








# Impact of cement- and screw- retained implant prostheses on marginal bone loss: overview of systematic reviews

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**Aim:** The choice between retention systems in implant-supported prostheses impacts marginal bone loss (MBL), a key factor for implant longevity. Due to variability in the findings of systematic reviews, this overview aims to assess the methodological quality and synthesize available evidence from systematic reviews on the effects of cement- versus screw-retained implant-supported prostheses on MBL. **Methods:** Six databases were searched for systematic reviews comparing MBL in screw- versus cement-retained implant-supported prostheses. The methodological quality was assessed using AMSTAR 2, and the MBL effects were classified as favoring cemented, no difference, or favoring screwed systems based on the conclusions of the reviews. Additionally, quantitative data on MBL at different intervals—up to 1, 3, 4, and more than 4 years—were extracted from primary articles and visually plotted for interpretation. **Results:** The search identified 8 systematic reviews, mainly classified as critically low quality, which found no significant difference in MBL between retention systems. Evaluating the quantitative data, both systems exhibited minor variations over time, with cemented implant-supported prostheses showing slightly less bone loss at the five-year follow-up. Beyond 4 years, both systems demonstrated similar MBL ranges. **Conclusion:** Both screw-retained and cement-retained implant-supported prostheses appear to be reliable options, with no significant difference in MBL observed in most systematic reviews, especially over longer follow-up periods. However, due to the low quality of existing systematic reviews, conclusions should be approached with caution, underscoring the need for better-designed studies to reach a clearer clinical consensus.

**Keywords:** Dental prosthesis. Dental prosthesis, implant-supported. Dental prosthesis retention. Dental implants. Bone resorption.



## Introduction

Implant-supported prostheses are widely recognized as effective for oral rehabilitation; however, considerable debate persists within dentistry over strategies to improve treatment predictability, particularly concerning marginal bone loss (MBL)<sup>1-4</sup>. Peri-implant MBL is a key criterion for assessing the success of osseointegrated dental implants, with success defined as  $\leq 1$  mm of bone loss in the first year and  $\leq 0.2$  mm annually thereafter by Albrektsson et al.<sup>5</sup> (1986). Recently, Galindo-Moreno et al.<sup>6</sup> (2022) suggested that implants showing over 0.5 mm of MBL within 6 months post-loading often fail to show radiographic success at a 12-month follow-up, proposing a 0.5 mm limit as a success criterion. A central topic in prosthetic dentistry influencing such outcome involves choosing between cement-retained and screw-retained systems for attaching the prosthetic restoration to implants<sup>7-9</sup>. These discrepancies can result from variations in study designs, such as differences in follow-up periods, participants, implant systems, and prosthesis manufacturing techniques. In addition, inconsistencies in the way MBL is measured - whether radiographically, clinically, or over different time intervals - further complicate comparisons<sup>7-9</sup>. Factors such as operator experience, occlusal loading variations, and residual cement or microleakage in the peri-implant sulcus also contribute to the contradictory evidence<sup>7,8</sup>.

Screw-retained systems provide the advantage of allowing prosthesis removal or replacement without damaging the implant abutment. This approach ensures a secure fit with minimal misalignment and eliminates the risk of cement remnants in the peri-implant sulcus, which can lead to inflammation<sup>1,2</sup>. Nevertheless, screw-retained systems face drawbacks, including higher costs, the possibility of screw loosening, and an increased risk of MBL due to the stresses exerted during repeated removal or adjustments of the prosthesis<sup>10,11</sup>. On the other hand, cement-retained prostheses, which lack a screw access hole, are often favored for their enhanced esthetics and occlusal stability, ease of fabrication, and lower production costs<sup>7,8,12-15</sup>. Additionally, they offer flexibility in cases with unfavorable implant angulation<sup>1,10,15</sup>. However, cement-retained systems demand precise handling to prevent complications such as inflammation and potential bone loss from residual cement<sup>7,9,10</sup>. Despite the availability of studies comparing these retention systems, inconsistencies persist in the reported outcomes. For instance, while some studies suggest higher MBL in cement-retained systems due to microleakage and residual cement complications<sup>7,9,16</sup>, others highlight the potential for increased stress-induced bone loss in screw-retained systems<sup>10,11</sup>. These disparities hinder the establishment of clear clinical guidelines, leaving dentists to rely heavily on personal preferences and anecdotal experience.

Although studies compare these systems, the results are inconsistent. Some point to higher MBL in cemented systems due to complications such as microleakage and cement residue<sup>7,9,16</sup>, while others suggest that mechanical stress in screw-retained systems contributes to bone loss<sup>10,11</sup>. Systematic reviews have sought to synthesize this evidence, but discrepancies in conclusions remain<sup>1-4,15,17-19</sup>. For example, while some highlight the bacterial complications of cemented systems, others emphasize

the technical problems of screw-retained systems, and some do not identify significant differences in MBL between the methods. This fragmentation highlights the need for a comprehensive analysis to address specific contradictions, such as the long-term impact of retention systems on MBL and the influence of methodological differences between studies. To fill these gaps, this study performs an overview of systematic reviews, critically evaluating the effectiveness of interventions, methodological rigor, and risk of bias. This approach seeks to clarify the effects of cemented and screw-retained systems on MBL, providing a robust basis for informed clinical decisions in prosthodontics.

## Materials and Methods

This overview was conducted in full compliance with the guidelines outlined in the Statement of Preferred Reporting Items for Overviews of Reviews (PRIOR)<sup>20</sup>, with the protocol registered in the Open Science Framework (OSF) ([osf.io/t72my](https://osf.io/t72my)) on December 12, 2024. Strict criteria were adopted for inclusion in this study: only self-named systematic reviews, with or without meta-analysis, were considered eligible. The studies had to address clinical questions according to the PICO model, with the population consisting of patients rehabilitated with prostheses on dental implants, comparatively analyzing cemented and screwed retention systems as an intervention and comparison, respectively. The articles had to evaluate marginal bone loss and/or implant failures related to bone loss. These criteria aimed to ensure the selection of studies that presented clear, comparable, and relevant clinical data on the impact of retention systems on dental implants.

A comprehensive literature search was conducted in six electronic databases - MEDLINE (via PubMed), Scopus, Web of Science, Embase, Epistemonikos, and Cochrane Database of Systematic Reviews - to identify the systematic reviews for inclusion. The search was conducted up to December 12, 2024. Additionally, the reference lists of all included systematic reviews were examined to identify any additional reviews relevant to this overview. The search strategy was carefully adapted for each database (Supplementary file, Table S1), with no restrictions on language or publication date. Additionally, database alerts were enabled to ensure the search remained current.

Duplicate articles were removed using Mendeley reference manager (Mendeley Desktop, v1.19.4; Elsevier), after which two independent reviewers (J.V.C.N. and C.A.S.C.) screened titles and abstracts using the Rayyan tool for systematic reviews<sup>21</sup> based on predefined eligibility criteria. Selected reviews underwent full-text evaluation, with a third reviewer (B.E.N.) mediating any disagreements. Eligible reviews were included, and data was extracted into an Excel® table (Microsoft Office 2017), with a third reviewer resolving any discrepancies. Authors were contacted thrice via email if additional information was needed. The inter-rater reliability during the study selection process was measured using the kappa statistic ( $\kappa$ ) to assess consistency<sup>22</sup> with IBM SPSS Statistics software (v20.0; IBM Corp).

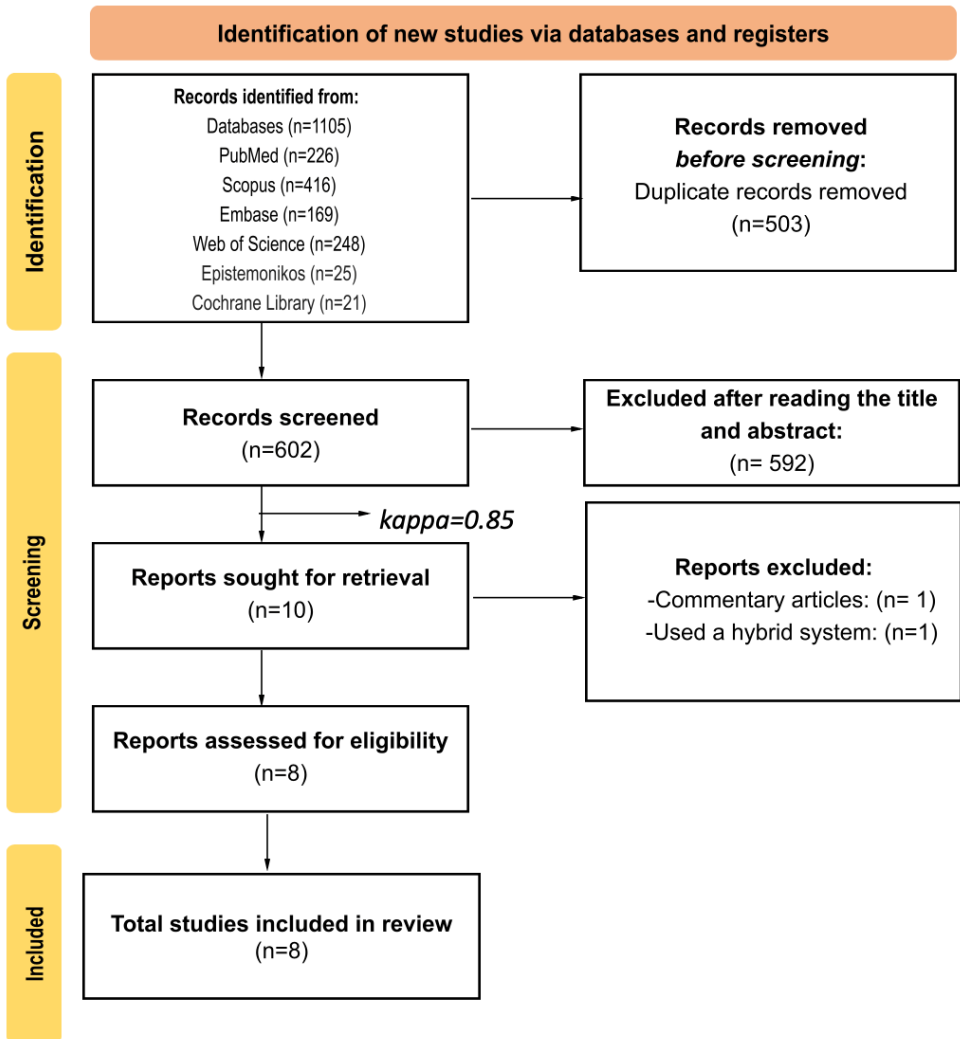
To evaluate the methodological quality of the selected reviews, both reviewers (J.V.C.N. and C.A.S.C.) first underwent a training session to ensure proper calibration

before applying the MeaSurement Tool to Assess Systematic Reviews (AMSTAR 2)<sup>23</sup>, a robust 16-item checklist designed to cover all critical stages of the systematic review process. This training aimed to standardize the assessment process and ensure consistency between the reviewers. Following the training, both reviewers independently applied AMSTAR 2 to the selected reviews. Any discrepancies in quality assessments were subsequently addressed and resolved through a consensus meeting involving all reviewers.

In addition, to enable a numerical comparison, direct data was gathered from primary studies within the systematic reviews that included meta-analyses on marginal bone loss. This data was organized in a structured Excel® table (Microsoft Office 2017) to capture the reported means and standard deviations. Using this compiled information, a scatter plot was created to illustrate marginal bone loss at various time intervals: up to 1 year, 3 years, 4 years, and more than 4 years, as reported in the included systematic reviews based on their primary studies. For the 1-year interval, a reference threshold of up to 1 mm of bone loss was set, following Albrektsson et al.<sup>5</sup> (1986) well-known findings on expected bone loss within the first year post-implantation.

## Results

A total of 1105 studies were initially identified for inclusion. After duplicates were removed, 602 studies remained, which were then screened by title and abstract. From this, 10 studies were selected for full-text review. The inter-rater agreement between evaluators had a Kappa coefficient ( $\kappa$ ) of 0.85, indicating near-perfect agreement<sup>22</sup>. Of the 10 studies, two were excluded: one was a commentary on a systematic review already included<sup>24</sup>, and the other assessed a hybrid retention system that combined features of cemented and screw-retained restorations<sup>25</sup>. Consequently, 8 systematic reviews, all published in English, were included in the final analysis. Overall characteristics of these reviews are provided in Table 1, with a detailed selection process illustrated in Figure 1.



**Figure 1.** Flowchart of the study selection process following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

**Table 1.** Characteristics of included systematic reviews.

Authors, Year (Country)	Written-Oriented Checklist	Registered Database	Aims	Searches	Search Restrictions and Period	Design and number of included studies	Risk of Bias	Quality of Included Primary Studies	Meta-Analysis	GRADE	Main Conclusions
Dini et al. <sup>1</sup> (2021) (Brazil)	PRISMA 2020 Statement	Open Science Framework (10.17605/OSF.IO/ER6M8)	To assess the changes in peri-implant tissues and the esthetic performance of cemented and screw-retained single-tooth implant crowns placed in the esthetic zone with zirconia abutments.	PubMed (MEDLINE), Scopus, Web of Science, Virtual Health Library, The Cochrane Library, Clinical Trials, Rebec, EMBASE, and grey literature (OpenGrey).	No language and publication time restrictions were applied; Up to February 2021.	RCT (n=7) N-RCT (n=2)	RoB 2: RCT: ROBINS-I: N-RCT.	Rob 2: High risk (n=7). ROBINS-I: Serious risk (n=2).	YES	YES	Screw-retained single implant crowns on zirconia abutments exhibited greater marginal bone level change, while cemented crowns were associated with higher bleeding on probing.
Gaddale et al. <sup>15</sup> (2020) (India)	PRISMA 2020 Statement	NP	To evaluate the technical and biological challenges associated with screw- and cement-retained implant-supported full-arch dental prostheses.	Medline/PubMed, Cochrane, and hand searches on journals of implants: Implant Dent, Clin Implant Dent Relat Res, Clin Oral Implants Res, Eur J Oral Sci, J Periodontol, and J Oral Implantol.	English; Up to February 2019.	PT (n=19) RT (n=8) RCT (n=2)	Newcastle-Ottawa scale: case control and cohort studies. Cochrane collaboration's tool: RCT.	Newcastle-Ottawa scale: High quality (n=26). Cochrane collaboration's tool: Low risk (n=2).	YES	NP	Cemented prostheses presented more biological problems, such as implant failures or marginal bone loss, than screw-retained prostheses.
Jain et al. <sup>17</sup> (2018) (India)	PRISMA 2009 Statement	NP	To analyze retention failures in fixed restorations supported by dental implants, comparing cement-retained and screw-retained systems in partially edentulous arches.	MEDLINE (PubMed), Cochrane Library, and EBSCO.	English language published in journals of dentistry; Up to January 2016.	RCT (n=3) PT (n=11) RT (n=19)	Newcastle-Ottawa Scale: cohort and case-control studies. Jadda Scale: RCT.	NR	YES	NP	Cement-retained prosthesis shows less retention failures as compared to screw-retained prosthesis

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Continuation	Potdukhe et al. <sup>3</sup> (2024) (India)	PRISMA 2020 Statement	PROSPERO (CRD42021261601)	To compare marginal bone loss and complications between screw- and cement-retained all-ceramic crowns on zirconia abutments.	Cochrane Library, EBSO, PubMed/Medline, and Google Scholar.	English, and published before 2014; Up to June 2023.	PT (n=1) RCT (n=7)	Cochrane ROB 2 tool: RCT: Newcastle-Ottawa: PT: Good quality (n=1).	Rob 2: Moderate risk (n=3) and low risk (n=4). Newcastle-Ottawa: Good quality (n=1).	YES	YES	No difference was observed between cemented and screwed at 3-year and 5-year follow-up.
Ramamoorthi and Esfandiari <sup>18</sup> (2016) (Canada)	Health Technology Assessment methodology	PROSPERO (CRD42015024649).	To analyze the cost-effectiveness of screw-retained versus cement-retained implant-supported prostheses in the treatment of partial edentulism	MEDLINE, EMBASE, PubMed, INHATA, CRD, CADTH, CENTRAL, Cochrane Registry, clinicaltrials.gov, Google Scholar, complemented by the following additional search: IADR Abstracts and journal databases (Wiley, Elsevier, Quintessence, Sage Pub).	NR; Up to October 7, 2015.	PT (n=69) RT (n=41) RCT (n=13) CCT (n=9)	Effective Public Health Practice Project Quality Assessment Tool.	NR	YES	NP	The meta-analysis suggested no statistical difference between the 2 retention systems.	
Ramamoorthi et al. <sup>19</sup> (2017) (Canada)	PRISMA 2020 Statement	PROSPERO (CRD42015024649)	To evaluate the impact of various retention systems for implant-supported prostheses in patients with partially edentulous arches, by assessing failure rates, survival rates, and complication-free outcomes.	MEDLINE in-process and other nonindexed citations, EMBASE, and PubMed.	English; Up to October 7, 2015.	PT (n=56) RCT (n=15) RT (n=29) CCT (n=4)	Effective Public Health Practice Project Quality Assessment Tool.	High quality (n=104).	YES	NP	Screwed systems showed less failure after 5 years compared to cemented.	

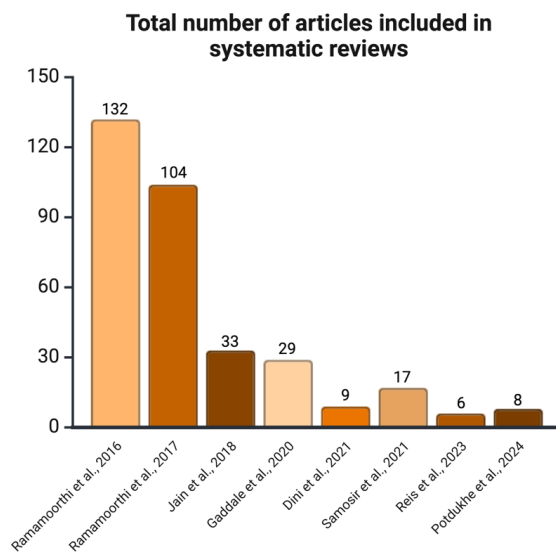
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<p>Reis et al.<sup>4</sup> (2023) (Brazil)</p>	<p>PRISMA 2020 Statement</p>	<p>PROSPERO (CRD42022379444)</p>	<p>To evaluate the incidence of peri-implant mucositis and peri-implantitis in cement-retained versus screw-retained prostheses; based on RCTs that directly compared both retention methods.</p>	<p>National Library of Medicine (MEDLINE- PubMed), SCOPUS, EMBASE, and ISI Web of Science.</p>	<p>NR; Up to January 2023. RCT (n=6) Cochrane ROB 2 tool. Some concerns (n=6).</p>	<p>YES YES</p>	<p>Cement-retained prosthesis present fewer technical problems, with more biological problems, such as implant failures or marginal bone loss, than screwed ones.</p>
<p>Samosir et al.<sup>2</sup> (2021) (Indonesia)</p>	<p>PRISMA 2020 Statement</p>	<p>NP</p>	<p>To compare the biological, clinical, and technical complications associated with cement-retained and screw-retained implants.</p>	<p>PubMed, EBSCO, and Cochrane Central Register of Controlled Trials (CENTRAL).</p>	<p>Newcastle- Ottawa scale: High (n=4). Jadad Scale: High (n=9).</p>	<p>NP NP</p>	<p>Screw-retained prosthesis combines advantages of both cemented and screw-retained prosthesis restorations.</p>

Legend. Clin Oral Implants: Res Clinical Oral Implants Research; RCT: Randomized controlled trial; CCT: Clinical Control Trial; PT: Prospective trials; RT: Retrospective trials; NP: No Performed; Implant Dent: Implant Dentistry; Clin Implant Dent Relat Res: Clinical Implant Dentistry and Related Research; Eur J Oral Sci: European Journal of Oral Implantology; CS: Cross-sectional; J Periodontol: Journal of Periodontology; J Oral Implantol: Journal of Oral Implantology; NP: Not performed; RoB 2: Risk Of Bias 2; ROBINS-I: Risk Of Bias In Non-randomized Studies - of Interventions; NR: No Reported.

The included reviews differed in the total number (Figure 2) and types of studies included, all of which included randomized controlled trials<sup>1-4,15,17-19</sup>, and 1 also included non-randomized controlled trial<sup>1</sup>. Furthermore, among the systematic reviews included, 7 carried out statistical analyses or meta-analyses. The variables analyzed included the incidence of marginal bone loss over time, comparing different retention systems (screw versus cemented)<sup>1,3,4,15,17-19,26-28</sup>, and 3 evaluated the certainty of the evidence with the tool Grading of Recommendations, Assessment, Development, and Evaluations (GRADE)<sup>1,3,4</sup>. Searches within the included reviews were conducted across electronic databases (some also utilizing registration platforms), reference lists of included studies, and through handsearching. Notably, as shown in Figure 2, more recent reviews included fewer studies than older ones. This reduction likely reflects stricter selection criteria, an emphasis on higher-quality evidence, and variation in the types of studies considered, as some reviews included a broader range of study designs while others were more selective.



**Figure 2.** Total number of studies included in each systematic review.

Before applying the AMSTAR 2 tool, both reviewers underwent calibration training to ensure consistency in their evaluations. This training not only aligned their understanding of the checklist criteria but also enhanced their ability to critically appraise the methodological rigor and identify potential biases in the systematic reviews. By ensuring a reliable and consistent assessment, this step supported the broader objective of synthesizing and discussing the included reviews. Rather than aiming for definitive conclusions, this process sought to provide a comprehensive overview of the strengths, weaknesses, and methodological limitations of the existing evidence, contributing to a nuanced understanding of intervention efficacy, meth-

odological quality, and risk of bias across studies. Figure 3 presents the results of the AMSTAR 2 assessment, showing that none of the reviews achieved a high or moderate quality rating. Three reviews were rated as low quality, largely due to critical methodological issues that affected the reliability of their summaries and limited the validity of their conclusions. These ratings were primarily due to insufficient reporting of methodological details, which compromised the reliability of findings and raised concerns about the robustness of the evidence provided<sup>4,15,17</sup>. The remaining 5 studies were categorized as critically low quality due to multiple critical flaws and serious deficiencies, which impacted the reliability of their findings<sup>1-3,18,19</sup>. Key issues included a lack of documented protocols, with only six reviews providing a written and independently reviewed protocol<sup>1,3,4,15,17,18</sup>. Furthermore, only one review sufficiently detailed the design of the included studies<sup>18</sup>, and one review performed an adequate and comprehensive literature search<sup>1</sup>. In terms of reporting the selection process, only one study adequately described this step by verifying study characteristics against the elements of the research question<sup>2</sup>.

Additionally, four studies lacked sufficient methodological detail during data extraction, which limited a thorough assessment of their quality and affected the overall validity of the conclusions<sup>2,15,18,19</sup>. Just one review provided a list of potentially eligible studies that were excluded, along with the reasons for exclusion<sup>17</sup>. Two studies did not provide adequate descriptions of the included studies<sup>2,18</sup>. Among those conducting meta-analyses, just one failed to report their results adequately<sup>18</sup>, while three did not discuss how biases in the included articles could have impacted the meta-analysis results<sup>3,17,18</sup>. Furthermore, only three studies took into account the bias of included studies when interpreting and discussing their findings, conclusions, or recommendations<sup>1,4,15</sup>. Additionally, one review did not provide a satisfactory explanation for the heterogeneity of primary studies, especially concerning methodological and design differences<sup>2</sup>. Three studies did not adequately investigate publication bias or discuss its potential impact on their results<sup>1,3,18</sup>.

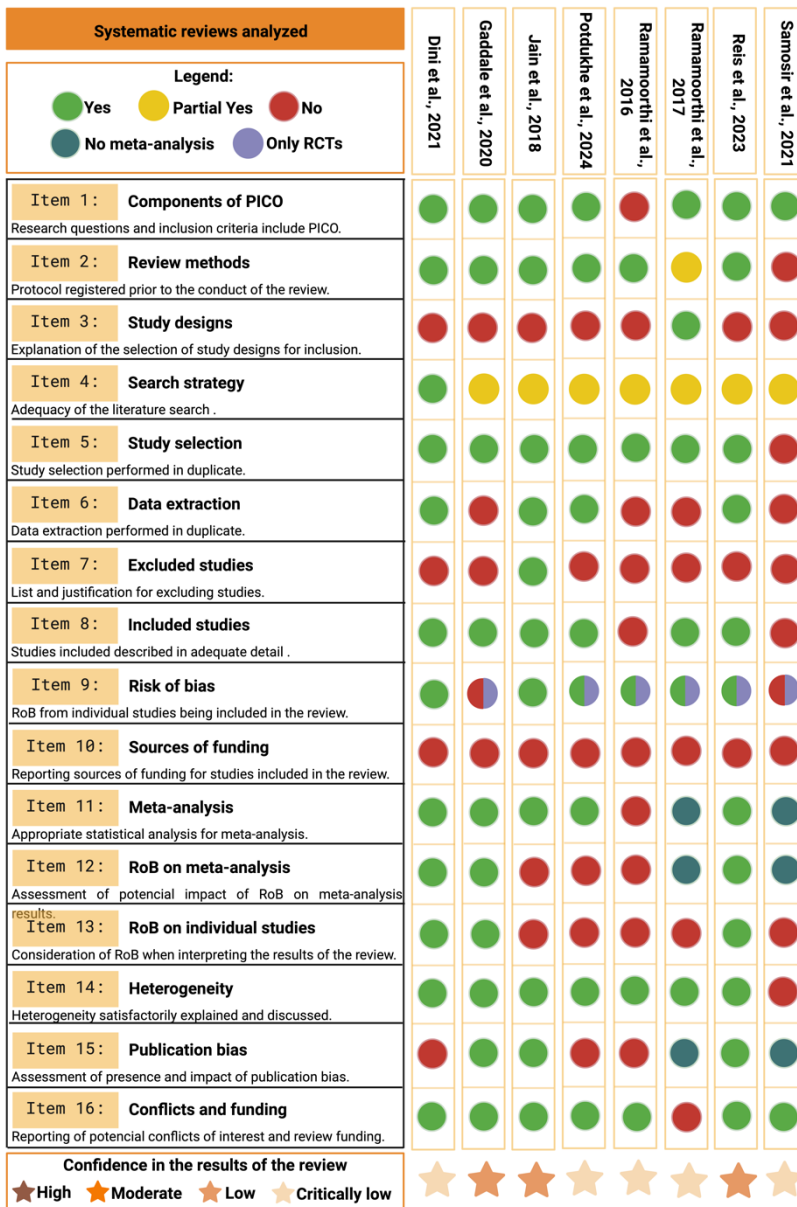
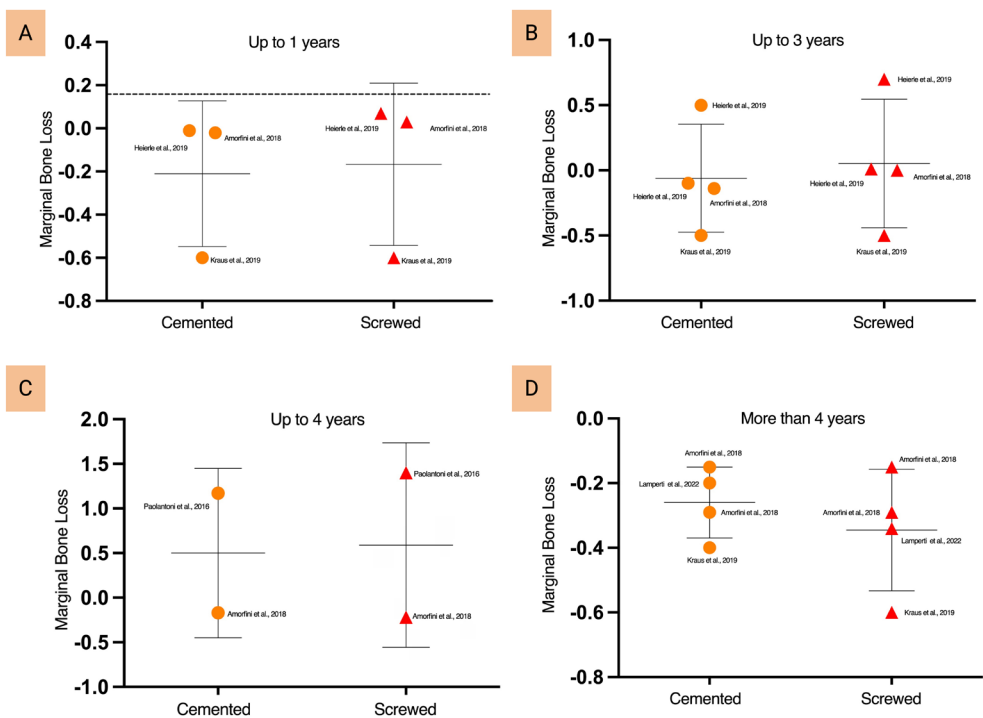


Figure 3. AMSTAR 2 methodological evaluation of included systematic reviews. Bubbles filled with 2 different colors represent different answers for subitems of question 9.

Figure 4 provides a detailed scatter plot analysis of MBL over various follow-up periods, with data extracted from primary studies included in systematic reviews that conducted meta-analyses on retention methods (Supplementary Table 2-5). Across different studies, each retention system exhibits comparable levels of bone maintenance, though individual study results occasionally vary due to differences in methodologies, sample sizes, and implant placements. In the early follow-up periods (up to 1 year), both systems generally stay within acceptable limits for MBL, aligning with

expected bone loss of up to 1 mm within the first year<sup>29-31</sup>. This trend of stability persists in the longer follow-up periods, from 3 to more than 4 years, where both cemented and screw-retained systems demonstrate minimal MBL, often showing negative MBL values, which reflect favorable bone preservation outcomes<sup>29-33</sup>. Nevertheless, it is important to emphasize that at the end of 3 years, cemented implants demonstrate bone maintenance, while screw-retained implants show a slightly higher loss. Variations observed across studies underscore the need for cautious interpretation, as methodological quality, study design, and patient selection can impact outcomes. Overall, these findings support the notion that both cemented and screw-retained systems can be effective choices for implant retention, with MBL trends generally favoring neither system conclusively over time.



**Figure 4.** Scatter plots illustrating marginal bone loss across different follow-up periods: A) Up to 1 year: both implant types show minimal bone loss. B) Up to 3 years: cemented implants maintain bone levels, while screw-retained implants experience greater loss. C) Up to 4 years: cemented implants exhibit moderate bone loss, while screw-retained implants show a wider range of loss. D) More than 4 years: both cemented and screw-retained implants demonstrate marginal bone stability.

## Discussion

Overall, our results indicated that the majority of systematic reviews found no significant difference in MBL between screw-retained and cement-retained implant-supported prostheses, suggesting that, in terms of MBL, both retention systems may be equally effective. This overview provides a comprehensive comparison

of cemented and screw-retained implant systems in terms of MBL, offering critical insights for clinical decision-making. The analyses included an extensive selection of clinical studies with follow-up periods spanning from 1 to 25 years, offering robust insights into the occurrence and progression of MBL over time. The inclusion of these studies was essential for drawing more precise inferences and reinforcing the observed associations, ultimately contributing to a more comprehensive understanding of MBL dynamics in implant-supported prostheses.

Our findings suggested that most systematic reviews did not conclude any significant difference in MBL between screw-retained and cement-retained implant-supported prostheses. Cemented implants demonstrated slightly more favorable outcomes, potentially due to their superior fit and stability, which minimize micromovements at the implant-abutment interface<sup>11,34</sup>. Studies like those of Jain et al.<sup>17</sup> (2018) highlight that reductions in MBL for cemented systems may be related to the precise adaptation of cement-retained prostheses, which can better distribute forces and reduce stress on the peri-implant bone<sup>17</sup>. Moreover, the analysis of the studies emphasized the superior passivity and enhanced control over occlusal morphology offered by the cement-retained technique. This method also proved to be technically less demanding compared to the screw-retained approach<sup>11,17,34</sup>. Furthermore, cemented prostheses present lower stress around the implant-to-bone junctions, which results in reduced crestal bone resorption caused by mechanical loads<sup>17</sup>.

However, cemented systems come with their own set of challenges, notably the risk of residual subgingival cement, which can promote an anaerobic environment that encourages biofilm formation, leading to an increased risk of peri-implantitis and subsequent bone loss<sup>4,9,11,35,36</sup>. Maintenance issues, such as porcelain chipping and abutment loosening, can also affect the longevity of cement-retained prostheses, presenting additional risks to the long-term stability of MBL<sup>35</sup>. These factors highlight the multifaceted nature of the discrepancies in MBL outcomes and the need for a nuanced approach in selecting retention methods for implant-supported prostheses. Screw-retained systems, on the other hand, offer distinct advantages in terms of retrievability, ease of maintenance, and the ability to repair or replace prosthetic components without significant intervention, which can be beneficial for preserving bone health over time<sup>2,11,17,19,27,28,34</sup>. Additionally, the absence of residual cement, a common concern with cemented systems, reduces the risk of peri-implantitis caused by biofilm accumulation, further supporting long-term peri-implant tissue stability<sup>2,18,19,28</sup>. Advances in preload and torque control have also enhanced the mechanical reliability of screw-retained systems, making them more resilient under functional loads<sup>27,34</sup>. This mechanical precision contributes to a better distribution of occlusal forces, minimizing localized stress on the peri-implant bone, which may help reduce marginal bone loss over time<sup>34</sup>.

Moreover, screw-retained systems provide superior retrievability, especially in cases where adjustments or repairs are needed, such as realigning prosthetic components or addressing biological complications<sup>27,34</sup>. This retrievability ensures that interventions can be carried out with minimal disruption to the implant-abutment interface, preserving structural integrity and promoting tissue health<sup>11,17,27</sup>. Despite these benefits, screw-retained systems are not without drawbacks; they are more

prone to complications such as abutment loosening and porcelain fractures, largely due to the access holes required in the prosthetic design<sup>27,34</sup>. These access points can weaken the prosthetic structure, leading to mechanical instability. If not managed correctly, this instability can result in greater MBL, particularly in cases where excessive functional or parafunctional loads are present<sup>27,34</sup>. However, the use of advanced materials and optimized prosthetic designs, such as angled screw channels, has been shown to mitigate these mechanical challenges, further enhancing the reliability of screw-retained systems<sup>34</sup>.

The variability in MBL outcomes between cement-retained and screw-retained systems can be attributed to differences in clinical application and prosthetic design. Sailer et al.<sup>8</sup> (2012) observed that biological complications, such as MBL exceeding 2 mm, were more frequently associated with cemented reconstructions. In our analysis, both cemented and screw-retained implants showed comparable bone loss of about 1 mm at the 1-year follow-up, suggesting similar initial outcomes<sup>8</sup>. However, cemented systems were associated with biological complications, such as biofilm formation in the microgaps between the abutment and prosthesis, which can contribute to bone resorption. In contrast, screw-retained systems exhibited higher rates of abutment loosening and porcelain fractures<sup>2,18,19,28</sup>. These failures can compromise implant stability, leading to micro-movements at the abutment-prosthesis interface. These micro-movements generate a local inflammatory response, leading to bone loss around the implant, increasing the risk of MBL. Wittneben et al.<sup>34</sup> (2014) highlighted those specific complications, such as retention loss in cemented systems and mechanical instability in screw-retained systems, negatively impact MBL<sup>34</sup>. These findings suggest neither fixation type has a clear advantage in long-term bone preservation, as both have unique risks and benefits that should be considered based on the specific clinical case.

The choice between cemented and screw-retained prostheses should be made on a case-by-case basis, considering factors such as patient history, implant positioning, and the specific biomechanical requirements of the case. Ultimately, both retention systems demonstrated satisfactory MBL outcomes within expected limits when applied appropriately, yet each carries its risks that can impact long-term bone health. Regular radiographic monitoring, careful planning of implant placement, and precise material selection are vital in optimizing outcomes, regardless of the retention method chosen. This individualized approach enables clinicians to align treatment with patient-specific needs, minimizing MBL and enhancing the longevity of implant-supported prostheses. For instance, for cement-retained prostheses, clinicians must weigh the benefits of stability and aesthetics against the potential need for replacement in cases of biomechanical failure, which could increase overall treatment costs<sup>17,37,38</sup>. Cemented restorations require meticulous positioning of the crown-abutment interface at or slightly below the gingival margin to ensure thorough cement removal and reduce the risk of subgingival inflammation. In contrast, screw-retained prostheses, though generally easier to maintain, necessitate careful design and material selection to minimize the risk of screw loosening. Equalization and precise occlusion adjustments are critical to avoiding unwanted lateral and protrusive contacts that could exacerbate bone loss<sup>14,17,27,39</sup>. Regular radiographic

assessments should be performed with screw-retained restorations to ensure accurate prosthetic alignment before applying the final torque<sup>9</sup>.

The findings from systematic reviews assessing the impact of retention systems on MBL were carefully evaluated both critically and methodologically, directly addressing the inconsistencies highlighted. Using the AMSTAR 2 assessment tool, this study systematically synthesized the evidence to identify key gaps in reporting, such as inadequate discussions on risk of bias and insufficient consideration of study heterogeneity. Essential information, including clear inclusion criteria and justifications for study restrictions, was often lacking, alongside limited transparency regarding funding sources, which weakened the methodological quality and reproducibility of many reviews. Additionally, this overview identified that the overly stringent inclusion and exclusion criteria applied in the analyzed reviews may have excluded relevant clinical studies. This narrowing of the evidence scope highlights a significant methodological limitation, potentially masking broader clinical trends and reducing the generalizability of findings. By identifying and discussing these issues, this overview provides a critical appraisal of the existing evidence, aligning with the objective of synthesizing and evaluating the methodological rigor and biases within the included reviews, rather than aiming for definitive conclusions. These findings contribute to resolving inconsistencies by providing a comprehensive synthesis of strengths and weaknesses across reviews, clarifying methodological limitations, and offering recommendations to improve future studies. This approach aligns with the proposed objective of evaluating intervention efficacy, methodological rigor, and risk of bias, offering clinicians a basis for informed decisions on MBL outcomes associated with different implant retention systems.

In conclusion, although this overview did not reveal significant differences in marginal bone loss between cemented and screw-retained retention systems across various time points, the low methodological quality of the included systematic reviews limits the reliability of these findings. Consequently, there is a pressing need for high-quality, long-term randomized clinical trials to provide stronger evidence and establish a clearer consensus on optimal retention methods for minimizing MBL. Such trials would also play a pivotal role in fostering the development of higher-quality systematic reviews and supporting evidence-based clinical guidelines.

## Conflict of Interest

The authors have no conflict of interest to disclose.

## Data availability

Datasets related to this article will be available to the corresponding author upon request.

## Author Contribution

**João Vicente Calazans Neto:** Study concept and design; acquisition of data; analysis and interpretation of data; and drafting of the manuscript. **Cícero Andrade Sigilião Celles:** Acquisition of data; and analysis and interpretation of data. **Maria Helena Rossy Borges, Samuel Santana Malheiros** and **Guilherme Almeida Borges:**

Analysis and interpretation of data; and critical revision of the manuscript for important intellectual content. **Valentim Adelino Ricardo Barão:** Administrative, technical, and material support. **Bruna Egumi Nagay:** Study concept and design; analysis and interpretation of data; drafting of the manuscript; critical revision of the manuscript for important intellectual content; administrative, technical, and material support; and study supervision. All authors actively revised and approved the final version of the manuscript.

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## SUPPLEMENTARY TABLES

**Table S1.** Search strategy (December 12, 2024).

MEDLINE - PubMed (n=226)	((Dental Implants [MeSH Terms] OR Surgical Dental Prostheses[Title/Abstract] OR Implant*[Title/Abstract] OR Prostheses and Implants[MeSH Terms] OR Prosthes*[Title/Abstract] OR Artificial Implants[Title/Abstract] OR Crowns[MeSH Terms] OR Crown[Title/Abstract] OR Dental Crown[Title/Abstract] OR Crown*[Title/Abstract] AND (Cement[Title/Abstract] OR Cement retained[Title/Abstract] OR Cement*[Title/Abstract])) AND (Screw[Title/Abstract] OR Screw retained[Title/Abstract] OR Screw*[Title/Abstract])) AND (Review[Title/Abstract] OR meta-analysis[Title/Abstract] OR meta-analyses[Title/Abstract])
Scopus (n=416)	TITLE-ABS-KEY ( "Dental Implants" ) OR TITLE-ABS-KEY ( "Surgical Dental Prostheses" ) OR TITLE-ABS-KEY ( implant* ) OR TITLE-ABS-KEY ( "Prostheses and Implants" ) OR TITLE-ABS-KEY ( prosthes* ) OR TITLE-ABS-KEY ( "Artificial Implants" ) OR TITLE-ABS-KEY ( crowns ) OR TITLE-ABS-KEY ( crown ) OR TITLE-ABS-KEY ( "Dental Crown" ) OR TITLE-ABS-KEY ( crown* ) AND TITLE-ABS-KEY ( cement ) OR TITLE-ABS-KEY ( "Cement retained" ) OR TITLE-ABS-KEY ( cement* ) AND TITLE-ABS-KEY ( screw ) OR TITLE-ABS-KEY ( "Screw retained" ) OR TITLE-ABS-KEY ( screw* ) AND TITLE-ABS-KEY ( review ) OR TITLE-ABS-KEY ( meta-analysis ) OR TITLE-ABS-KEY ( meta-analyses )
Web of Science (n=248)	(TS=("Dental Implants") OR TS=("Surgical Dental Prostheses") OR TS=(implant*) OR TS=("Prostheses and Implants") OR TS=(prosthes*) OR TS=("Artificial Implants") OR TS=(crowns) OR TS=(crown) OR TS=("Dental Crown")) AND TS=(crown*) OR TS=("Dental Crown") AND (TS=(cement) OR TS=("Cement retained") OR TS=(cement*)) AND (TS=(screw) OR TS=("Screw retained") OR TS=(screw*)) AND (TS=(review) OR TS=("meta-analysis") OR TS=("meta-analyses"))
Embase (n=169)	('Dental Implants':ti,ab,kw OR 'Surgical Dental Prostheses':ti,ab,kw OR implant*:ti,ab,kw OR 'Prostheses and Implants':ti,ab,kw OR prosthes*:ti,ab,kw OR 'Artificial Implants':ti,ab,kw OR crowns:ti,ab,kw OR crown:ti,ab,kw OR 'Dental Crown':ti,ab,kw) AND (cement:ti,ab,kw OR 'Cement retained':ti,ab,kw OR cement*:ti,ab,kw) AND (screw:ti,ab,kw OR 'Screw retained':ti,ab,kw OR screw*:ti,ab,kw) AND (review:ti,ab,kw OR 'meta-analysis':ti,ab,kw OR 'meta-analyses':ti,ab,kw)
Epistemonikos (n=25)	("Dental Implants" OR "Surgical Dental Prostheses" OR implant* OR "Prostheses and Implants" OR prosthes* OR "Artificial Implants" OR crowns OR crown OR "Dental Crown" OR crown*) AND (cement OR "Cement retained" OR cement*) AND (screw OR "Screw retained" OR screw*) AND (review OR "meta-analysis" OR "meta-analyses")
Cochrane Library (n=21)	("Dental Implants" OR "Surgical Dental Prostheses" OR implant* OR "Prostheses and Implants" OR prosthes* OR "Artificial Implants" OR crowns OR crown OR "Dental Crown") AND (cement OR "Cement retained") AND (screw OR "Screw retained") AND (review OR "meta-analysis" OR "meta-analyses")

Legend. TS: topic; Ti: Title; Ab: Abstract; kw: Keywords

**Table S2.** Data extracted from primary studies included in systematic reviews that conducted meta-analyses on retention method within a period of up to 1 year.

Systematic review	Primary study	Up to 1 year					
		Cemented			Screw-retained		
		Mean	SD	N	Mean	SD	N
Dini et al. <sup>1</sup> , 2021	Amorfini et al. <sup>29</sup> , 2018	-0.01	0.05	16	0.03	0.06	16
	Kraus et al. <sup>30</sup> , 2019	-0.6	0.5	20	-0.6	0.2	24
	Heierle et al. <sup>31</sup> , 2018	-0.02	0.658	14	0.07	0.541	15

**Table S3.** Data extracted from primary studies included in systematic reviews that conducted meta-analyses on retention method within a period of up to 3 year.

Systematic review	Primary study	Up to 3 years					
		Cemented			Screw-retained		
		Mean	SD	N	Mean	SD	N
Dini et al. <sup>1</sup> , 2021	Amorfini et al. <sup>29</sup> , 2018	-0.14	0.11	16	0.01	0.09	16
	Kraus et al. <sup>30</sup> , 2019	-0.5	0.2	14	-0.5	0.3	14
	Heierle et al. <sup>31</sup> , 2019	-0.1	0.39	14	0	0.0001	13
Potdukhe et al. <sup>3</sup> , 2024	Heierle et al. <sup>31</sup> , 2019	0.5	0.35	17	0.7	0.34	17

**Table S4.** Data extracted from primary studies included in systematic reviews that conducted meta-analyses on retention method within a period of more than 4 years.

Systematic review	Primary study	Up to 4 years					
		Cemented			Screw-retained		
		Mean	SD	N	Mean	SD	N
Dini et al. <sup>1</sup> , 2021	Amorfini et al. <sup>29</sup> , 2018	-0.15	0.09	16	-0.22	0.19	16
	Paolantoni et al. <sup>32</sup> , 2016	1.17	0.89	29	1.4	0.99	45

**Table S5.** Data extracted from primary studies included in systematic reviews that conducted meta-analyses on retention method within a period of more than 4 years.

Systematic review	Primary study	More than 4 years					
		Cemented			Screw-retained		
		Mean	SD	N	Mean	SD	N
Dini et al. <sup>1</sup> , 2021	Amorfini et al. <sup>29</sup> , 2018	-0.15	0.09	16	-0.29	0.23	16
	Lamperti et al. <sup>33</sup> , 2022	-0.2	0.4	17	-0.34	0.31	17
Potdukhe et al. <sup>3</sup> , 2024	Kraus et al. <sup>30</sup> , 2019	-0.4	0.4	24	-0.6	0.4	20
	Amorfini et al. <sup>29</sup> , 2018	-0.29	0.23	26	-0.15	0.09	16