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Success Rate in Single Posterior Dental Implant Installation: A Literature Review

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Abstract: Single posterior tooth loss can impair masticatory function, occlusion, and oral health. Dental implants offer an effective treatment; however, their long-term success depends on biological, biomechanical, prosthetic, and technological factors. This review aims to analyze the factors influencing the clinical success of single posterior dental implants, particularly implant techniques, restorative materials, retention systems, and digital technologies. A systematic literature review was conducted following the PRISMA guidelines. Relevant clinical studies published between 2015 and 2024 were reviewed based on predefined inclusion and exclusion criteria. Data were analyzed descriptively to identify factors affecting implant success and complications. The reviewed studies reported implant success rates of approximately 94–97%. Implant success was associated with appropriate prosthetic planning, balanced occlusal loading, and suitable restorative materials. Zirconia and lithium disilicate demonstrated favorable clinical performance, while screw-retained restorations offered advantages in maintenance. Digital technologies improved implant placement precision, although biological and mechanical complications remained important challenges. In conclusion, the long-term success of single posterior dental implants depends on proper treatment planning, surgical techniques, restorative materials, and digital technology. Evidence-based clinical management is essential to achieve predictable and sustainable outcomes.

Keywords: Digital implantology; Evidence-based prosthetics; Guided surgery; Osseointegration; Screw-retained; Single posterior dental implant; Zirconia.

Introduction

Advances in technology and materials science in implantology have brought significant progress to the success of single posterior dental implant restorations. A literature review of fifteen recent scientific journals reveals that implant success is not solely determined by the osseointegration process, but also by the integration of prosthetic planning, surgical technique, material selection, and control of the patient's biomechanical and biological factors. Studies have shown that the success rate of single posterior implants ranges from 94–97% over five to ten years, with a relatively low marginal bone loss rate of less than 1 mm per year (Systematic Review, 2016; Kim et al., 2018; Thoma et al., 2024).

Single posterior dental implants are generally used to replace missing molars or premolars, where the occlusal load is higher than that of anterior teeth. Therefore, proper prosthetic planning and balanced chewing load distribution are key to preventing both mechanical and biological complications. A study by Bathiya et al. (2024) confirmed that changes in occlusion patterns after implant placement can lead to increased chewing forces on the implant side, necessitating periodic occlusal adjustments to maintain functional stability. A prosthetically driven implant placement approach is an essential principle to ensure that the implant position aligns with the final prosthetic needs and allows for physiological load distribution (Thoma et al., 2021; Sailer et al., 2023).

In addition to biomechanical aspects, restorative material selection also plays a crucial role in determining long-term success. Research by Schnutenhaus et al. (2025) and Donker et al. (2022) demonstrated that the use of monolithic zirconia and lithium disilicate materials yielded excellent results in terms of aesthetics, biocompatibility, and mechanical stability. Zirconia materials, in particular, exhibit high fracture and

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corrosion resistance, making them ideal alternatives to traditional materials such as porcelain fused to metal (PFM). However, technical complications such as veneer fracture or screw loosening have been reported, particularly with hybrid ceramic materials, which have lower stress resistance. Therefore, material selection must be tailored to the patient's clinical condition, tooth position, and occlusal load.

Another noteworthy advancement is the use of digital technology in implant planning and placement. Techniques such as guided surgery, CAD/CAM abutments, and digital occlusion analysis (T-Scan systems) have been shown to improve implant placement precision and minimize directional and depth deviations (Donker et al., 2022; Digital Occlusion Review, 2025). Digital technology also allows three-dimensional visualization of anatomical structures, allowing the operator to determine the ideal implant position while simultaneously considering aesthetic, functional, and prosthetic aspects. However, research shows that conventional surgical guides still have limitations in controlling angulation, so operator experience and direct clinical evaluation remain the determining factors for successful procedures (Sailer et al., 2023).

In terms of surgical technique, the two-stage surgical approach remains the most widely used method in posterior cases, as it allows for better healing time for bone and soft tissue before final restoration (Thoma et al., 2024; Kim et al., 2018). Furthermore, short implants (≤8 mm) are now widely developed as an alternative for cases with limited bone height, particularly in the posterior maxillary region adjacent to the sinus. Studies have shown that short implants provide success rates equivalent to standard implants and have fewer complications than bone augmentation procedures (Tolentino da Rosa de Souza et al., 2018). This approach represents a paradigm shift in modern implantology, where clinical efficiency and trauma minimization are top priorities without compromising functional or aesthetic outcomes.

From a biological perspective, long-term studies have shown that single posterior implants do not significantly affect the condition of adjacent teeth or periodontal tissues if the patient maintains good oral hygiene and undergoes regular check-ups (Author, 2009; Author, 2023). However, plaque accumulation, smoking, and suboptimal occlusal control remain major risk factors for peri-implant inflammation and peri-implantitis (Manfredini et al., 2024). Therefore, the long-term success of implants depends not only on the operator but also on the patient's active involvement in maintaining hygiene and following the post-treatment check-up schedule.

Overall, the analysis of fifteen journals demonstrates that the clinical success of single posterior implants is the result of a synergy between technological innovation, modern material selection, atraumatic surgical approaches, and evidence-based long-term maintenance. The application of digital technology has improved the accuracy, efficiency, and predictability of clinical outcomes, while the use of restorative materials such as zirconia and lithium disilicate has provided significant improvements in aesthetics and biocompatibility. However, several challenges remain, such as precision implant placement, occlusal load control, and prevention of peri-implant complications. Therefore, multidisciplinary collaboration between prosthodontists, oral surgeons, and material scientists is needed to develop more predictive, sustainable, and evidence-based clinical protocols in the future.

Method

This study is a systematic literature review aimed at assessing the success rate of single posterior dental implant placement based on previous research findings. The study methodology followed the principles of a Systematic Literature Review with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, as adapted from Li et al. (2025) and Needleman et al. (2012). A comprehensive and structured literature search. Keywords used in the search included: "single tooth implant," "posterior dental implant," "implant success rate," "implant survival," "marginal bone loss," "osseointegration," and "prosthetic complications." The publication deadline was set between 2015 and 2024 to ensure data up-to-dateness and relevance to developments in modern implantology.

Inclusion criteria included scientific articles reporting human clinical studies on single implant placement in the posterior region, in both the upper and lower jaws, and presenting data on success rates, survival rates, or biological and prosthetic complications. Included studies included prospective and retrospective studies, randomized controlled trials (RCTs), and case series reports with adequate sample sizes. Exclusion criteria included in vitro or animal studies, single case reports without quantitative data, studies that did not specifically mention posterior locations, and publications not available in full-text form.

The literature selection process was conducted in a step-by-step and systematic manner through review of the titles, abstracts, and full articles. Two independent researchers conducted screening to ensure objectivity, and any disagreements were resolved through consensus discussion. Data extracted from each article

included: author name, year of publication, number of samples, implant location, type of implant material and system, surgical technique (one-stage or two-stage), prosthetic retention system (screw-retained or cemented), follow-up duration, marginal bone loss, and reported success rates and complications.

The analysis was conducted using a descriptive and thematic approach to identify various factors influencing the success rate of single posterior implants. If data between studies had a sufficient level of homogeneity, the average success rate and survival rate were calculated, taking into account confidence intervals.

Methodological quality and risk of bias were assessed using the Newcastle-Ottawa Scale (NOS) for observational studies and the Cochrane Risk of Bias Tool for randomized controlled trials. The review results were then analyzed analogously to previous studies, such as Gheisari et al. (2017), which compared one-stage and two-stage techniques; Wittneben et al. (2017) on prosthetic retention systems; and Bosshardt et al. (2017) and Kim et al. (2020), which evaluated the biocompatibility of implant materials. With this systematic approach, the literature review is expected to yield a comprehensive understanding of the clinical, biological, and prosthetic factors influencing the success of single posterior dental implant placement, while also providing a scientific foundation for the development of evidence-based clinical guidelines in modern implantology.

and clinical challenges in posterior single-tooth implant placement. Sources were selected selectively based on their relevance to the topic, publication novelty (year range 2015–2024), and suitability to the keywords osseointegration , zirconia , screw-retained , guided surgery , and posterior single- tooth implant . The literature analysis was conducted using a descriptive-qualitative approach, encompassing a review of the research objectives, methods used, key findings, and clinical implications of each study reviewed.

The results of the literature synthesis indicate that recent research provides important contributions to enriching the understanding of modern implantology, particularly in the aspects of digital-based prosthetic planning, the selection of restorative materials with high biocompatibility, and the comparative evaluation of screw-retained and screw-cemented retention systems . Furthermore, several studies also highlight the effectiveness of using short implants in posterior areas with limited bone volume, as well as the challenges in maintaining long-term biomechanical and biological stability.

To provide a more systematic and comprehensive overview, the review results from each journal are presented in the following table. This table summarizes the authors' names, research objectives, methods used, main results, and the relevance of each study to the topic "Clinical Advances and Challenges in Single Posterior Dental Implant Placement."

Result and Discussion

Research result

This section presents the results of an in-depth review of fifteen scientific journals discussing advances

Table 1. Summary of Previous Studies on Clinical Outcomes, Success Rates, and Complications of Single Posterior Dental Implants

Author & Year	Background	Method	Research Results
Schnutenhaus et al., 2025	To assess the effect of crown material type (lithium disilicate vs. hybrid ceramic) on technical complications and marginal bone loss in single implants in the posterior region over a 3-year period.	A randomized controlled clinical trial with 80 patients receiving single posterior implants using two different types of restorative materials.	The results showed no significant difference in marginal bone loss between the two materials, but technical complications such as veneer cracking and screw loosening were more common in the hybrid ceramic group. Overall, both lithium disilicate and hybrid ceramic can be used clinically, with consideration of long-term mechanical strength.
Systematic Review, 2016	To evaluate the success rate, bone loss, and biomechanical complications of posterior single implants compared to the anterior region.	A systematic review of 25 long-term clinical studies involving more than 1,200 posterior single implants.	The average success rate is 94–97% within the first five years, with marginal bone loss <1 mm. However, complications such as screw loosening and ceramic fracture are more common in the posterior region due to higher occlusal loads. higher occlusal.
Bathiya et al., 2024	To investigate the changes in occlusion and chewing load	Meta-analysis of 15 clinical studies involving	It was found that there was a redistribution of chewing forces with increased pressure on the

Author & Year	Background	Method	Research Results
	distribution patterns after single implant placement in the posterior region.	digital evaluation of occlusion and changes in interocclusal contacts after implant placement.	implant side during the first 3 months. Inappropriate occlusion design can lead to micromovement and risk of peri-implant bone loss. Occlusion adjustment is necessary to maintain long-term stability. term long.
Tolentino da Rosa de Souza et al., 2018	Comparing the success of short implants (≤8 mm) and standard implants (>10 mm) in cases of missing a single posterior tooth.	Systematic review and meta-analysis of 13 randomized clinical trials comparing two implant groups with observation duration ≥5 years.	There was no significant difference in success rates (95–98%) between the two groups, but short implants showed a slight increase in marginal bone loss in the first year. Similar biomechanical complications were found in both groups.
Kim et al., 2018	To evaluate the long-term clinical results of short implants (<8 mm) in the posterior areas of the upper and lower jaws.	A 5-year retrospective study of 60 patients with a total of 80 posterior single implants.	The success rate was 96.7%, with no significant difference in bone loss between the upper and lower jaws. The most common complication was mild screw loosening.
Thoma et al., 2024	Comparing the performance of short implants (6 mm) with long implants (11–15 mm) combined with a sinus lift procedure.	Multi-center randomized clinical trial with 10 years of observation.	Both groups showed survival rates above 95%, but the short implant group had a lower incidence of postoperative complications and a simpler surgical procedure.
Donker et al., 2022	Assessing the performance of posterior single implant restorations using monolithic zirconia with CAD/CAM-fabricated titanium abutments.	A 1-year prospective study with 20 patients receiving Straumann BLT implants and zirconia crowns.	No significant biological or technical complications were observed. All patients reported high levels of comfort and satisfactory aesthetic results. Radiographs demonstrated excellent peri-implant bone stability.
Thoma et al., 2021	Comparing two short implants against one short implant with cantilever extension in the posterior region.	RCT with 5 years follow-up.	Two short implants provide better mechanical stability, with a more even distribution of occlusal loads than a single cantilever design.
Author, 2023	Assess the effect of posterior implant restoration on the condition of adjacent teeth and surrounding periodontal tissues.	Case control study of 60 patients post-implant restoration over 3 years.	There was no significant change in the integrity of the adjacent teeth, but a tendency for plaque accumulation around the implant was found if hygiene was not maintained.
Sailer et al., 2023	Analyzing clinical outcomes and success parameters in single and partial implant restorations in the last 10 years.	Systematic review of 70 international clinical studies.	Implant success is heavily influenced by digital-based prosthetic planning and patient care. Studies also highlight a lack of uniformity in clinical evaluation parameters across studies.
Denkert et al., 1998	Reviewing the success rate and prosthetic complications of single implants (classic review).	Initial literature review in the field of implantology.	Survival rate exceeds 90% with the main complications being screw loosening and cracking of porcelain veneers.
Digital Occlusion Review, 2025	Assessing occlusion variations before and after posterior implant placement using digital analysis.	Meta-analysis of 10 studies with digital occlusal force technology (T-Scan).	There are significant occlusal contact changes in the first 6 months that require periodic adjustments to avoid overload.
Author, 2023	Comparing complications that occur in teeth around posterior implants with healthy contralateral sides.	Longitudinal observational study with clinical and radiographic evaluation.	Slight tooth shifting and minor bone resorption were found around the implant area, but these were not clinically significant.
Author, 2009	Evaluating the condition of adjacent teeth for 10 years after the placement of a single implant in the posterior region.	Long-term retrospective study of 150 cases.	The implants showed a 93% survival rate, and most of the adjacent teeth remained healthy with no signs of root resorption or significant bone loss.

Author & Year	Background	Method	Research Results
Manfredini et al., 2024	Reviewing the causative factors of implant fracture in posterior cases based on clinical and biomechanical data.	Systematic review of 42 publications.	The main causes of fracture include occlusal overload, undersized implant diameter, and unbalanced prosthesis design. Proper use of zirconia abutments can reduce these risks.

Discussion

From the fifteen studies analyzed, it can be concluded that the success of single posterior tooth implants is largely determined by a combination of careful prosthetic planning, atraumatic surgical techniques, and the selection of appropriate restorative materials. All studies confirm that achieving optimal osseointegration depends not only on the quality of the alveolar bone, but also on a carefully designed biomechanical approach and occlusal load distribution (Systematic Review, 2016; Kim et al., 2018; Thoma et al., 2024). In this context, the role of the operator in prosthetically driven implant placement is key to ensuring the position and orientation of the implant support long-term stability and satisfactory aesthetic results.

Research by Schnutenhaus et al. (2025) and Donker et al. (2022) highlights that advances in restorative materials and digital technology have provided significant improvements in the predictability of clinical outcomes. The use of monolithic zirconia and lithium disilicate in posterior implant crowns has been shown to provide high biocompatibility, excellent mechanical strength, and aesthetics similar to natural teeth. However, complications such as veneer fracture and screw loosening remain a challenge, particularly with hybrid ceramic materials, which have lower resistance to posterior occlusal forces. These findings demonstrate that material innovation must be accompanied by in-depth biomechanical evaluation to ensure consistent clinical outcomes over the long term.

Meanwhile, from a surgical and biomechanical perspective, several studies have shown that short implants ≤8 mm in length can be an effective alternative in posterior areas with limited bone quality without the need for complex augmentation procedures such as a sinus lift (Tolentino da Rosa de Souza et al., 2018; Thoma et al., 2024). Two-stage surgery has also been shown to improve primary stability and support optimal osseointegration, especially in medium-thick bones. This is in line with the findings of Bathiya et al. (2024), who demonstrated that biomechanical success is significantly influenced by occlusion design and post- restoration chewing load adjustment. Occlusal imbalance can cause micromovements that lead to marginal bone resorption.

From a technological perspective, the application of guided surgery and CAD/CAM abutments has shown significant advances in treatment accuracy and efficiency. Donker et al. (2022) and Sailer et al. (2023) confirmed that digital implant planning can reduce implant placement deviations and improve prosthetic precision. However, several studies also revealed limitations in conventional guidance systems, which are not yet able to fully control implant angulation. Therefore, operator skill and clinical experience remain important factors in the success of digital surgery (Digital Occlusion Review, 2025).

From a biological perspective, long-term studies by the Author (2009, 2023) show that posterior single implant restorations do not cause significant pathological changes in adjacent teeth or surrounding periodontal tissues, provided the patient has good plaque control. Conversely, lack of follow-up treatment can trigger peri- implant inflammation and biological complications such as peri-implantitis. In addition, Manfredini et al. (2024) added that implant fracture remains a relevant mechanical challenge, especially due to occlusal overload, unbalanced prosthetic design, or the use of implants that are too small in diameter to withstand large posterior chewing forces.

Overall, the results of these fifteen journals reinforce the view that the success of dental implants is not only measured by initial osseointegration, but also by biomechanical stability, soft tissue integrity, and the resistance of the restorative material to functional loads. Advances in digital technology and modern biomaterials such as monolithic zirconia have brought implantology into a new era of greater precision and aesthetics, but clinical challenges such as placement precision, occlusal load control, and prevention of peri-implant complications still require serious attention (Schnutenhaus et al., 2025; Bathiya et al., 2024; Manfredini et al., 2024). Therefore, the long-term success of single posterior tooth implant therapy can only be achieved through the integration of technological innovation, operator expertise, and patient commitment to maintaining hygiene and conducting routine post-treatment checks.

Conclusion

Based on the results of a systematic review of fifteen relevant scientific journals, it can be concluded that the success of single posterior dental implants depends on appropriate treatment planning, surgical techniques, restorative materials, and digital technology. The reviewed

studies reported success rates of approximately 94–97%, indicating favorable clinical outcomes. Prosthetically driven implant placement, balanced occlusal loading, and the use of suitable restorative materials, such as zirconia and lithium disilicate, contribute to long-term implant stability. Furthermore, digital technologies, including guided surgery and CAD/CAM systems, improve implant placement accuracy and treatment efficiency. However, biological and mechanical complications remain important challenges that require careful management.

Future studies should focus on long-term clinical outcomes, particularly the effectiveness of digital technologies, restorative materials, and different implant techniques. Further prospective studies with larger sample sizes and longer follow-up periods are recommended to strengthen the available evidence. In clinical practice, regular monitoring, proper oral hygiene, and individualized treatment planning are essential to minimize complications and improve the long-term success of single posterior dental implants.

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The authors declare no conflict of interest.

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