International Journal of Community Medicine and Public Health
Alakkad T et al. Int J Community Med Public Health. 2025 Nov;12(11):5325-5330
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20253722

Review Article

Survival rates of different full-coverage restorations

Tarik Alakkad[1]*, Ali Alghamdi[2], Fotoun Alansari[3], Samaher Alfawzan[4], Saleh Alfaleh[5], Sarah Alshehry[6], Khalid Alsulami[7], Wafa Aljakthami[8], Mohammed Albati[9], Rawan Alshehri[10], Rehab Alzahrani[11]

[1]Department of Restorative Dentistry, Al Thager Hospital, Jeddah, Saudi Arabia
[2]Department of Dentistry, Andalusia Hospital, Jeddah, Saudi Arabia
[3]College Dentistry, King Abdulaziz University, Jeddah, Saudi Arabia
[4]Department of Dentistry, Alswarqiah Healthcare Center, Madinah, Saudi Arabia
[5]Department of Dentistry, Prince Sultan Military Medical City, Riyadh, Saudi Arabia
[6]Department of Dentistry, Private Clinic, Taif, Saudi Arabia
[7]College of Dentistry, King Abdulaziz University, GP (General Dentist), Adwa Ishbiliyah Medical Complex Private Clinic, Riyadh, Saudi Arabia
[8]College of Dentistry, University of Sharjah, Sharjah, United Arab Emirates
[9]Department of General dentistry, Apex care clinic Private Clinic, Buraydah, Saudi Arabia
[10]Department of Dentistry, Private Clinic, Abha, Saudi Arabia
[11]Department of Dentistry, Prodent Clinic (Private Clinic), Jeddah, Saudi Arabia

Received: 16 October 2025
Accepted: 30 October 2025

***Correspondence:**
Dr. Tarik Alakkad,
E-mail: tm.akkad@gmail.com

ABSTRACT

Full-coverage restorations are dental prostheses used to restore the function and aesthetics of missing teeth. They can be classified based on restoration type and design (e.g., single crowns), material type such as metals and ceramics, and clinical technique factors (e.g., impression technique and luting agent). Full-coverage restorations can be classified based on the prosthetic design into single crowns and fixed dental prostheses (FDPs). These different types of designs and materials can significantly impact the survival rates of full-coverage restorations. This review aims to summarize the survival rates of different full-coverage restorations. All-ceramic restorations showed high survival and success rates, including full-coverage crowns and fixed partial dentures. Resin-bonded and conventional FDPs also demonstrate similar long-term success when selected appropriately based on patient and abutment conditions. Future studies should focus on validating and assessing outcomes for emerging restorations. Overall, material selection and clinical protocol should be guided by case-specific risk factors to optimize restoration success and longevity.

Keywords: Full-coverage restorations, Survival rates, Fixed dental prostheses, Single crowns

INTRODUCTION

Full-coverage restorations play a pivotal role in the long-term rehabilitation of structurally compromised teeth, particularly those affected by extensive caries. Full-coverage restorations can be classified based on the prosthetic design as single crowns and fixed dental prostheses (FDPs).[1,2] Single crowns include full metal crowns, porcelain-fused-to-metal crowns (PFMs), all-ceramic crowns, and hybrid polymer-based crowns. Full metal crowns are totally formed from metal; they provide adequate strength and durability.[3] PFMs are made of metal as well as porcelain veneer, which provide adequate aesthetics and function.[4]

All ceramic crowns include zirconia crowns, characterized by excellent aesthetics, strength, and fracture-resistant; lithium disilicate (e.max), characterized

by high translucency and esthetics; and leucite-reinforced ceramics.[5] Lithium disilicate is mainly used for anterior and premolars, and leucite-reinforced ceramics are suitable for anterior regions.[6] All ceramic crowns also include hybrid polymer-based crowns, which are restorations milled by computer-aided design (CAD) and computer-aided manufacturing (CAM) formed of composite-resin-ceramic blends.[2] FDPs are bridges that replace missing teeth, usually supported by abutment crowns, including metal bridges, PFM bridges, and zirconia bridges.[7]

Luting agents are critical to improve the retention of restorations by bonding to the tooth substance and the restoration. Full-coverage restorations made entirely of metal require only luting cement due to the mechanical retentive properties and adequate strength of the metal framework. On the other hand, ceramic restorations require chemical bonding to the tooth structure in order to not be fractured.[8] Thus, it is recommended to perform a bonding procedure using resin cement for the cementation of ceramic-based restorations.[9] Nevertheless, the process of bonding zirconia to abutments is challenging due to its densely sintered and polycrystalline nature, which is resistant to conventional acid etching.[10] Thus, multiple approaches have been introduced to bond zirconia restorations to tooth abutments.[11]

Previous studies reported high survival rates for full-coverage crowns ranging between 78 and 85% following 20–25 years of follow-up periods.[12] The restoration type and design, material used, and clinical technique factors can significantly impact the survival rates of full-coverage restorations. This review aims to explore current evidence reporting the survival rates of full-coverage restorations based on restoration type and design, material used, and clinical technique factors.

METHODS

A comprehensive literature search was conducted in Medline (via PubMed), Scopus, and Web of Science databases up to August 5, 2025. Medical Subject Headings (MeSH) and relevant free-text keywords were used to identify synonyms. Boolean operators (AND', OR') were applied to combine search terms in alignment with guidance from the Cochrane Handbook for Systematic Reviews of Interventions. Key search terms included: "full-coverage restoration" and "survival rates". Summaries and duplicates of the found studies were exported and removed by EndNoteX8. Any study that discusses the survival rates of different full-coverage restorations and published in peer-reviewed journals was included. All languages are included.

Full-text articles, case series, and abstracts with the related topics are included. Case reports, comments, animal studies and letters were excluded.

DISCUSSION

Survival rates of full-coverage restorations

Based on material type

All-ceramic restorations serve both clinical requirements and patients' preferences due to their high biocompatibility, and possession of fair material and optical properties.[13,14] In vitro and clinical studies reported that all-ceramic crowns can be a good alternative to metal-ceramic crowns.[15,16] Multiple studies have evaluated the survival rates of IPS e.max, which is a lithium-disilicate system involving a wide range of products. The glass-ceramic nature of lithium silicate allows adhesive luting for retention, while still allowing the use of conventional cementation when appropriate.[1] It also provides high fracture resistance and maximum esthetics.[17,18]

A previous study by Brandt et al examined the survival and success rates of all-ceramic IPS e.max restorations, including full-coverage crowns and fixed partial dentures (FPDs).[1] They reported overall high survival at different observation periods Table 1. IPS e.max full-coverage restorations also showed overall high success rates at 12 months (97.36%), at 24 months (96.32%), at 48 months (90.37%), and at 60 months (87.99%).[1] Furthermore, they reported a 100% survival rate for zirconia-based crowns, consistent with Miura et al (98.5%), and a 90.58% survival rate for glass-ceramic FPDs, similar to Yang et al's finding (90.6%).[19,20]

Table 1: Survival rates of IPS e.max full-coverage restorations.

Observation period (months)	Survival rate (%)
12	98.83
24	98.41
36	96.93
48	95.52
60	94.22

Brandt et al reported that both conventional and adhesive cementation can be used with the IPS e.max system;[1] however, it has been reported that conventional cementation showed superior survival.[21] Common complications of this type include ceramic fractures/ chipping, endodontic issues (e.g., apical osteitis), and secondary caries.[15,22] Yang et al reported survival rate of 96.6% for IPS e.max Press restorations over 60 months, and Kern et al reported a survival rate of 100% for three-unit FPDs over 60 months, which is higher than Brandt et al's finding (94.22%).[1,20,23]

In recent years, metal-free CAD/CAM materials have gained popularity in dentistry.[24] These materials are associated with favorable outcomes and high satisfaction among dentists and patients in the restorative field,

highlighting their good biologic and esthetic properties.[25] CAD/CAM technology enabled the development of high-performance hybrid materials, such as hybrid-polymer ceramic (HPC) and resin-matrix ceramics (RMC).[26-28]

A previous systematic review and meta-analysis by Husain et al evaluated the function and survival rates of partial and full fixed restorations made from hybrid polymer and ceramic CAD/CAM materials. They reported overall survival rates of 99% at ≤24 months and 95% at ≥36 months.[2] Husain et al also reported that full-coverage crowns showed higher clinical success compared to partial crowns. Sailer et al reported that full-coverage crowns formed of leucite/lithium disilicate ceramics, sintered alumina and zirconia, and zirconia CAD/CAM restorations achieved 5-year survival rates of 96.6%, 96%, and 91.2%, respectively.[29] While Sampaio et al reported that partial restorations achieved a 97% survival rate at 5 years.[30] Notably, porcelain-fused-to-metal crowns remain the gold standard for full crowns, with survival >95% at 5 years.[29]

Based on restoration type and design

The restoration type and design have a significant effect on the survival rates of restorations. Multiple studies have compared the survival rates of full-coverage crowns with direct resin composites. Phengudom et al reported that the survival rates from unrestorable fracture of anterior endodontically treated teeth (ETT) restored with full-coverage crowns (99.1%) were higher than those restored with direct resin composites (90.4%).[31] Other studies reported similar results, including both anterior and posterior teeth.[32,33]

Risk factors for direct resin composite failure include cervical tooth structure with less than three remaining walls; site of remaining structure with palatal walls in maxillary ETT showing similar survival rates to full cervical structure; loss of posterior support reducing anterior ETT survival rates; thickness of cervical root dentin with a ratio <1:1:1 and thin dentin reducing survival rates and increasing fracture risk; and parafunctional habits with bruxism and clenching increasing fracture risk due to extreme forces.[34-37] Conditions that increase the success of direct resin composite in anterior ETT include ≥3 cervical walls remaining, bilateral posterior support, cervical root dentin thickness ratio ≥1:1:1, and no parafunctional habits. Notably, adhesive degradation over time might decrease the effectiveness of direct resin composite effectiveness and increase leakage risk.[38]

Fixed dental prostheses function by connecting and fixing the remaining teeth as abutment teeth, restoring their aesthetics, form, and function. Conventional full-coverage FDPs require the removal of the undercut of the abutment tooth, increasing the risk of complications such as pulp extirpation of the abutment tooth. On the other hand, resin-bonded FDPs (RBFDPs) require cutting of the abutment tooth confined to the enamel. Thus, RBFDPs are considered less invasive than conventional full-coverage FDPs. Several previous studies investigated the survival rates of both RBFDPs and conventional full-coverage FDPs. Yoshida et al reported no significant difference in survival rates and event-free rates between the full coverage FDPs group and the RBFDPs group.[39] The 10-year survival and 15-year survival of the RBFDPs group were 78.6% and 66.5%, respectively, similar to the FDPs group, who showed 10-year survival of 78.9% and 15-year survival of 61.6%.[39]

Younes et al reported 10-year survival of 88% and 20-year survival of 66%, while Najafi et al reported 10-year survival of 32% and 15-year survival of 14%.[40,41] Both groups also showed no significant difference between non-survival due to abutment extraction and re-treatment due to detachment or secondary caries.[39] Thus, clinicians should choose prostheses based on abutment condition and patient factors. Furthermore, studies analyzed predictors for non-survival of restorations such as treatment age, sex, and method. Yoshida et al found no significant predictors for non-survival of RBFDPs and full coverage FDPs.[39] While Najafi et al reported significant predictors, including sex (male > female, p=0.002), jaw region (mandible > maxilla, p<0.001), and side (right < left, p=0.043).[41]

Based on clinical technique factors

Luting agents can significantly affect the survival rate and success of full-coverage restorations. Multiple studies compared the impact of resin-modified glass ionomer cement (RMGIC) to the impact of self-adhesive resin cement (SAC) on various restorations. In vitro studies showed that SAC has been associated with higher shear bond strength compared to RMGIC.[42] However, RMGIC has been associated with better outcomes clinically. Previous studies reported that RMGIC achieved high survival rates for zirconia restorations. Raigrodski et al reported zero debonding after five years of following up on zirconia fixed partial dentures cemented with RMGIC.[43] Lestan et al reported zero retention loss at 40 months for zirconia crowns.[44] Furthermore, Alfadhli et al reported that RMGIC restorations were associated with zero retention loss out of 59 restorations, while SAC was associated with 6 retention losses out of 72 restorations.[45]

Nevertheless, a recent study by Pyo et al reported no significant difference in survival rates of single-unit zirconia restorations when cemented by both cements, with >95% 4-year success rate with both.[46] Additionally, no significant difference in retention loss between both cements was observed. The clinical advantages of RMGIC include reduced technique sensitivity, easier handling and excess cement removal, clinically sufficient bond strength, and success rates similar to SAC with a lower incidence of complications.[45] However, it was reported that it lacks strong adhesion, which makes it inappropriate for restorations that need high bond

strength, such as veneers and onlays.[47] SAC clinical limitations include high technique sensitivity as observed in terms of light curing, control of moisture, and cement removal, particularly in subgingival margins and thick zirconia crowns.[48,49] Furthermore, SAC is harder to remove, thus increasing the risk of underseating, gingival damage during cement removal, and tooth fracture during crown retrieval due to excessive bond strength.[50]

A previous study by Piemjai et al evaluated the survival and complication rates of full-coverage crowns and fixed partial dentures on tooth abutments with acid-base cements such as glass ionomer, zinc polycarboxylate, and zinc phosphate or 4-META/MMA-TBB following 5, 10, and 15 years of function. They found that full-coverage crowns and fixed partial dentures fixed with resin luting agent led to higher survival rates compared to those fixed with acid-base cements.[51] Secondary caries was the most encountered complication found in the acid-base group (6.7%), followed by pulp necrosis (2.7%) and prosthesis detachment (2.6%). While in the resin group, no prosthesis detachment was observed, only minor complications from secondary caries (1.2%) and pulp necrosis (0.9%). Survival from secondary caries and prosthesis detachment was significantly higher in the resin group.[51] Notably, they reported no significant difference in failures not related to the luting agents, including periodontal disease, abutment fractures, loose prosthesis contacts, and porcelain fractures.

The risk of failure, secondary caries, prosthesis detachment, and prosthesis renewal of full-coverage crowns and FPDs fixed with acid-base cements were 1.664, 3.333, 4.444, and 2.95 times higher than those fixed with the resin luting agent.[51] These results suggest that 4-META/MMA-TBB resin increases the survival rate of full-coverage crowns and FPDs compared with those cemented with acid-base cements, as acid-base cements were associated with higher risk of prosthesis detachment and secondary caries due to marginal leakage.[52,53] 4-META/MMA-TBB resin can prevent leakage in laboratory experiments and form a hybrid layer both in vitro and in vivo, improving both short- and long-term function.[52,54,55]

Future implications and recommendations

Advances in CAD/CAM technology and modern materials such as hybrid polymers and zirconia are improving the longevity of full-coverage restorations. Adhesive cements like 4-META/MMA-TBB enhance retention and reduce secondary caries, supporting a shift toward adhesive protocols. Clinicians are encouraged to use adhesive cements for improved retention, select materials and bonding protocols appropriate to the restoration type, and preserve tooth structure where possible. Future studies should focus on validating and assessing outcomes for emerging restorations.

CONCLUSION

Full-coverage restorations remain a cornerstone in the long-term rehabilitation of compromised teeth. Their clinical survival is influenced by multiple factors, including the type of material, restoration design, luting agent, and clinical technique. Evidence supports high survival rates for all-ceramic restorations, especially lithium disilicate and zirconia crowns, with comparable performance to traditional metal-based crowns. Overall, material selection and clinical protocol should be guided by case-specific risk factors to optimize restoration success and longevity.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Alakkad T, Alghamdi A, Alansari F, Alfawzan S, Alfaleh S, Alshehry S, et al. Survival rates of different full-coverage restorations. Int J Community Med Public Health 2025;12:5325-30.