://doi.org/10.1111/cid.12946