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COMPLICATIONS IN SCREW VERSUS CEMENT RETAINED IMPLANT-SUPPORTED SINGLE CROWNS: A SYSTEMATIC REVIEW

Prosthodontics

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ABSTRACT

Background: The choice between screw- and cement-retained implant-supported crowns remains one of the most debated decisions in implant prosthodontics, with each approach carrying distinct biological, mechanical, and clinical implications. **Objectives:** To systematically compare complications—biological, technical, and aesthetic—associated with screw- and cement-retained implant-supported single crowns, and to evaluate contributing clinical factors.**Methods:** A systematic review was conducted following PRISMA 2020 guidelines (PROSPERO: CRD420251015357). Electronic searches of PubMed/MEDLINE, Cochrane CENTRAL, ScienceDirect, and Google Scholar (2005–2025) yielded 533 records, supplemented by 2 articles from manual searching. Following deduplication and sequential screening, 7 studies were included. Risk of bias was assessed using RoB 2 and ROBINS-I tools. **Results:** Seven studies encompassing 365 implants in 263 patients were included (2 RCTs; 5 non-randomized interventional studies). Follow-up ranged from 6 months to 15 years. Implant survival was consistently high in both groups (93.7–100%). Screw-retained restorations demonstrated higher ceramic fracture rates (38% vs. 4%) and abutment screw loosening (32% vs. 9%) in one long-term study. Cement-retained restorations carried a higher biological risk from residual cement-associated peri-implantitis. Most studies found no significant difference in peri-implant bone loss or soft tissue health.**Conclusion:** Both retention systems demonstrate comparable long-term survival. Clinical selection should be individualized, balancing retrievability, aesthetic requirements, biological risk, and occlusal load. Advances in digital workflows and monolithic materials are progressively narrowing the performance gap between both techniques.

KEYWORDS

screw-retained prosthesis; cement-retained prosthesis; implant complications; peri-implantitis; screw loosening.

INTRODUCTION

Osseointegrated dental implants have become the standard of care for single-tooth replacement, offering functional restoration without compromising adjacent tooth structure. Over four decades of clinical research has established high long-term survival rates exceeding 90% for implant-supported crowns across diverse patient populations.

Two primary prosthetic retention strategies are employed clinically: screw retention, in which the crown is secured via a transocclusal access screw, and cement retention, in which the crown is luted onto a prefabricated or custom abutment. Each strategy offers distinct advantages. Cement-retained restorations have historically been favored for their superior esthetics, passive fit, and simplified laboratory procedures,[1,2] while screw-retained restorations are preferred for their non-destructive retrievability and elimination of cement-associated biological risks.[3,4]

Complications arising from both methods can be categorized as biological (peri-implant mucositis, peri-implantitis, marginal bone loss), technical (ceramic fracture, screw loosening, loss of retention), or aesthetic (impaired soft tissue contour, visible access channel).[5,6] Residual cement in the peri-implant sulcus has been identified as a primary etiological factor in cement-retained crown complications,[7,8] while the screw-access channel introduces a structural discontinuity that predisposes ceramic veneers to fracture under masticatory loading.[9,10]

Despite a substantial body of comparative literature, definitive clinical guidance remains elusive due to heterogeneity in study design, follow-up duration, implant systems, and prosthetic materials.[11,12] Emerging technologies—including angulated screw channels, monolithic ceramics, and computer-aided design/manufacturing (CAD/CAM) workflows—have substantially altered the clinical landscape, necessitating updated evidence synthesis.[13,14] This systematic review was conducted to compare complication profiles, survival outcomes, and biological responses between the two retention systems, with the aim of providing evidence-based clinical guidance.

MATERIALS AND METHODS

Protocol and Registration

This systematic review was conducted and reported in accordance with the PRISMA 2020 guidelines[15] and prospectively registered on PROSPERO (CRD420251015357).

PICO Framework

The review question was structured using the Population–Intervention–Comparison–Outcome (PICO) format: Population — patients with implant-supported single crowns; Intervention — screw-retained crowns; Comparison — cement-retained crowns; Outcomes — incidence and type of biological, mechanical, and technical complications; implant/crown survival rates; and maintenance burden.

Eligibility Criteria

Studies were included if they were randomized controlled trials (RCTs), prospective cohort studies, or comparative interventional studies; involved human subjects; directly compared screw- and cement-retained implant-supported single crowns; reported at least one complication outcome; included a minimum of five participants per group; and were published in English between January 2005 and March 2025. Excluded were animal and in vitro studies, case reports, retrospective studies lacking comparative outcome data, non-English publications, reviews, and studies using non-standard retention systems without separate outcome reporting.

Search Strategy

Comprehensive electronic searches were conducted in PubMed/MEDLINE, Cochrane CENTRAL, ScienceDirect, and Google Scholar using Medical Subject Headings (MeSH) terms and free-text synonyms structured around the PICO framework. Boolean operators, phrase searching, and truncation were applied. A representative search string was: (("screw retained implant supported crown") OR ("screw retained implant prosthesis")) AND (("cement retained implant supported crown") OR ("cement retained implant prosthesis")) AND ("complications"). Manual searches of four institutional library

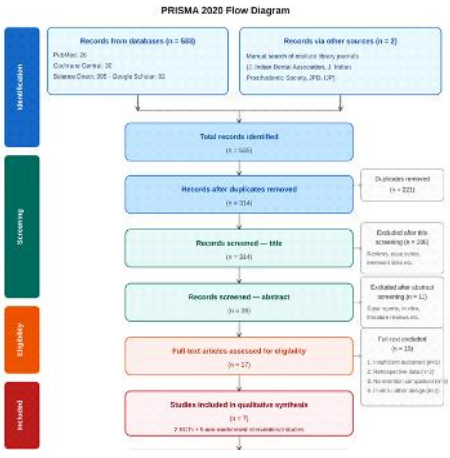
journals supplemented the electronic search. The search returned 533 electronic and 2 manual records (total: 535).

Study Selection and Data Extraction

Retrieved records were imported into Mendeley Desktop for deduplication, yielding 314 unique records. Two independent calibrated reviewers sequentially screened titles (n = 314), abstracts (n = 28), and full texts (n = 17), resolving disagreements by consensus or third-reviewer adjudication. Data were extracted onto standardized forms capturing: study design, sample size, follow-up duration, retention system details, primary and secondary outcomes, and conclusions.

Risk of Bias Assessment

The two RCTs were appraised using the Cochrane RoB 2 tool[16] and the five non-randomized studies using the ROBINS-I tool,[17] operationalized through RevMan 5.4.1 and the ROBVIS visualization tool. Inter-rater reliability was high (κ > 0.89).



RESULTS

Study Selection

After removing 221 duplicates, 314 records underwent title screening; 286 were excluded, leaving 28 for abstract review. A further 11 were excluded at abstract stage, and 10 of the remaining 17 full texts were excluded with documented reasons (Table 2). Seven studies met all inclusion criteria and were included in the qualitative synthesis.

Characteristics of Included Studies

The seven included studies comprised two RCTs[18,19] and five non-randomized interventional studies,[20,21,22,23,24] collectively evaluating 365 implants in 263 patients with follow-up from 6 months to 15 years. Approximately equal proportions of screw- and cement-retained restorations were assessed. Full study characteristics are presented in Table 1.

Table 1. Characteristics of Included Studies

No.	Author (Year)	Design	n (Implants)	Follow-up	Retention Groups	Key Outcomes	Conclusion
1	Vigolo et al. (2005)[18]	4-yr Split-mouth RCT	12 pts (24)	4 yr	Screw vs. Cement single-tooth crowns	100% survival; no significant difference in bone levels or soft tissue parameters	No difference in peri-implant bone or soft tissue behaviour
2	Weber et al. (2006)[19]	3-yr Multi-centre prospective	80 pts (152)	3 yr	Screw (93) vs. Cement (59) anterior crowns	MPI/SBI improved in screw group; worsened in cement group (NS)	Soft tissues more favourable with screw retention
3	Nissan et al. (2011)[20]	Split-mouth interventional (15 yr)	38 pts (221)	Up to 15 yr	Screw vs. Cement	Ceramic fracture: 38% (S) vs. 4% (C), partial restorations	p<0.001; Screw loosening: 32% vs. 9%; Bone loss: 1.4 mm vs. 0.69 mm	superior clinically and biologically
4	Sherif et al. (2011)[21]	5-yr Multi-centre prospective	102 pts (214)	5 yr	Screw (53.4%) vs. Cement (46.6%) anterior maxilla	Survival 96.4%; no significant intergroup difference in clinician- or patient-reported outcomes	Equivalent outcomes in most success parameters
5	Vigolo et al. (2012)[22]	10-yr Split-mouth RCT	18 pts (36)	10 yr	Screw vs. Cement single-tooth crowns	Cumulative success 93.7%; no significant difference in bone levels or soft tissue health	No significant difference in clinical behaviour at 10 years
6	Wolfart et al. (2021)[23]	24-month RCT (digital workflow)	41 pts (56)	24 mo	Screw (28) vs. Cement (28) monolithic lithium-disilicate	Mucositis 14.2% (S) vs. 17.9% (C) at 12 mo; no restoration failures; no ceramic fractures	Retention mode did not influence biological or technical complication rate
7	Rajput et al. (2024)[24]	Comparative interventional	14 pts (28)	6 mo	Screw (Group I) vs. Cement (Group II) mandibular molars	No significant difference in screw loosening or peri-implant soft tissue parameters	No advantage of either method at 6-month loading

S = screw-retained; C = cement-retained; MPI = Modified Plaque Index; SBI = Sulcus Bleeding Index; RCT = Randomized Controlled Trial; pts = patients; mo = months; yr = year(s).

Risk of Bias

Both RCTs were rated as low risk of bias across all five RoB 2 domains.[16] Of the five non-randomized studies assessed with ROBINS-I,[17] three (Weber et al., Sherif et al., Vigolo et al. 2012) achieved low risk across all seven domains. Nissan et al. and Rajput et al. were rated as moderate risk specifically in the domains of deviations from intended interventions (D4) and missing outcome data (D5), primarily attributable to incomplete reporting of cementation protocols and patient attrition. Full ratings are presented in Table 2.

Table 2. Risk of Bias Assessment Summary

Study	Tool	D1	D2	D3	D4	D5	D6/D7	Overall
Vigolo et al. (2005)	RoB 2	Low	Low	Low	Low	Low	—	Low
Wolfart et al. (2021)	RoB 2	Low	Low	Low	Low	Low	—	Low
Weber et al. (2006)	ROBINS-I	Low	Low	Low	Low	Low	Low	Low
Sherif et al. (2011)	ROBINS-I	Low	Low	Low	Low	Low	Low	Low
Vigolo et al. (2012)	ROBINS-I	Low	Low	Low	Low	Low	Low	Low
Nissan et al. (2011)	ROBINS-I	Low	Low	Low	Mod	Low	Low	Moderate
Rajput et al. (2024)	ROBINS-I	Low	Low	Low	Mod	Mod	Low	Moderate

D1–D5 = RoB 2 domains (RCTs); D1–D7 = ROBINS-I domains (non-randomized studies). Mod = Moderate risk.

Synthesis of Results

Implant survival: Across all seven studies, implant survival was uniformly high regardless of retention method. Vigolo et al.[22] reported a 10-year cumulative success rate of 93.7% with no intergroup difference. Sherif et al.[21] documented 96.4% overall survival at 5 years, and Wolfart et al.[23] observed zero restorations failures at 24 months. These figures align with the broader implant literature reporting ≥90% survival over decade-long follow-ups.[1,2,25]

Peri-implant bone loss: Most studies found no statistically significant difference in marginal bone loss between the two groups.[18,21,23] The notable exception was Nissan et al.,[20] whose long-term follow-up (up to 15 years) documented significantly greater bone loss in screw-retained restorations (1.4 mm) versus cement-retained restorations (0.69 mm). This difference likely reflects the compounding effect of recurrent mechanical complications in that cohort rather than a direct biological effect of the retention mode.[3,26]

Peri-implant soft tissue health: Weber et al.[19] observed that cement-retained crowns demonstrated a progressive deterioration in Modified Plaque Index (MPI) and Sulcus Bleeding Index (SBI) scores over 36 months, while screw-retained restorations exhibited improving trends—differences that were directionally consistent but did not achieve statistical significance. Wolfart et al.[23] recorded mucositis at 12 months in 14.2% of screw-retained and 17.9% of cement-retained sites (NS). A clinically important hazard unique to cemented restorations is residual excess cement, which functions as a mechanical irritant promoting peri-implant inflammation. This association was first comprehensively documented by Wilson et al.[8] and subsequently reinforced by Linkevicius et al.,[7] who established a direct relationship between subgingival cement margin depth and peri-implant bone loss.[27,28]

Technical complications: Nissan et al.[20] reported markedly higher ceramic fracture rates in screw-retained (38%) versus cement-retained restorations (4%; $p<0.001$), and substantially greater abutment screw loosening (32% vs. 9%). Both outcomes are attributed to the screw-access channel introducing structural discontinuity and stress concentration under cyclic masticatory loading.[9,10] Crucially, neither of the two included RCTs replicated this fracture rate. Wolfart et al.[23] recorded no ceramic fractures in either group employing monolithic lithium-disilicate crowns, and Vigolo et al.[22] found no significant complication-rate differences at 10 years. This divergence likely reflects material science advances: monolithic ceramics eliminate the veneering-ceramic/framework interface, dramatically reducing cohesive fracture risk.[11,13,29]

Retrievability: Screw-retained restorations permit non-destructive removal, facilitating maintenance and management of biological or mechanical complications. Retrieval of cement-retained crowns typically necessitates sectioning the prosthesis and carries risks of abutment damage.[20,21] The clinical value of non-destructive retrievability is proportional to the complexity and anticipated service life of the restoration.

DISCUSSION

This systematic review synthesizes evidence from seven clinical studies encompassing 365 implants in 263 patients, with follow-up ranging from 6 months to 15 years. The findings are broadly consistent with prior systematic reviews, which have likewise reported comparable survival rates and complication profiles for both retention systems.[1,2,3]

Implant survival was consistently high across all seven included studies, regardless of retention method. Vigolo et al.[18,22] reported 100% survival at 4 years and 93.7% cumulative success at 10 years with no intergroup differences in bone levels, providing Level 1 evidence of long-term equivalence. Sherif et al.[21] corroborated these findings in a large multicenter cohort (96.4% survival, 5 years), and Wolfart et al.[23] observed zero restoration failures at 24 months using monolithic lithium-disilicate crowns. These results align with the broader implant literature: a systematic review by Pjetursson et al.[25] reported five-year implant-supported fixed dental prosthesis survival exceeding 95%, irrespective of retention mode, and a large-scale systematic review by Sailer et al.[2] similarly found no significant survival difference between screw- and cement-retained reconstructions over five years. The sole exception within our review was Nissan et al.,[20] who documented significantly greater marginal bone loss in screw-retained restorations (1.4 mm vs. 0.69 mm) at 15 years. However, this cohort was established in the 1990s with external-connection implants and veneered porcelain frameworks, and the observed bone loss more plausibly reflects compounding mechanical complications than a direct biological effect of the retention mode.[3,26] A meta-analysis by Lemos et al.[5] likewise found no statistically significant difference in marginal bone loss between the two retention systems.

The most clinically significant biological hazard specific to cement-retained restorations is peri-implant inflammation driven by residual subgingival cement. Wilson et al.[8] prospectively demonstrated a direct association between excess cement and peri-implant disease, while Linkevicius et al.[7] established a dose-response relationship between subgingival margin depth and the amount of undetectable residual cement. Korsch et al.[28] and a subsequent meta-analysis by Korsch and Walther[30] confirmed higher peri-implant disease incidence with cemented restorations, particularly when margins are placed deeper than 1.5 mm subgingivally. Within our review, Weber et al.[19] observed directional deterioration of plaque and bleeding indices in the cemented group over 36 months, consistent with these findings, although statistical significance was not reached. Wolfart et al.[23] recorded equivalent mucositis rates (14.2% screw vs. 17.9% cement) at 12 months. Screw-retained restorations eliminate the cement-contamination risk entirely; this biological advantage gains particular importance for patients with deep peri-implant sulci or subgingival implant platforms, where cement retrieval is clinically unreliable.[6,7]

The divergence between Nissan et al.[20] (38% ceramic fracture, 32% screw loosening in screw-retained) and Wolfart et al.[23] (0% ceramic fracture in either group) illustrates how profoundly material and connection advances have transformed the technical risk profile. The screw-access channel in veneered porcelain-fused-to-metal designs creates stress concentration that predisposes ceramic delamination under masticatory loading,[9,10] whereas monolithic ceramic materials eliminate the veneering-porcelain interface entirely. This is corroborated by a recent systematic review and meta-analysis by Naenni et al.,[11] who reported significantly lower complication rates for monolithic zirconia implant-supported crowns regardless of retention mode. Similarly, Thoma et al.[12] in a five-year RCT comparing cemented and screw-retained zirconia crowns found no significant differences in complication rates or marginal bone loss, further reinforcing the material-driven convergence of outcomes. Internal conical implant-abutment connections also reduce micromotion and abutment screw loosening compared to earlier external hexagonal designs,[13] as evidenced by Rajput et al.,[24] who found no increased screw loosening in posterior mandibular regions using contemporary internal connections. A systematic review by Wittneben et al.[1] reported higher technical complication rates for screw-retained fixed reconstructions overall, but noted this association attenuates markedly with modern materials and connection geometries.

Non-destructive retrievability remains a defining advantage of screw-retained restorations, facilitating management of biological or mechanical complications without prosthesis sacrifice.[3,4] This is particularly valuable in the anterior esthetic zone—where both Weber et al.[19] and Sherif et al.[21] reported equivalent or superior outcomes with screw retention—and in patients at elevated biological risk from cement contamination. Cement-retained restorations remain clinically appropriate when unfavorable implant angulation precludes a functional screw-access channel, when passive fit is critical, or when supragingival margins can be reliably achieved.[6,14] Advances in angulated screw-channel abutments have further broadened the range of implant angulations compatible with screw retention, reducing one of the historically cited advantages of cemented designs.[13]

Limitations

This review is limited by the small number of included studies (n=7), substantial heterogeneity in implant systems, prosthetic materials, abutment designs, and outcome definitions, and the inability to perform meta-analysis. Cementation protocols were inconsistently reported, and patient-reported outcomes varied across studies. Future research should employ standardized complication criteria, documented margin placement protocols, and stratified analyses by material generation and connection type.[3,5,12]

CONCLUSION

Both screw- and cement-retained implant-supported crowns demonstrate high and comparable long-term survival rates, with no

consistent differences in marginal bone loss or patient-reported outcomes across most studies. Screw-retained restorations offer meaningful advantages in retrievability and biological safety, while cement-retained restorations retain selected mechanical and logistical merits in specific clinical scenarios. Advances in digital fabrication, monolithic ceramics, and angulated screw-channel technology are progressively reducing the performance gap between the two systems. Clinical selection should be individualized, guided by implant position, esthetic demands, biological risk profile, and long-term maintenance planning. Methodologically robust, long-term randomized controlled trials with standardized complication and cementation-protocol reporting are needed to provide definitive clinical guidance.

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