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SYSTEMATIC REVIEW

Prosthetic complications of implant-supported complete arch prostheses: An umbrella review of systematic reviews

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ABSTRACT

Statement of problem. Implant-supported complete arch prostheses rehabilitate edentulous arches, yet long-term complications vary by prosthetic design, material, and implant number and existing systematic reviews provide fragmented evidence with inconsistent follow-up duration and outcome reporting.

Purpose. This umbrella review synthesized systematic reviews with at least 5 years of follow-up to evaluate the long-term prosthetic complications, implant survival, and biological outcomes of screw- or cement-retained implant-supported fixed complete arch prostheses fabricated from metal-ceramic, metal-resin, veneered zirconia, or monolithic zirconia.

Material and methods. This umbrella review was conducted using established methodological guidance, including systematic reviews reporting the prosthetic complications, implant survival, marginal bone loss, or biological outcomes of implant-supported complete arch prostheses with at least 5 years of follow-up; these reviews were identified through searches of the PubMed (MEDLINE), Cochrane Library, Scopus, Web of Science, Google Scholar, and LILACS databases between January 2000 and August 2025.

Results. Seven systematic reviews met the inclusion criteria. Prosthetic survival ranged from 89.5% to 96.8% over 5 to 15 years, and implant survival from 95.2% to 99.2%. Reported complications included screw loosening (5% to 15%), veneer chipping (15% to 35% in veneered zirconia), and framework fractures (less than 5%). Veneered zirconia showed higher chipping rates than monolithic zirconia ($P<.05$), while metal–ceramic frameworks showed comparable performance ($P=.38$). Peri-implantitis prevalence ranged from 4% to 18%, and implant number (4 versus 6) did not affect implant or prosthesis survival ($P>.05$).

Conclusions. Implant-supported complete arch prostheses demonstrated high long-term implant and prosthesis survival. Prosthetic material and design influence complication patterns, with monolithic zirconia and screw-retained frameworks showing lower technical complication rates. (J Prosthet Dent 2026;136:52-59)

The rehabilitation of completely edentulous patients with implant-supported complete arch prostheses is a predictable and widely accepted treatment option, offering substantial improvement in function, esthetics, and quality of life compared with conventional complete dentures.[1–3] Long-term studies over the past 3 decades have consistently demonstrated implant survival rates exceeding 95%, establishing osseointegrated implants as a reliable foundation for both fixed and removable prostheses.[4,5] Despite these favorable outcomes, long-term success is determined not only by implant survival but also by the stability and maintenance of the prosthesis.[6,7]

These restorations include fixed complete arch implant-supported prostheses retained by screws or cement and fabricated using metal-ceramic, metal-resin, veneered zirconia, or monolithic zirconia frameworks in completely edentulous arches. Prosthetic complications remain a major concern in complete arch prostheses. These may include technical problems such as screw loosening, framework fractures, and veneering chipping, as well as biological issues including peri-implantitis and marginal bone loss.[8–10] While most of these complications are not catastrophic, they compromise function, esthetics, and patient satisfaction and increase maintenance costs.[11,12] Complication patterns are influenced by prosthesis retention, restorative material, implant distribution, and

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Clinical Implications

Complete arch implant-supported prostheses demonstrate predictable long-term outcomes when prosthetic design and material selection follow biomechanical principles. Screw-retained and monolithic zirconia prostheses show superior long-term reliability and reduced complication rates. Patient centered treatment planning and maintenance protocols remain crucial for sustained success.

patient-related factors such as oral hygiene and parafunction.[13–15]

Retention design plays a critical role. Screw-retained prostheses permit retrievability and the simplified management of complications but are susceptible to screw loosening and access-related esthetic issues.[16,17] Cement-retained restorations provide improved esthetics and occlusion but are associated with risks of excess cement leading to peri-implant disease and limited retrievability.[18,19] Current evidence suggests screw-retained designs may be associated with fewer biological complications, although consensus remains inconclusive.[20]

The prosthetic material is also a determinant of complication rates. Metal-ceramic frameworks have long been considered the standard because of their strength and clinical performance,[21] yet veneer chipping and porcelain fracture remain common complications.[22] Monolithic zirconia prostheses have gained popularity by demonstrating reduced chipping compared with veneered zirconia,[23,24] whereas metal-resin prostheses, though cost effective, may exhibit increased wear and fracture over time.[25,26]

Biomechanical aspects such as implant number, distribution, and loading protocol influence prosthetic performance. The 4 implant–supported complete arch fixed dental prostheses concept, using 2 anterior axial and 2 posterior tilted implants, has shown high survival rates with reduced need for grafting.[27] Nevertheless, cantilever length, occlusal loading, and implant angulation remain critical factors in stress distribution and complication risk.

Rather than eliminating the heterogeneity inherent in primary studies, this umbrella review aimed to contextualize and critically appraise long-term evidence by comparing findings across systematic reviews with similar follow-up thresholds. The research hypothesis was that, although implant survival remains consistently high, prosthetic design and material selection would significantly influence long-term complication rates.

MATERIAL AND METHODS

This umbrella review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement[28] and the Joanna Briggs Institute (JBI) umbrella review guidance.[29] The protocol was prospectively registered on the international prospective register of systematic reviews (PROSPERO) database (CRD420251143650).

Systematic reviews and meta-analyses of clinical studies reporting outcomes of implant-supported complete arch fixed or removable prostheses with a minimum follow-up of 5 years were included. Eligible outcomes were prostheses survival, implant survival, technical complications (screw loosening, framework fracture, veneer chipping), biological complications (peri-implantitis, marginal bone loss), and patient reported outcomes when available. Reviews without primary clinical data, with follow-up less than 5 years, or including only case reports, case series, and in vitro or animal studies were excluded.

A comprehensive electronic search was conducted across the PubMed/MEDLINE, Cochrane Library, Scopus, Web of Science, Google Scholar, and LILACS databases between January 2000 and August 2025 using predefined MeSH terms and free-text keywords; the complete search strategy is presented in Table 1. Reference lists of relevant reviews and included studies were also screened.

All retrieved references were exported into a software program (EndNote; Clarivate Analytics) and duplicates were removed. Two reviewers (S.T., N.A.) independently screened titles and abstracts, followed by a full-text review of potentially eligible papers. Screening was conducted in a software program (Rayyan; Qatar Computing Research Institute). Disagreements were resolved by discussion, and, if consensus could not be reached, a third reviewer (G.V.) acted as arbiter. Reasons for full-text exclusion were recorded and are summarized in Table 2.

Table 1. Electronic search strategy used for identification of systematic reviews

Concept	Mesh Terms	Free-text Keywords
Dental implants	"dental implants" [mesh]; "dental implantation"[mesh]	dental implant*; implant-supported; implant-borne; osseointegrated implant*
Edentulous arch	"mouth, edentulous" [mesh]; "jaw, edentulous"[mesh]	full-arch; full mouth; complete arch; edentulous arch; complete-arch fixed; full-mouth fixed; full-arch prosthes*; full-mouth prosthes*
Prosthesis type / material	"prosthesis design" [mesh]; "dental prostheses"[mesh]; "dental prostheses, implant-supported"[mesh]	fixed dental prosthes*; fixed prosthes*; full-arch rehabilitation; hybrid prosthes*; metal–ceramic; zirconia; monolithic zirconia; hybrid resin
Study design	"systematic review"[publication type]; "meta-analysis"[publication type]	systematic review; meta-analysis; evidence synthesis; umbrella review

Table 2. Excluded systematic reviews (less than 5-year follow-up)

First author (Year)	Focus	Follow-up	Reason for Exclusion
Abdulmajeed 2016	Monolithic zirconia fixed dental prostheses	At least 1 year	Short-term only
Afrashtehfar 2022	Three-implant versus all-on-four prostheses	Not restricted	Protocol, no 5-year data
Ahlam 2019	Immediate loading in maxilla	At least 3 months	Short-term trials only
Alexandra (Tsigarida) 2021	Fixed versus removable prostheses (overview)	Mixed, at least 1 year	Included short-term reviews
Ausra (Ramanauskaite) 2021	Prevalence of peri-implant disease	At least 12 months	Less than 5 years
Bagegni 2019	Prosthetic material influence	At least 3 years	Less than 5 years
Bianca (Gallardo/Bianca)	Complete arch prostheses (varied)	Unclear, some less than 5 years	Less than 5 years
Bidra 2017	Zirconia complete arch fixed dental prostheses	One to 5 years	Short-term only
Sanchez-Labrador 2021	Three implant mandibular prostheses	At least 1 year (most 1 to 6 years)	Less than 5 years
Francesco (Gallardo 2019/Francesco)	Complications of fixed prostheses	Mostly less than 5 years	Less than 5 years
Gabriela Sumie	Implant complications	Mixed, short term	Less than 5 years
Gallardo 2019	Complications, complete arch prostheses	Mostly less than 5 years	Less than 5 years
Harder 2009	CAD/CAM versus conventional fixed dental prostheses	Variable, less than 5 years	Less than 5 years
Kim 2020	Prosthetic complications	Up to 3 years	Less than 5 years
Lima 2018	Complete arch prostheses outcomes	Up to 3 years	Less than 5 years
Del Fabbro 2022	Tilted versus axial implants	At least 3 years	Less than 5 years
Messias 2022	Outcomes reporting in last 10 years	At least 1 year	Less than 5 years
Moraschini 2015	Guided surgery, flapless	One to 4years	Less than 5 years
Moraschini 2016	Mandibular complete arch 2 to 4 implants	At least 1 year (mixed)	Less than 5 years
Pauletto 2019	Short implants of 8 millimeters or less for complete arch	At least 1 year	Less than 5 years
Reetika 2020	Screw versus cement retention	Unclear, mostly less than 5 years	Less than 5 years
Saleh 2023	Monolithic versus veneered zirconia fixed dental prostheses	At least 1 year	Less than 5 years
Sandra AlTarawneh 2021	Monolithic zirconia fixed dental prostheses	At least 1 year	Less than 5 years
Sunil Kumar Mishra 2023	PEEK or PEKK frameworks	One to 6 years	Less than 5 years

The data were independently extracted by 2 reviewers (S.T., N.A.) using a standardized form. Extracted data included first author, year, journal, objective, number and type of included primary studies, patient and prosthesis characteristics, mean or median follow-up, prosthesis type (fixed versus removable), retention method, prosthesis material, and reported outcomes (prosthetic survival, implant survival, technical or biological complications, and patient reported outcomes). Where reviews reported both short- and long-term results, only data at 5 or more years were extracted.

The methodological quality of each included review was evaluated using a measurement tool to assess systematic reviews, (AMSTAR)–2 tool, which assessed 16 domains including the adequacy of the search strategy, protocol registration, appropriateness of meta-analytical methods, and assessment of publication bias. Each review was assigned an overall confidence rating of high, moderate, low, or critically low. Assessments were performed independently by 2 reviewers (S.T., N.A.), with disagreements resolved by consensus.

Because umbrella reviews often include overlapping primary studies, overlap was calculated using the corrected covered area (CCA) method, which quantified the duplication of primary studies across reviews. The CCA among the included reviews was 10.8%, indicating moderate overlap and confirming that each review contributed distinct data. The findings were interpreted qualitatively rather than by aggregating numerical outcomes across reviews.

Where meta-analyses were reported, pooled estimates and *P* values were extracted verbatim; no new quantitative meta-analysis was performed. For reviews without quantitative pooling, data were summarized descriptively according to the prostheses or patient level as reported. Heterogeneity, methodological confidence, and effect direction were considered when formulating conclusions.

RESULTS

The electronic search identified 547 records. After the removal of duplicates, 195 titles and abstracts were screened, and 93 full-text articles were assessed. Seven systematic reviews[30–36] met the inclusion criteria of reporting outcomes with a minimum follow-up of 5 years and were included in this umbrella review (Fig. 1). These reviews synthesized data from randomized controlled trials, prospective cohort studies, and retrospective designs, with follow-up ranging from 5 to 15 years. The prostheses evaluated included monolithic and veneered zirconia, metal-ceramic, and metal-resin frameworks, supported by 4 to 8 implants, with both screw and cement retention. A summary of the characteristics of the included reviews is presented in Table 3.

The CCA was 10.8%, indicating a moderate degree of overlap among the included reviews. Overlap was most evident in reviews focusing on zirconia prostheses and implant numbers, although each addressed distinct outcomes, justifying their inclusion.

Across the reviews, prosthetic survival ranged from 89.6% to 100% over 5 to 15 years, while implant survival ranged between 95.4% and 99.5%. No statistically

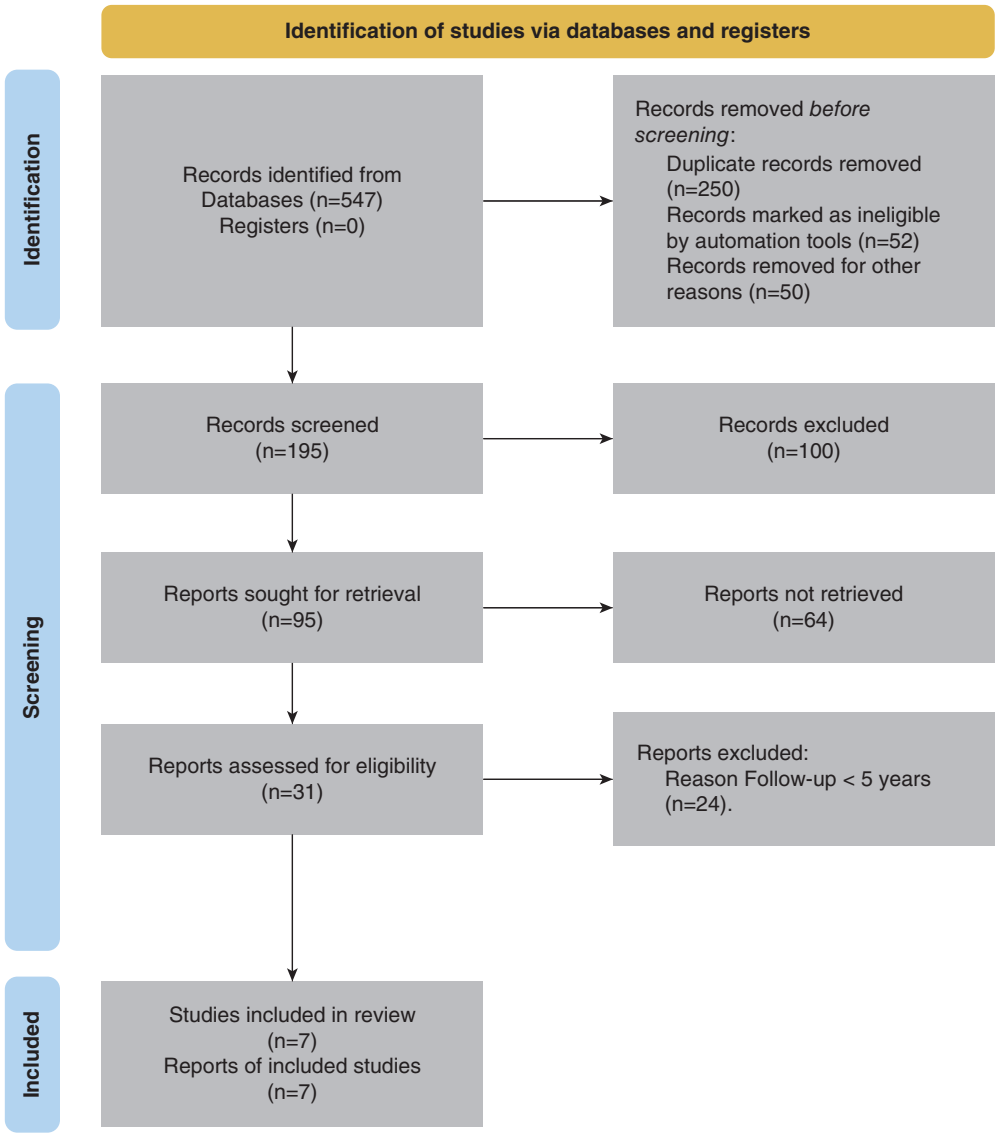

Figure 1. PRISMA 2020 flow diagram of study selection.

significant difference was identified between screw- and cement-retained prostheses. However, cement-retained prostheses were consistently associated with higher rates of biological complications, particularly peri-implantitis and marginal bone loss greater than 2 mm.[31,32,36]

Technical complications were frequently reported, with overall prevalence ranging between 5% and 33%. The most common problem included screw loosening, veneer chipping, and framework fractures. Veneered zirconia prostheses exhibited significantly higher rates of chipping than monolithic zirconia (P<.05), whereas metal-ceramic and metal-resin prostheses had more comparable complication and survival outcomes (P=.38).[33–35]

Biological complications were reported with variable prevalence. Peri-implantitis was documented in 4% to 18% of participants, with higher frequency observed in cement-retained prostheses. Mean marginal bone loss ranged from 1.2 to 1.5 mm after 5 to 10 years and was not influenced by the number of supporting implants.[31,36] Reviews comparing prostheses supported by 4 versus 5 or more implants found no significant difference in implant survival, prosthetic survival, or marginal bone stability.[31]

The methodological quality of the reviews, assessed by using AMSTAR-2, varied considerably. One review[36] was rated as high confidence, 5 as moderate,[30,31,33–35] and 1 as low.[32] While most reviews performed duplicate selection and data extraction and assessed the risk of bias of included studies, several lacked protocol registrations, failed to provide lists of excluded studies, and did not evaluate publication bias. These deficiencies lowered overall confidence in the evidence (Table 4).

Table 3. Characteristics of systematic reviews included in umbrella review (5 or more years follow-up)

No.	Citation (authors, year)	Journal/source	Focus or scope	Mean follow-up (reported)	Key outcomes or main findings (as reported in review)
1	Daudt Polido et al 2018	Clin Oral Implants Res (2018;29 Suppl.16).	Number of implants placed for complete arch fixed prostheses systematic review and meta-analysis (implant number vs outcomes).	Mean 8 years (range 1to 15 years reported across included studies).	No significant difference in implant or prosthesis survival comparing less than 5 versus 5 or more implants (P>.05). Meta-analysis of many cohort studies; conclusion: similar survival rates across implant counts.
2	De Luna Gomes et al 2019	The Journal of Prosthetic Dentistry (2019)	Optimal number of implants for complete-arch prostheses with more than 5 years follow-up systematic review and meta-analysis.	Studies included 5 to 15 years (pooled data reported for more than 5 years).	No relationship between implant number and implant/prostheses survival, bone loss or complications in more than 5 years follow up studies; pooled complication and bone loss rates reported with I^2 values.
3	Harder S and Kern M, et al 2009	Clin Oral Impl Res (supplement)	CAD–CAM versus conventional implant prostheses survival and complications (includes some complete arch data).	variable: mean follow-up thresholds in included clinical studies (1or more years for CAD/CAM studies).	Limited number of clinical studies for CAD/CAM complete arch prostheses; reported survival ranges and estimated annual veneer failure rates; highlights scarcity of long term data for some materials.
4	Kwon et al2014	Journal of Dentistry (2014)	Survival and success of complete arch hybrid prostheses and supporting implants systematic review (short versus long term).	Short term 5 to 10 years; long term 10 or more years where available (included studies up to long term categories).	High short term survival (93.3 to 100% prostheses); lack of sufficient long term data to draw firm conclusions on 10 or more years outcomes; reports complications and bias risks.
5	Lima et al, 2018	Int J Oral Maxillofac Implants (2018)	Impact of implant number on mandibular implant-supported prostheses systematic review.	Included studies up to available; first-year bone loss and survival curves reported (various follow-up lengths; pooled where possible).	Implant survival satisfactory for 3 implant reconstructions (90%); 4 implant ~95%; variable prosthesis survival stats reported (Kaplan-Meier, Kruskal-Wallis).
6	Papaspyridakos et al, 2013	Clin Implant Dent Relat Res / Int J Oral Maxillofac Implants (2013)	Implant and prosthodontic survival rates for implant fixed complete prostheses in the edentulous mandible 5 or more years.	5 or more years (pooled 5 and 10-years survival reported).	High implant and prostheses survival (more than 96% after 10 years); number/distribution of implants had no significant influence (P>0.05).
7	Wong et al, 2018	Journal of Prosthodontics (2018)	Prosthodontic complications of metal-ceramic and all ceramic complete arch fixed implant prostheses (5 or more years mean follow-up) systematic review and meta-analysis.	Mean 5 or more years follow up (selected studies had mean follow up 5 or more years; maximum reported ~14.7 year in some included studies).	Veneer fracture is the most common prosthodontic complication; 5 and 10 year cumulative veneer fracture rates reported for metal-ceramic and complete arch fixed implant dental prostheses (approx. 22.1% and 39.3% respectively); all ceramic data was limited and heterogeneous.

Table 4. AMSTAR-2 quality assessment of 7 systematic reviews included in umbrella review

Author (Year)	Q1 Protocol registered?	Q2 Adequacy of search?	Q3 Justification of study selection?	Q4 Risk of bias assessment?	Q5 Meta-analysis appropriate?	Q6 Publication bias assessed?	Q7 Conflicts of interest reported?	Overall confidence
Daudt Polido (2018)	Yes	Yes	Partial	Yes	Yes	No	Yes	Moderate
de Luna Gomes (2019)	Yes	Yes	Yes	Yes	Yes	No	Yes	Moderate
Harder (2009)	Yes	Yes	Partial	Yes	Partial	No	Yes	Moderate
Kwon (2014)	No	Partial	Partial	Yes	Partial	No	Yes	Low
Lima (2018)	Yes	Yes	Partial	Yes	Yes	No	Yes	Moderate
Papaspyridakos (2013)	No	Yes	Partial	Yes	Yes	No	Yes	Moderate
Wong (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High

Publication bias was explicitly assessed in 2 of the reviews using the Egger test, which indicated no significant bias ($P>.05$).[34,35] Funnel plots in zirconia prosthesis-focused reviews appeared symmetric, while reviews addressing prosthetic materials demonstrated mild asymmetry, suggesting possible small study effects. For the remaining reviews, publication bias could not be adequately evaluated because of the lack of reporting.

DISCUSSION

This umbrella review was conducted to evaluate the research hypothesis that prosthetic complications are frequent in complete arch implant-supported prostheses and that long term outcomes are significantly influenced by prosthetic design, retention type, number of implants, and restorative material. The results of this review largely supported this hypothesis. Across the 7 included systematic reviews with a minimum follow-up of 5 years, implant survival consistently exceeded 95%, and prosthetic survival was generally above 89%, confirming the long-term reliability of complete arch implant-supported prostheses.[30–36] Marginal bone loss remained within clinically acceptable limits, ranging between 1.2 and 1.5 mm, which suggests that peri-implant bone stability is determined more by prosthetic design, loading strategy, and patient- related factors than by the absolute number of supporting implants.[31,36]

One of the key findings of this review was that the number of implants used per arch appears less critical to long-term success than previously assumed. Evidence from reviews comparing prostheses supported by 4 versus 5 or more implants found no significant differences in implant survival, prosthetic survival, or marginal bone loss.[31,36] These data supported the predictability of cost- and morbidity-reducing approaches such as 4 implant-supported complete arch fixed prostheses, tilted implant placement, and immediate loading, provided that biomechanical principles such as cantilever control and occlusal force distribution are maintained.

Prosthetic complications were frequently reported, particularly screw loosening, veneer chipping, and framework fractures. Veneered zirconia frameworks exhibited a higher risk of chipping than monolithic zirconia, which demonstrated better survival and fewer technical failures.[33–35] Metal-ceramic and metal-resin prostheses showed similar complication rates and survival outcomes.[33,34] These findings highlighted the importance of restorative material selection, as monolithic zirconia appeared to offer superior long-term reliability. Biological complications were less common but clinically significant. The prevalence of peri-implantitis ranged from 4% to 18%, with cement-retained prostheses

consistently associated with higher rates of biological complications than screw-retained designs,[31,32,36] likely attributable to undetected cement remnants, underscoring the importance of prosthetic retrievability and maintenance protocols.

Patient-reported outcomes were consistently favorable across all prosthetic designs and implant numbers. Improvements in oral health-related quality of life, esthetics, and function were consistently documented, reinforcing that patient satisfaction remains high, regardless of the chosen restorative approach.[33,34] These findings supported the role of patient centered treatment planning, where decisions on implant number or material selection should be balanced with individual expectations and long-term maintenance requirements.

The limitations most frequently encountered included the lack of protocol registration, incomplete lists of excluded studies, and the absence of publication bias assessment. Publication bias was explicitly assessed in only 2 reviews,[33,34] which did not reveal significant bias, although mild asymmetry was observed in reviews focused on prosthetic materials.

Furthermore, as with any umbrella review, the conclusions of this study depended on the methodological rigor of the included reviews, which varied in quality. The conclusions were constrained by heterogeneity among reviews, mixed study designs, and dependence on secondary data from existing meta-analyses. The moderate overlap (CCA=10.8%) may also have reduced independence among included data sets.

From a clinical perspective, the findings suggested that complete arch implant-supported prostheses are highly reliable, regardless of the number of supporting implants, provided that prosthetic and biomechanical principles are respected. Monolithic zirconia and screw-retained prostheses appear to offer lower complication rates and better long-term predictability compared with veneered zirconia or cement-retained designs. Treatment planning should therefore emphasize prosthetic design and material selection, balancing long-term reliability with patient-specific esthetic demands, maintenance needs, and cost effectiveness. Future long-term clinical studies should report outcomes separately for maxillary and mandibular complete arch prostheses and stratify results by prosthetic material and design to enable clinically meaningful comparisons.

CONCLUSIONS

Based on the findings of this umbrella review, the following conclusions were drawn:

1. Implant-supported complete arch prostheses demonstrated high long-term implant and prosthesis survival, consistently exceeding 95% beyond 5 years.
2. Prosthetic complication patterns varied by prosthetic material, with monolithic zirconia exhibiting fewer technical failures than veneered zirconia and performance comparable with that of metal-ceramic frameworks.
3. Screw loosening, veneer chipping, and framework fractures were the most frequently reported complications, although most events were manageable and did not compromise long-term prosthesis survival.
4. The number of supporting implants (4 versus more) did not significantly influence implant survival, prosthesis survival, or marginal bone loss when appropriate prosthetic and biomechanical principles were followed.
5. Further long-term standardized clinical studies are needed to clarify material specific complication risks and optimize treatment planning for complete arch implant-supported prostheses.

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